DOMESTIC ECONOMY

ETHEL R. LUSH

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Logan, Utah.
1902

DOMESTIC ECONOMY FOR SCHOLARSHIP AND CERTIFICATE STUDENTS

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BY

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PREFACE

In preparing the present volume the author has attempted to provide for teachers a concise and clearly-written Domestic Economy which shall entirely cover the syllabus of the *King's Scholarship* and *Certificate Examinations.* While omitting nothing necessary to meet the requirements of these examinations, the writer has endeavoured to exclude extraneous matter. It has been her aim throughout to present the subject in an attractive and simple manner so as to remove from the path of the student as many difficulties as possible; and in furtherance of this idea numerous illustrations have been introduced.

The writer has no doubt that teachers of Domestic Economy, as well as students, will find the work helpful in preparing lessons for their classes.

Domestic Economy is a subject of wide range, comprising not only the skilful *Management of Domestic Affairs*, and the wise *Expenditure of the Income*, but, in addition, the *Laws of Health* with the *Physiological Principles* underlying them, the *Management of the Sick*, and the *Treatment of Ailments and Accidents.*

The chapters on Hygiene, embracing Food and Beverages, Water, Clothing, and the Construction, Lighting, Warming, Ventilation, and Cleaning of the Dwelling, have been treated on the scientific lines now generally demanded, and would serve equally well to meet the requirements of the same sections in the syllabus for the examination in Hygiene by the Science and Art Department.

The chapters dealing with Household Management, including the Duties of Servants, Domestic Cleaning, Furnishing the Home, Expenditure and Investment of Savings, have been prepared with a view to making practice and theory run hand in hand.

The portion devoted to Infectious Diseases, Ailments, Accidents, and the Management of the Sick, it is hoped will be of interest and practical utility to all who have to do with children or the direction of a home.

In conclusion, the author trusts that though specially designed for teachers the work will be found useful to all who have at heart the promotion of health and happiness.

E. R. L.

1901.

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CHAPTER I.

THE FUNCTIONS AND CLASSIFICATION OF FOOD.

Definition of Food. Food may be defined as including every substance taken into our bodies and used to build up or repair the tissues, or to produce heat or strength.

General Uses of Food. Food is necessary to us for many reasons. In the first place, we must remember that our bodies are constantly wearing away—every thought or act is followed by tissue-waste; and even when our bodies and minds are inactive, as during sleep, the vital organs continue working and wasting. It is clear that unless the tissues are systematically repaired, they must in time become enfeebled and useless; it is, therefore, mainly **to repair the daily waste** of the tissues that food is taken.

Food is also used **to build up the growing tissues.** An infant properly fed, increases rapidly in weight and size; young children eat with appetite and grow in stature. This is the work of food, and gives explanation of the fact that growing children eat more, in proportion to their size, than adults.

Food is used, too, **to produce heat and energy.** If you drop food of any kind into a fire, it burns with more or less readiness, showing that some, at least, of its constituents have the power of producing heat.

In the body a process of slow burning—known as combustion—goes on, and heat is produced as a result. That

food gives strength is readily proved by noting the weakness that is consequent upon an insufficient supply of food, as, for instance, in times of famine.

The Tissues of the Body.

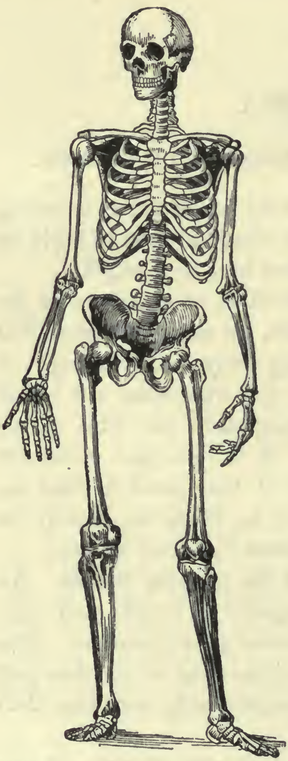


FIG. 1.—THE HUMAN SKELETON.

In order to understand the work of food in the body, it is necessary to know something of the structure of its tissues. The foundation or framework is known as the **skeleton**. The new photography, about which we have heard so much, shows us the framework of bones surrounded by the enveloping tissues. We find that upwards of 200 separate bones go to make up the skeleton, and it is their shape and arrangement which determines the human figure. Many of the bones are so joined together that they can move one upon another, as, for instance, the bones of the fore-arm, which can be pulled up to the upper arm; others are fixed, as the upper jaw, the bones of the skull, etc.

The movable bones, however, do not move by their own power. They are worked upon by another set of tissues—the muscles, which cover and are attached to the bones, and by contracting and relaxing pull the bones into different positions. If you close your fist and bring it gradually up to your shoulder, you may feel a hard lump rise in the upper arm—this is your biceps muscle. By studying the flesh of a skinned rabbit a good idea of the arrangement of the muscles may be gained. Here we find them in bundles, tapering at the two ends and thick in the middle, interlacing and overlapping each other in many different directions.

Even the muscles require stimulation, and this is supplied by the **nerves**, which, in the rabbit, look like thin, white, silky strings. If we could trace one of these nerves to its source, we should find that it is one of several branches from a soft white cord which lies inside the backbone, and is known as the **spinal cord**. By following the course of this upwards we should reach the brain, which occupies the cavity of the skull. It is easy to realise that there is connection between the brain, which is the seat of thought, and the nerves. If you wish to move your leg, an impulse is started in the brain, the message is transmitted downwards along the spinal cord and the nerves governing that particular set of muscles, and the action is accordingly performed.

Fatty tissue is found in various parts of the body.

All the foregoing tissues are nourished by blood, which circulates through a system of blood-vessels, some large and strong, others as fine as a hair; but of this you will hear more presently.

Composition of Food. What has this to do with food? You remember that the great work of food is **to build up and repair the waste of the tissues.** It is clear, therefore, that food must bear some relation to those tissues, in fact, have very much the same composition. We should not find it easy or practicable to eat bone to repair bone, nerve tissue to repair nerves, and so on; but when we reduce all the tissues of the body to their elements, we find that four of them stand pre-eminent, viz., Nitrogen, Carbon, Hydrogen, and Oxygen. These elements are found combined in many substances in the natural world. We therefore take some of these substances, use them for food, and submit them in the body to a series of processes which eventually lead to them becoming actually tissue-material.

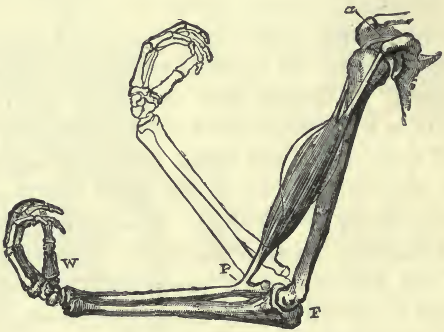


FIG. 2.—SHOWING THE BICEPS MUSCLE.

Classification of Food. The substances which constitute food are variously spoken of as **food-stuffs, food-substances,** or **proximate principles.** The last-mentioned term is applied because the substances—consisting as they do of compounds of nitrogen, oxygen, carbon, and hydrogen—really are elementary constituents, or proximate principles, of the human body.

They may be classified as follows:

Organic. I. NITROGENOUS—(*a*) Albumens, (*b*) Albumenoids or Gelatinoids. II. NON-NITROGENOUS—(*a*) Fats, (*b*) Carbohydrates, (*c*) Vegetable Acids.

Inorganic. III. MINERAL SALTS. IV. WATER.

Special Uses of each Class of Food. We have seen that the body is composed of various tissues differing widely from each other in structure and composition; and that these tissues are supported by the food supplied to them daily. It follows, therefore, that the different kinds of food-substances must be put to various uses according to their composition and the relation it bears to the tissues.

Nitrogenous Foods are composed of Carbon, Hydrogen, Oxygen, and Nitrogen, with Sulphur and a little Phosphorus. As shown above, they may be divided into two great groups, according to their nutritive value. (*a*) The Albumens or True Proteids, (*b*) The Albumenoids or Gelatinoids.

The Albumens include the following proximate principles:

Albumen found in white of egg and lean meat.
Myosin found in flesh.
Casein found in milk and cheese.
Gluten found in all cereals.
Legumen found in peas, beans, and lentils.

The Albumenoids include:

Gelatin obtained by boiling bones of animals.
Chondrin found in gristle or cartilage.

The albumens are much more nutritious than the albumenoids; the value of the latter lies in the great ease with which they are digested. They also serve to form a bulk, and may retard tissue-waste.

The Functions of Nitrogenous Foods. We learn from physiology that the cells which make up the animal body are formed of protoplasm—a nitrogenous substance made from the proteids taken as food. It is seen from this that nitrogenous foods play a very important part in the nutrition of the body. Because of the work they do in building up muscular tissue they are frequently called **Flesh-formers.** In addition to their work of nutrition nitrogenous foods may be regarded as **heat-producers.** The general percentage composition of proteids is given by

Dr. J. Lane Notter as nitrogen, 16 parts; carbon, 54 parts; oxygen, 22 parts; hydrogen, 7 parts; sulphur, 1 part. It is clear that the combustion of the large proportion of carbon in nitrogenous foods must be attended by the production of heat. Nitrogenous foods also help to form some of the digestive juices, and aid, too, in the absorption of oxygen.

Fats are compounds of fatty acids, oleic, stearic, palmitic acid, etc., with glycerine. They are made up of the elements—carbon, hydrogen, and oxygen, the general formula being $C_{10}H_{18}O$.

The Functions of Fats. When taken as food fats yield energy and heat—they are indeed the great heat-givers of the body. In addition to this they repair and build up the fatty tissues; they help in the digestion of other foods by promoting the flow of the bile and pancreatic juice; they assist excretion by oiling the passages along which the waste matter has to pass,—a proof of this is found in the practice of administering castor-oil in cases of constipation; and when more fat is supplied in the diet than is needed for immediate use it is stored up in the body, forming a reserve fund to be drawn upon in time of need, as for instance in illness when an insufficient supply of food is taken by the invalid. Fatty tissue, thus stored up in the body, serves, too, to protect delicate organs; the eye, heart, and kidneys are all cushioned in fat. It also forms a subcutaneous layer which gives a rounded appearance to the limbs, and softens sharp angles, besides helping to keep in the heat of the body.

Carbohydrates. This class includes starches, sugars, and gums. They consist of the three elements—carbon, hydrogen, and oxygen, and gain their name from the fact that the hydrogen and oxygen are united in the proportion to form water. The formula for water is H_2O, *i.e.* twice as much hydrogen as oxygen. If we inquire into the composition of starch, we find that the formula is $C_6H_{10}O_5$, and

FIG. 3.—STARCH GRAINS OF WHEAT. Highly Magnified.

FIG. 4.—STARCH GRANULES OF POTATO.

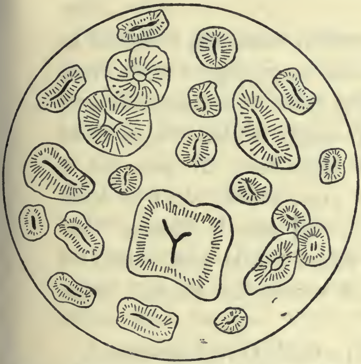


FIG. 5.—STARCH GRAINS OF MAIZE. Highly Magnified.

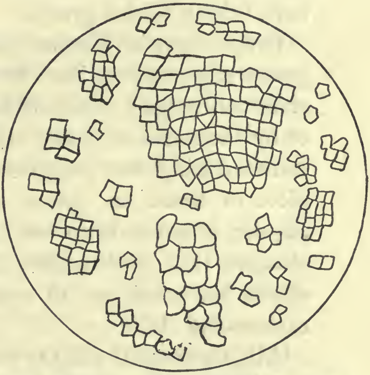


FIG. 6.—STARCH GRANULES FROM RICE.

that of grape sugar $C_6H_{12}O_6$. In each of these substances there is twice as much hydrogen as oxygen, and the same is true of all compounds belonging to the carbohydrates.

The Starches are a large class of foods, constituting the chief part of the seeds of the various cereals, of the potato, and many roots and tubers. They exist in the form of granules, which vary in shape in the different plants. A knowledge of the distinctive character of the principal starch granules, as revealed under the microscope, is useful in detecting the fraudulent admixture of an inferior starch with a more expensive one. (See Figs. 3, 4, 5, and 6.)

The presence of starch is detected by staining with iodine, with which starch combines to form a blue colour. In cold water starch is insoluble, but at a heat of about 180° F. water makes the granules burst and swell out. It is owing to this peculiarity that starchy foods need thorough cooking to be digestible.

Sugar is of two varieties—cane-sugar or sucrose, and glucose or grape-sugar. Cane-sugar is represented by the formula $C_{12}H_{22}O_{11}$; maltose and lactose (sugar of milk) both belong to this group.

Grape-sugar or glucose, also called dextrose, is found in grapes and other fruits. It is also very largely made from starch either as a result of boiling with dilute mineral acid or by the action of malt. Grape-sugar is also formed from starch during the processes of digestion. If you put a piece of bread or potato into your mouth it will soon acquire a sweet taste owing to the starch having been changed into grape-sugar; in other words, each atom of starch has taken up an atom of water, the change being represented thus:

$$C_6H_{10}O_5 \text{ (starch)} + H_2O \text{ (water)} = C_6H_{12}O_6 \text{ (grape-sugar).}$$

Cellulose, the substance which forms the chief framework of plants, and **Pectose**, a vegetable jelly found in ripe fruits, are both included among the carbohydrates.

Functions of Carbohydrates. Like fats, the carbohydrates are used in the production of heat and force, and in the formation of fatty tissue. They do not, however, produce heat in so great a degree as fat, and if fat is entirely withdrawn from the diet and carbohydrates substituted, the health rapidly suffers.

Mineral Salts. The principal salts taken as food are—common salt or chloride of sodium, iron, and the phosphates of lime, potash, soda, and magnesium. Common salt is the only one of these taken alone; the others are found in various foods. Thus **Potassium salts** exist in meat, milk, bread, fresh vegetables and fruits; **Iron salts** occur in lean meat, and in small quantities in all our foods; **Calcium or Lime salts** are found in bread, milk, and in soup and jelly made from bones; **Magnesium salts** are contained in most of our foods.

Uses of Mineral Salts. Common salt is obtained from sea-water and salt-springs by means of evaporation; it is found too in mines. Rock salt is obtained from beds of salt.

Ordinary salt is so necessary to health that if it be entirely absent from the diet, disease and death rapidly ensue. Its presence is absolutely necessary to the proper formation of the hydrochloric acid of the gastric juice, and of the salts of the bile; it enters, too, into the composition of all the tissues and the blood.

Iron forms an important part in the colouring of the red corpuscles of the blood. Salts of lime, potash, and magnesia enter into the formation of bone. Salts of potash and magnesia serve, too, in keeping the blood in a pure state.

Functions of Water. No less than 64 per cent. of the body is made up of water; remembering this it is easy to understand the great need for water in a diet and the suffering caused when it is withheld. In the body water serves chiefly for the solution of food and its conveyance, by means of the blood, to the various parts of the system.

It enables the digestive juices and other secretions to flow freely. It forms the channel by which waste products pass from the body, thus perspiration exudes from the pores, moisture is found in the exhaled breath, and a large amount passes daily from the kidneys. Finally, water serves to keep the temperature of the body uniform by evaporation both from the lungs and the skin.

Questions.

1. What kinds of foods are specially useful (1) for maintaining the heat of the body, (2) for forming flesh, and (3) for forming bone? What names are given to these several kinds of food, and why? (*Scholarship*, 1890.)

2. The food stuffs on which man subsists may be divided into two well-marked groups—nitrogenous and non-nitrogenous. Explain what this means, and why these terms are used. (*Scholarship*, 1891.)

3. What are the chief purposes to be served by taking food? Name several articles of food which are respectively suited to serve each of these several purposes. (*Scholarship*, 1892.)

4. Define "Food." In nitrogenous and carbonaceous foods what other elements are present besides nitrogen and carbon respectively? (*Scholarship*, 1895.)

5. Explain carefully the several functions of food and the nature of the foods respectively suited for each of those functions. (*Scholarship*, 1895.)

6. Classify food-stuffs in accordance with their use and chemical nature.

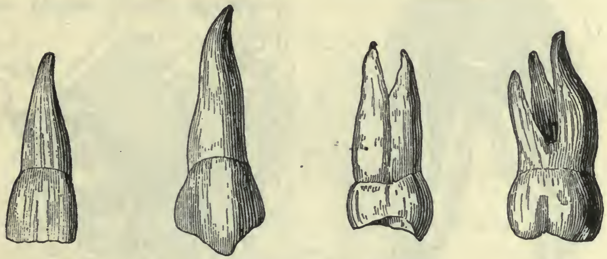
CHAPTER II.

THE DIGESTION OF FOODS.

The term **Digestion** includes those processes by means of which food is made fit to enter the blood.

Mastication. When food enters the mouth it is broken up by the teeth so that it may be more readily acted upon by the various digestive fluids. The teeth of an adult are 32 in number. In each jaw are 4 chisel-shaped teeth called

incisors, because they are especially adapted for cutting. On each side of the incisors is a sharp, pointed tooth known as the **canine** tooth, because of its resemblance to the corner tooth of the dog. Beyond the canines are 4 **bicuspid** teeth, and beyond these 6 **molar** or grinding teeth (Fig. 7).



(a) Incisor. (b) Canine (c) Bicuspid. (d) Molar.

FIG. 7.—THE FOUR KINDS OF TEETH.

Each tooth has a crown, a neck, and a root. The crown is the part which is visible in the mouth, the neck is the slightly narrower part embraced by the gum, and the root consists of one or more fangs which penetrate into the jaw.

A tooth is made up of a hard substance known as **dentine** or ivory. The dentine forming the crown is covered with **enamel**, the hardest substance in the body; the fangs are covered with **cement**, a softer substance. Within each tooth is a cavity, called the pulp-cavity, containing a mass of minute blood-vessels and nerves which enter the cavity through an opening at the tip of each fang (Fig. 8).

Insalivation. The process of insalivation goes on simultaneously with that of mastication. When food is taken into the mouth, saliva, a thin watery fluid, is poured upon it from the salivary glands and by the aid of the muscles of the tongue and cheeks thoroughly mixed with it.

Saliva is secreted in three pairs of glands: one pair being placed under the lower jaw, and called the sub-lingual glands; another pair, below the ear—the parotid

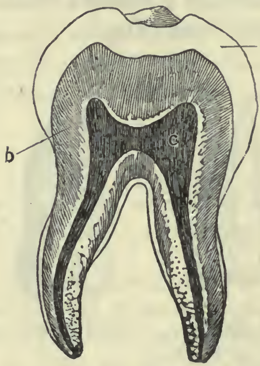


FIG. 8.—SECTION OF TOOTH SHOWING STRUCTURE. (*a*) Enamel, (*b*) dentine, (*c*) cavity.

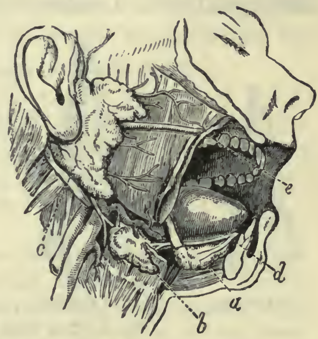


FIG. 9.—THE SALIVARY GLANDS OF THE RIGHT SIDE. (*a*) Sub-lingual, (*b*) sub-maxillary, (*c*) parotid.

glands; and a third, under the jaw—the sub-maxillary glands (Fig. 9).

The saliva is a fluid of an alkaline nature, containing as its active principle **Ptyalin**, a nitrogenous substance which has the power of converting starch into sugar as explained in Chapter I.

Deglutition. When food has been masticated and mixed with saliva, it is rolled into a bolus by the tongue and muscles of the cheeks and passed to the back part of the mouth, whence it reaches the œsophagus or food-pipe. It must not be imagined that food simply drops down the œsophagus by its own weight; it is **forced** downwards by the muscular contraction of the walls of the food-pipe. A somewhat imperfect illustration of this action may be gained by forcing a marble through an indiarubber tube by repeatedly squeezing the part of the tube immediately above the marble; the difference between the two actions lies in the fact that whereas the marble proceeds in jerks, the oesophagus keeps up a wave-like movement.

To understand the further processes of digestion it is necessary to know how the various digestive organs are placed in the body.

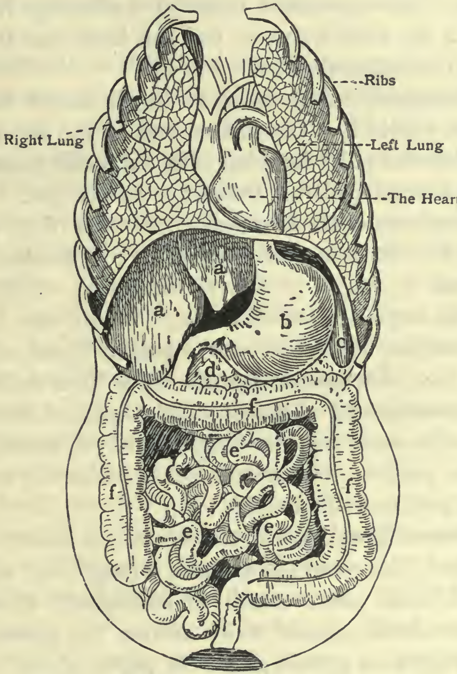


FIG. 10.—THE POSITION OF THE INTERNAL ORGANS.

The Position of the Digestive Organs. The accompanying diagram shows the position of the most important organs of the chest and abdomen.

The heart, lungs, and great blood-vessels occupy the chest or thorax.

In the abdomen—the lower cavity of the body—we find the principal organs of digestion. To the right in the upper part of the abdomen is the liver (*a*), lying partly over the stomach (*b*), the pear-shaped bag to the left.

The spleen (*c*) lies to the left of the stomach and the pancreas or sweetbread (*d*) behind and just underneath the stomach. The convoluted tube (*e*) continuing from the stomach is the small intestine, and this leads into the larger tube (*f*), the large intestine.

The Stomach is from 10 to 12 ins. in length and from 4 to 5 ins. in width. The dilated end to the left is called the **cardiac** end; the junction with the small intestine, at the other extremity, is the **pylorus** or pyloric end.

The Structure of the Stomach. The walls of the stomach consist of four distinct coats. The outer coat is a layer of the **peritoneum**, a tough, protective membrane which covers most of the organs in the abdomen. Within this is first a coat of muscular fibres, then one of **areolar tissue**, and lastly an inner coat of **mucous membrane** which lines the stomach.

The **muscular coat** of the stomach consists of three sets of muscles: the outer set runs longitudinally from the cardiac end to the pylorus; the middle set encircles the stomach; the inner set runs obliquely.

The Mucous Membrane of the stomach is drawn up into longitudinal folds when the stomach is empty, but is smooth and level when the stomach is distended. It contains numerous minute glands which secrete the gastric juice, and are known as gastric glands or peptic glands; it also contains innumerable blood-vessels.

The Gastric Juice is a clear, colourless liquid of an acid nature, containing pepsin, hydrochloric acid, common salt and various other salts. Pepsin, the active principle of the gastric juice, is a nitrogenous substance which has the power, aided by an acid, of dissolving nitrogenous foods.

Digestion in the Stomach. When food enters the stomach from the œsophagus, the mucous membrane assumes a bright pink colour, consequent upon the increased supply of blood, the secretion of the gastric juice commences, and the muscular fibres of the walls contract, producing a churning motion by means of which the contents of the stomach are thoroughly mixed with the gastric juice.

Experiments to illustrate Gastric Digestion. (1) Place in a large test-tube a few small pieces of lean meat or boiled white of egg. Add to it a few drops of hydrochloric acid (spirits of salts) and a little pepsin solution, both of which may be obtained from a chemist. Heat the contents over a spirit lamp to about 100° Fahr.; keep up this temperature by standing the tube in hot water; stir the contents at intervals. At the end of five or six hours the meat or egg will be completely dissolved. (2) Treat arrowroot, cornflour, fat of meat, or any starchy or fatty food in the same way, and they will remain undissolved.

From the above we see that gastric juice has the power of dissolving flesh-formers, of which meat is an example, but has no power over starches and fats. When the nitrogenous foods are dissolved, the peptones, as they are then called, are absorbed by the blood-vessels in the walls of the stomach, and thus enter the circulation.

Experiments to illustrate Absorption. (1) Make a solution of sugar by mixing a tablespoonful of sugar with half-a-glassful of water and put it into a sheep's bladder. Tie the bladder firmly and put it into a bowl of fresh water. After a time you will find that the water in the bowl has a sweet taste, while that in the bladder is less sweet.

This proves that some of the contents of the bladder have passed through its walls—this is known as diffusion.

(2) Put some fluid white of egg in a bladder and float it in water as before. It will be found that water passes into the bladder, but the white of egg does not pass out. This shows that albumen is not diffusible.

(3) Take some of the dissolved white of egg, or lean meat resulting from Experiment 1, put it into a bladder and float it in water. The solution will be found to diffuse readily through the walls of the bladder.

These experiments show us in the first place what diffusion is, and, secondly, that nitrogenous matter is diffusible only when digested.

Sugar and mineral salts, being readily dissolved in water, also enter the blood-vessels in the walls of the stomach, as does too a large proportion of the water drunk. When absorption is complete, there is left in the stomach a milk-like mixture termed **chyme**, which is composed of undigested starch, fat, waste matter, water, and possibly some partially dissolved nitrogenous foods.

After the food has been in the stomach from three to four hours the muscles of the pylorus relax and allow the contents of the stomach to pass into the small intestine.

The Structure of the Small Intestine. The small intestine is a convoluted tube, about 20 ft. in length, connected with the stomach at one end and the large intestine at the other; it lies in the lower part of the abdominal cavity.

The structure of its walls resembles that of the stomach in consisting of four coats arranged as follows:

1. An outer coat formed by the peritoneum.
2. A muscular coat made up of—
   (*a*) External longitudinal fibres;
   (*b*) Internal circular fibres.
3. A coat of areolar tissue.
4. Mucous membrane forming the lining.

The mucous membrane of the small intestine is drawn up into folds similar to those of the stomach, but to a greater extent; it consists chiefly of glands.

The interior of the small intestine is covered with innumerable minute projections called villi, which give to the surface a velvety appearance; the structure of these will be explained later on.

Digestion in the Small Intestine. The first part of the small intestine, not far from the stomach, has a tube

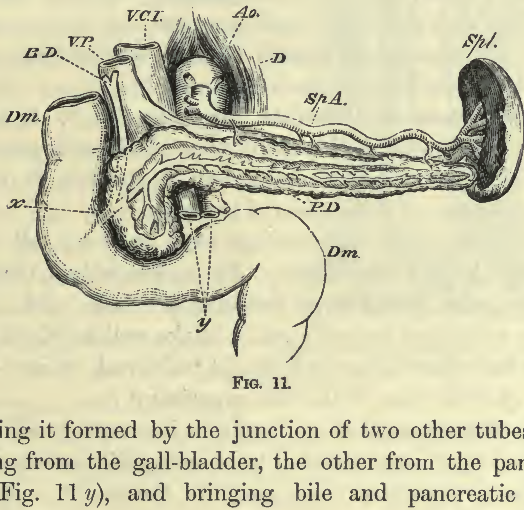


Fig. 11.

entering it formed by the junction of two other tubes, one coming from the gall-bladder, the other from the pancreas (see Fig. 11 *y*), and bringing bile and pancreatic juice respectively.

The Pancreas is a gland situated behind the stomach, and in structure not unlike the salivary glands. It secretes the **pancreatic juice**, a colourless, transparent fluid slightly alkaline in nature.

The pancreatic juice is threefold in its action. It has the power of (*a*) converting starches into sugar, (*b*) turning nitrogenous foods into peptones, (*c*) emulsifying fats and, in part, splitting them up into fatty acids and glycerine. It therefore digests foods which have escaped action in the mouth and the stomach, and prevents loss of digestible food. Food thus digested is absorbed by the blood-vessels in the walls of the intestine.

The Digestion of Fats is chiefly effected by the liver, a large gland situated at the upper part of the right side of the abdomen (Fig. 10 *a*). One of the chief functions of the liver is the secretion of **bile**, a thick greenish-yellow fluid, which is stored up in the gall-bladder.

When food enters the small intestine, bile and pancreatic juice are immediately poured upon it, and by their means the fat is emulsified or rendered cream-like

Experiments to illustrate Emulsification (1) If you shake well together a spoonful of oil and some water, the oil will separate into globules, but on standing it quickly collects again on the surface of the water.

(2) Obtain from the butcher some bullock's gall (taken from the liver of the bullock). Put a piece of lard, dripping, or other fat into a large test-tube or glass; add a little warm water and bullock's gall. Shake well or stir the contents for a short time, and the fat will break up into much finer globules than in the first experiment.

The best example of an emulsion is cream, in which the globules of fat are too small to be seen with the naked eye.

When emulsification is complete the fat finds its way into the villi.

A glance at Fig. 12 will explain the structure of the villi. Each villus contains one or more lacteals running up the centre and surrounded by a network of blood-vessels; a single layer of cells forms the covering of each villus.

The emulsified fat passes through the single layer of cells into the lacteal, and is thence conducted to larger lacteals which finally form into one tube about as large as a crow's quill, called the **Thoracic Duct.**

It is conveyed by this duct, which passes up through the thorax on the inner side of the vertebral column, to the junction of the left subclavian and left jugular veins at the root of the neck, and here it pours its contents into the blood.

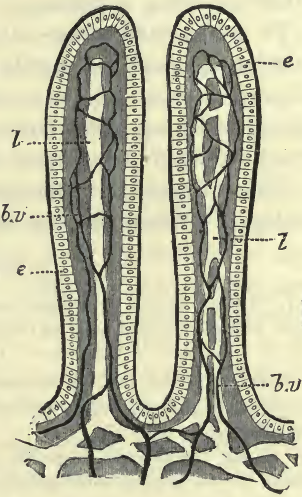


FIG. 12.—VILLI OF THE SMALL INTESTINE. Highly magnified. (*l*) Lacteal, (*b.v.*) blood-vessels.

The Large Intestine is a tube about 6 ft. long, the chief function of which is the excretion of waste matter. When the **chyle,** as the fluid-contents of the small intestine are called, enters the large intestine, the greater part of its nutritive and fluid parts has been absorbed. Digestion and absorption continue to take place in the large intestine, until nothing is left but solid matter made up of undigested food and indigestible substances with a little bile. This is known as the solid excreta or the **faeces**; it should be expelled from the body at least once in every 24 hours.

Indigestion is caused in many ways. It may be the result of general ill-health and want of tone, or it may arise from over-feeding or under-feeding. It may be caused by swallowing unmasticated food which the gastric juice is unable to act upon. The habit of drinking freely during meals hinders digestion, as does, too, the practice of drinking very hot or very cold liquids.

If the bowels are allowed to become constipated, indigestion ensues. In this case it is cured by keeping the bowels open by means of suitable diet, such as brown bread, fresh fruits and vegetables, prunes, fatty food and water taken last thing at night.

To avoid indigestion it is wise to make a habit of masticating food thoroughly; a sufficient time should be allowed between meals to admit of the digestive organs taking rest—say 4 to 5 hours; outdoor exercise should be freely indulged in and heavy suppers avoided.

Where mental worry or overwork is the cause, rest and change of air form the best cure.

Questions.

1. What is meant by indigestion? Say why it is harmful, and by what sort of habits it may be either promoted or prevented. (*Scholarship*, 1890.)
2. What is the use of the mastication of food? Describe the process, and the organs concerned in it. What kinds of food are not affected by saliva? (1*st Year Certificate*, 1893.)
3. Trace the several digestive processes through which our food passes before uniting with the blood. (1*st Year Certificate*, 1894.)
4. How is fat digested? (1*st Year Certificate*, 1896.)

CHAPTER III.

DIET.

A Mixed Diet. It has been repeatedly proved that life cannot be maintained upon any single group of food-substances—the proteids, or starches, for example; and that to sustain life for any length of time a mixed diet is necessary. Evidence to support this theory is derived (*a*) from the instinctive tastes of human beings, whose appetites require variety; (*b*) from the structure of the digestive apparatus, which is designed to deal with different kinds of food-substances; (*c*) from an examination of the excretions from the skin, lungs, kidneys and large intestine. It has been shown as a result of scientific investigation that life can be sustained upon one nitrogenous and one non-nitrogenous food-stuff for a considerable time, but for a permanency mineral salts must be added to the diet. The best form of diet, however, includes nitrogenous foods, both fats and carbohydrates, and mineral salts; and the greater the variety provided in each class of food-substances the more nearly perfect the diet will be.

Amount of Food Required. Though standard dietaries are drawn up, the actual amount required varies very considerably under such influences as age, sex, occupation, season and climate. As regards **age**, young and growing children require a larger proportion of nitrogenous and fatty food to supply the needs of the growing tissues. The tendency is for young people to take too little and old people to take too much of these kinds of food. Concerning **sex**, women as a rule require 10 per cent. less food than men, though this rule would not hold good where women are engaged in laborious occupations. With reference to **occupation**, outdoor workers and those engaged in heavy work need more food, especially of proteid and fatty kinds, than those leading a sedentary life. In cold **climates** a larger proportion of heat-giving food is required than in warmer latitudes; thus the Esquimaux consume large quantities of fat. **Season** exerts some slight influence: in spring, when vital processes are active, more food is required than in autumn; in winter more heat-giving food is demanded than in summer.

Calculation of Diets. In all good diets there is a definite proportion between the nitrogenous and non-nitrogenous foods—as a rule, $1 : 3\frac{1}{2}$ or $4\frac{1}{2}$. The ratio of nitrogen to carbon should be 1 : 15 or 16. From experiments made by various scientists it is found that from 250 to 350 grains of nitrogen are required daily by an adult, and from 3500 to 6500 grains of carbon. An average diet should yield 300 grains of nitrogen and 4800 grains of carbon.

Taking the average amounts as a basis, certain **standard diets** have been compiled. One of the best known is **Moleschott's**, which states that for an adult engaged in moderate work the following amounts of perfectly dry food are required daily :

	4½ ozs.	nitrogenous matter.
	3 ,,	fats.
	14¼ ,,	carbohydrates.
	1 ,,	salts.
Total,	22¾ ozs.	

It must be remembered that the above figures refer to water-free food, and that ordinary moist solid food contains about 50 per cent. of water. Moleschott's dictary is, therefore, equal to about 45½ ozs. of ordinary food, to which must be added from two to three pints of water taken in the form of beverages.

A man engaged in very hard work would require a larger quantity of food than stated above, whereas a person at rest would require much less. One authority states, for instance, that of water-free food during **rest** only 2½ ozs. nitrogenous food, 1 oz. fats, 12 ozs. carbohydrates, and ½ oz. salts are required ; while for hard work as much as 6 ozs. nitrogenous food, 3½ ozs. fats, 16 ozs. carbohydrates, and 1½ oz. salts should be supplied.

Times for Eating. If food is to do its work of nutrition properly, due attention must be paid to the method of taking it. Food must be taken with regularity. It is essential that whatever arrangement be adopted for meals it be steadily adhered to day after day. The digestive organs acquire habits, like other parts of the body, and regularity in the hours of eating is an aid to digestion.

The interval between meals must not be too long. An ordinary meal has passed from the stomach in about four hours, after which the stomach should be allowed to rest for an hour. The best arrangement seems to be, for most people, to have three meals a day, with an interval of five hours between each. For persons engaged in hard manual labour the heavy meal of the day is best taken at mid-day; for brain-workers it is generally found more convenient to take dinner in the evening, provided the hour is not fixed too late.

Heavy suppers should be avoided; the practice of going to bed immediately after a heavy meal is particularly injurious. On the other hand, the stomach must not be empty, or wakefulness may be brought about. In such cases the eating of a hard biscuit has been found useful in inducing sleep.

It is hurtful to the system to go out in the early morning before taking food. A cup of hot tea or coffee, with a biscuit or two, at such a time will be found to strengthen the body.

Vegetarianism. The fact that all foods necessary to sustain life can be derived from the vegetable kingdom, has led to the proposition that vegetable food alone should be taken by mankind.

The arguments in **favour** of this theory are:

(1) That a large amount of suffering to animals would be prevented;

(2) That animal food is more expensive than vegetable food;

(3) That health can be maintained on vegetable foods.

On the other hand, there are many **objections** against a purely vegetable diet:

(1) The undigested refuse resulting from such a diet is greater than with an equal quantity of animal food;

(2) The most nutritious vegetable foods, as legumens, for instance, require a longer time and more exertion to digest than animal foods, while the other vegetable foods are deficient in nitrogen.

(3) A greater bulk of vegetable food is required because, owing to the fact that it is less easily assimilated than animal food, the appetite is not so soon satisfied.

(4) Vegetable food entails greater trouble in cooking and preparation in order to secure appetising and nutritious dishes. An examination of the structure of the teeth will show that man is supplied with **tearing** as well as grinding teeth, and is therefore evidently intended to be carnivorous in habit as well as herbivorous.

Diseases arising from Food. Bad effects may arise where food is excessive or deficient in quantity, or where the quality of the food is not good.

An Excess of Food leads to constipation, diarrhœa, dyspepsia, gout and obesity.

Constipation and dyspepsia are brought about by an accumulation of undigested food in the bowels. Diarrhœa is due to the irritation set up by an overloaded condition of the bowels. Gout is specially due to an excess of proteid food, which also results in some cases in enlargement of the liver, with dyspepsia and diarrhœa. Gall-stones are sometimes produced by rich foods and an excess of sugar. Fats and carbohydrates taken in excess are likely to cause stoutness, with acidity and flatulency in adults, and rickets in young children.

A deficiency of Food, if prolonged, results in a wasting of the tissues, which ends in death when the body has lost 40 per cent. of its weight. In children a diet deficient in nourishing power leads to diarrhœa and weakness. A deficiency of nitrogenous matter results in gradual loss of muscular power, mental weakness, fever and general pro stration. An insufficient supply of fats and carbohydrates leads to a weak state of health, as does, too, any diminution in the amount of water taken. Scurvy results from a scanty supply of mineral salts.

Unwholesome Food. The diseases arising from unwholesome food are so numerous that it will be convenient to discuss them in subsequent chapters on food.

Questions.

(1) On what grounds can a diet consisting wholly of vegetable food be defended? What objections to it can be fairly urged, and to persons of what class or age are such objections applicable?

(*Scholarship*, 1888.)

(2) Why would fat bacon be an insufficient food for a single day in the south of Europe? What other foods would you suggest should be taken in conjunction with it? State the proper proportion of the bacon and such other foods to each other.

(1*st Year Certificate*, 1895.)

CHAPTER IV.

ANIMAL FOODS.

Milk. Its Composition. Milk has already been described as a nitrogenous food, containing casein. The following experiment will show what are the other constituents of milk:

Experiment. Let a glass of new milk stand until the cream has risen to the top, then remove the cream, and put it in another glass. Add rennet to the skim milk, and a clot is formed. Separate the clot or casein from the liquid whey by pouring the contents of the glass through a funnel lined with filter paper. The clot remains in the paper and the liquid passes through into the vessel underneath.

By means of the above experiment the milk is divided into three parts: cream, casein, and whey. In the liquid are dissolved sugar of milk and various mineral salts, the chief of which are common salt, salts of lime, magnesia, potash, and iron.

The average composition of cow's milk per 100 parts is shown below:

Casein,	3·5
Fat or Cream,	3·6
Sugar of milk or lactose,	4·8
Salts,	0·7
Water,	87·4

It differs from **Human Milk** in containing more casein and less sugar, as will be seen from the following figures:

Composition of human milk:

Casein,	1·8	per cent.
Fat,	4	,,
Lactose,	7	,,
Salts,	0·3	,,
Water,	86·9	,,

A Perfect Food. It is seen that milk contains a representative of every class of food, and the above figures show that these food substances are united in the proper proportion to satisfy the requirements of the growing body. For these reasons milk is called a perfect food.

Milk is the Best Food for Infants, because (*a*) it supplies them with all the principles necessary to support life, (*b*) combined in the proper proportion for building up growing tissues; (*c*) it needs no mastication; and (*d*) is easily digested.

The proportion of nitrogenous to non-nitrogenous matter in milk is as much as 4 to 8·8. This would be excessive for a healthy adult, but is not too much to build up the rapidly growing body of an infant.

Milk and Disease. It is now generally recognised that milk has a special affinity for disease-germs, and is capable of spreading infectious diseases over wide districts. Tuberculosis in cows affects their milk, and if such milk be consumed the corresponding disease may appear in the consumer. Boiling the milk, or, better still, sterilising it, is effectual in killing the germs of disease, and such pre caution should never be neglected.

Milk, too, is liable to ferment in warm weather, or if kept in a warm room, and in that condition may produce acute diarrhœa. Milk allowed to stand in a dirty room or foul atmosphere has the power of absorbing noxious gases which render it unfit to drink.

In dealing with milk the most scrupulous cleanliness must be observed. Milk jugs should be wide mouthed, so that they may be easily kept clean. A piece of clean muslin should be thrown over the mouth of the vessel to keep out dust. Milk pails, etc., should be scalded out every time they are used. Babies' feeding-bottles need especial care, for a foul bottle leads to grave derangement of the digestion, and causes diarrhœa. It is better to use the tubeless bottles, as they are more easily kept clean ; but if the latter are used the tube must be thoroughly cleansed with the tube-brush, and replaced by a new one at short intervals.

Preservation of Milk. The simplest method is that of boiling it and then tightly corking the bottle. Another method is to add antiseptics, such as salicylic acid, boracic acid, or boro-glycerine, to the milk after it has been boiled ; it is doubtful whether milk thus treated can be regarded as altogether wholesome. The most satisfactory method of preserving milk is that of "drying" or condensing it. This is done in most cases by evaporating the milk to a third or a quarter of its original bulk and adding sugar. Though useful in certain cases, condensed

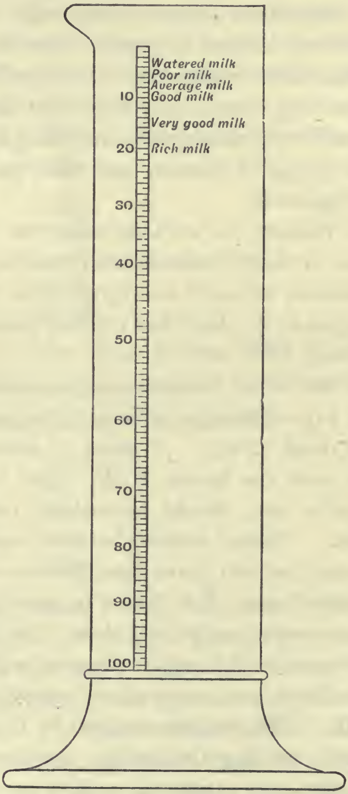


Fig. 13.—Creamometer for Measuring the Percentage of Cream.

Fig. 14.—A Lactometer.

milk is, as a rule, less nutritive than fresh milk, and infants fed on it are specially liable to rickets.

Adulteration of Milk. Milk may be adulterated (*a*) by the removal of cream; (*b*) by the addition of water; (*c*) by the addition of carbonate of soda, salt, boracic or salicylic acid, glycerine and starch.

The removal of cream is detected by means of the **creamometer** (Fig. 13), a narrow glass vessel, graduated into 100 parts. If this be filled with new milk and allowed to stand for some hours the cream will rise to the top and its percentage be easily ascertained. Good milk should show from 10 to 12 per cent. of cream.

The addition of water is detected by the **lactometer.** Cow's milk has a specific gravity of 1028, taking water as 1000. The removal of cream raises the specific gravity, while the subsequent addition of water would bring it down to normal If water is added without the removal of cream, the specific gravity is lowered. The use of the lactometer (Fig. 14) indicates the specific gravity of milk, and is some guide as to whether or no adulteration has been practised. It is most satisfactory, however, to use both creamometer and lactometer; a low specific gravity, together with a low percentage of cream, would almost certainly indicate adulteration.

Carbonate of soda, boracic acid, etc., are added either to preserve the milk or to raise the proportion of solids.

Eggs. Composition of a hen's egg. Since a hen's egg is capable of developing the young chick, it must contain all that is required for the construction of the body, and after milk it is regarded as the nearest approach to a perfect food.

The percentage composition of a hen's egg is as follows:

Water,	70
Albumen,	14
Oil and fat,	11
Mineral salts and membranes,	5
	100

A glance at these figures shows us that eggs are deficient in carbohydrates. The salts, moreover, are chiefly found in the shell. For these reasons eggs are generally eaten with plenty of common salt and with heat-giving food.

Albumen is contained in the white; the yolk is principally composed of a very digestible oil.

Nutritive value of eggs. An egg is a very nourishing article of food, and if lightly cooked is digestible. Hard boiled eggs and fried eggs are very indigestible. For invalids they should be beaten up raw and mixed with milk.

Tests for eggs. To know whether an egg is fresh or stale, any one of the following tests may be applied.

(1) Put one ounce of salt into a pint of water, thus making a brine solution. Drop the egg into this; a fresh egg will sink, a stale one will float.

(2) Hold the egg to the light; a fresh egg is clear, a stale one is cloudy or spotted.

Preservation of eggs. Large quantities of eggs are imported into England from Ireland, France, Denmark, Belgium, and Germany to supply the enormous demand. These eggs must of necessity be preserved. There are several ways of doing this, but any method which by stopping up the pores in the shell prevents the loss of water and the admission of air will answer. The following are some methods in common use:

(1) Smear the shell thickly with lard or butter.

(2) Keep the eggs in a mixture of lime and water, or in a brine solution.

(3) Pack the eggs in bran or in powdered salt.

Cheese. This is prepared from milk by the action of rennet, which is derived from the fourth stomach of the calf. Rennet has the power of converting the casein of milk into curd, which separates from the whey and carries with it the cream and a considerable proportion of the salts, more especially salts of lime. The curd is broken up, mixed with salt, pressed into moulds, and put away to ripen.

Kinds of Cheese. The different qualities of cheese depend upon the quality of the milk used. Thus, Double Gloucester and Stilton are made from whole milk, to which cream has been added; Cheddar and Cheshire from whole milk; Suffolk, Parmesan and Dutch cheese from skimmed milk. Cream cheese consists of the fresh curd slightly pressed.

Nutritive Value of Cheese. Cheese is rich in casein, fat and mineral salts, and has, therefore, considerable nutritive value. It is, unfortunately, very difficult of digestion, and is on this account only suitable for those who work much in the open air.

The adulterations of cheese are not important. Margarine may be substituted for the fat of milk, and starch is sometimes added to give weight.

Meat. The flesh of various animals is termed collectively meat. The different kinds of meat are beef from the ox, mutton from the sheep, veal from the calf, lamb from the young of the sheep, pork, ham and bacon from the pig.

Beef. This is the most important of the meats, also the most nutritious. It is, too, the most economical, having less fat or bone in proportion to the flesh. Its drawbacks are that it is less digestible than some other meats, and has a less delicate flavour.

How to distinguish good Beef. In choosing a joint of beef, it is well to remember that young meat is not so nutritious as older meat, but that old meat is apt to be tough. Good beef should be of a red colour, neither pink nor purple, have an open grain, flesh firm and elastic to the touch, not flabby, the fat firm and white and mixed with the lean.

Joints of Beef. The **sirloin** is the best joint, and is always baked or roasted. **Rib** of beef is a good joint, and if the bones are removed and the beef rolled it has a nice appearance at table. The **round** is either baked or boiled, the **rump** may be cooked in any manner. **Brisket** or **breast** and **shin** are cheap joints, generally stewed; the former is often salted and boiled.

Mutton. As an article of diet mutton is of less value than beef, being less nutritious. It is, too, less economical, having a large proportion of fat and bone. Its flavour is, however, more delicate than that of beef, and being easily digested it forms a suitable food for invalids.

Good Mutton may be distinguished by its bright red colour, its firm, white fat, and the elasticity of the fibres; avoid mutton with yellow fat and dull-looking flesh.

Joints of Mutton. Of these the **leg** is the best, and though sold at a higher price per pound is more economical than other joints, owing to the small proportion of fat and bone. It should always be roasted or baked. The **shoulder** is not so economical owing to the size of the bone; it, too, is generally baked or roasted, **Loin** of mutton is roasted, and so is the best end of the neck, which cuts up into cutlets. The **scrag** end and the **breast** are stewed or used for making broth.

Veal is deficient in fat, and for this reason is eaten with ham or other fatty food. Its delicate flavour makes it popular, but its elastic fibres render it difficult of mastication and digestion. In colour it is pale, due to the draining away of the blood. Owing to this practice veal is less nutritious than either beef or mutton.

Lamb is watery and has less nutriment than the flesh of older animals, but it has a delicious flavour and is very tender. It is not an economical article of diet.

Pork is neither so nourishing nor so wholesome as the foregoing meats. It is also extremely indigestible and very fat. Its delicious flavour and its cheapness are two points which ensure its popularity, however, and to persons of sound digestion there is little objection to its use.

Good Pork is distinguished by its fine fibres, purplish brown tint, white fat and thin rind.

Ham and Bacon. These are forms of cured pork. Hams consist of the leg of pork cured, and bacon of the sides cured, dried, and sometimes smoked.

Preserved Meats. Tinned meats, which are first cooked and then packed in air-tight tins, are imported in large quantities from Australia and America; corned beef and ox-tongue are examples. Frozen meat, brought over from Australia and New Zealand in specially constructed ships, is quite fresh on its arrival in England, but should be cooked shortly afterwards. Its flavour is usually very good, and its quality excellent; it is also much cheaper than English meat.

Fish is only second in importance as an article of diet to butcher's meat. Its value lies in the fact that it is highly nitrogenous, very digestible, and generally cheap. Its drawback lies in its watery condition. Fish is a valuable brain food owing to the phosphates it contains.

White Fish and Oily Fish. We divide fish into two classes: (*a*) those that have the fat stored in the liver—these are white fish; and (*b*) oily fish which have their fat distributed all over the body. Examples of the first class are cod, ling, halibut, plaice, sole, whiting; of the second class: salmon, mackerel, herring, eel, etc.

Shell Fish include lobsters, crabs, cray fish, prawns, and shrimps. They are indigestible but of delicate flavour. **Oysters**, eaten raw, are almost self-digesting, but if cooked are tough. **Mussels** are fairly nutritious, but are indigestible and liable to produce irritating symptoms.

Poultry and Game. The term poultry includes all domestic fowl, such as the turkey, goose, duck, and chicken.

Game is applied to various wild birds, such as the pheasant, grouse, and partridge, and to such animals as the hare.

The flesh of game and poultry is either dark or white in colour. Examples of dark-coloured flesh are furnished by the goose, duck, and hare; chicken and turkey are instances of white flesh.

Value of Game and Poultry. Speaking generally, the flesh of game and poultry is easy of digestion and delicate of flavour. It is deficient in fat, and therefore some fatty food is served with it, *e.g.* bacon or ham.

Red and White Meats. Meat is sometimes classified under these heads. Red meats include all butcher's meat, salmon, and game. White meats include poultry, rabbit, white fish, and shell fish.

Meat and Disease. **Tainted meat**, if eaten, is liable to produce diarrhœa. Meat slightly tainted may be refreshed by washing in vinegar and water or a very weak solution of Permanganate of Potash. **Tinned meats** which have not been kept air-tight are unfit for food owing to the likelihood of putrefaction and decomposition having set in. Occasionally the presence of salts of tin, lead or zinc, in the meat, due in all probability to the action of certain organic acids upon the solder or tin, causes serious derangement of the digestive apparatus. The flesh of **over-driven animals** is said to be injurious, and the flesh of animals which have died a natural death should also be avoided. The flesh of **animals suffering from disease** must be regarded as wholly unfit for food. The symptoms generally resulting from the consumption of such meat are diarrhœa, vomiting, fever and prostration. Diseased meat is as a rule moist, dark in colour, flabby and tasteless.

Tuberculosis is common among oxen, and is called by butchers "the grapes" or pearl disease owing to the fact that small, white, pearly tumours occur on the lungs and lining of the chest. There is a probability that such meat would produce consumption in man. Pork is specially liable to **parasitic diseases.** One is known as "measles"

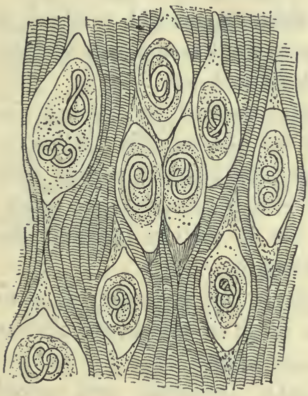


FIG. 15.—FLESH OF THE PIG CONTAINING PARASITES. (Highly magnified.)

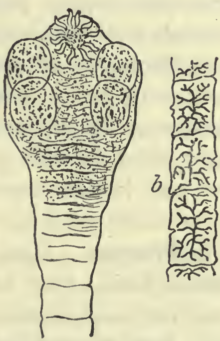


FIG. 16.—(*a*) HEAD OF TAPE-WORM. (*b*) SEGMENTS OF TAPE-WORM.

and is characterised by the presence in the flesh of the pig of a cyst the size of a small marble (Cysticercus cellulosæ) which gives rise to a tapeworm in man (Tœnia solium. See Fig 16). Measly pork is rendered harmless by thorough cooking, but as this cannot be relied upon in all cases, meat thus infected is condemned. Another parasite is the **Trichina Spiralis** (Fig. 15), a minute worm which lies coiled up in cysts and forms white specks in the flesh. When trichinized meat is imperfectly cooked and eaten the worm rapidly develops and multiplies in the alimentary canal, giving rise to a painful and dangerous disease known as trichinosis.

Preservation of Meat. 1. **Drying.** Meat to be dried is cut into thin slices and exposed to the smoke of a wood fire or to dry air. It is best applied to fish.

2. **Freezing** is a common method of preserving meat imported from America and Australia. Frozen meat must be cooked as soon as thawing sets in or it rapidly decomposes.

3. **Salting or Pickling in Brine** is an old method of preserving meat. Meat thus preserved is not so nutritious as fresh meat and tends to be hard and dry.

4. **Exclusion of Air.** This is secured by coating the meat with fat or gelatine; or by hermetically sealing in tin cases. In the latter instance the tins are packed with meat, filled up with gravy and closed except at one point; the case is then heated and the air driven out and the cover sealed while the gravy is boiling.

5. **Pressure.** Meat is preserved by pressing it, as in corned beef. Such meat loses much of its nutritive value with the meat-juices which are expelled.

6. **Boro-glyceride** is a valuable antiseptic, and mixed with water in the proportion of 1 of the former to 40 of the latter is used to preserve meat, fish, milk, etc.

Fatty Foods. **Butter** may be described as the clotted fat of milk. Its average composition is:

Fat, - - - - -	78 to 94 per cent.
Curd, - - - -	1 to 3 ,,
Water, - - - -	5 to 14 ,,
Salt, - - - - -	0 to 7 ,,

The flavour of good butter is due to the presence of butyric acid. Water should not be more than 15 or 16 per cent.

Adulteration of Butter. Starch is occasionally added to butter to give weight, and annatto to give colour. The only important adulteration is the substitution of meat-fats, palm-oil or cocoanut-oil for milk-fat. Such adulteration is detected by determining the melting point of the fat after separating it from other constituents. Pure butter should melt at 95° F., though it may vary; the addition of animal fats tends to raise the melting-point, the addition of vegetable oils to lower it.

Margarine is an artificial butter made from beef-fat by melting it down and separating the stearin. The olein and margarine remaining are mixed with butter and coloured with annatto. There is no objection to margarine as food provided it be made from pure fats and honestly sold under its own name.

Lard is the leaf-fat of the pig, and is used for making pastry and for frying.

Questions.

1. What are the special advantages of fish as an article of food? (*Scholarship*, 1889.)

2. What points would you notice in choosing a piece of beef? (*2nd Year Certificate*, 1892.)

3. Give any useful receipts for the preservation of meat and milk in hot weather. (*2nd Year Certificate*, 1893.)

4. Why is veal less wholesome than mutton or beef? Compare the food value of the flesh of young and of full-grown animals. (*1st Year Certificate*, 1895.)

5. How may the adulteration of milk be best detected? (*2nd Year Certificate*, 1895.)

6. Show the advantages and risks involved in the purchase of tinned meats. (*2nd Year Certificate*, 1896.)

7. How may eggs be best preserved for winter use? (*2nd Year Certificate*, 1896.)

CHAPTER V.

VEGETABLE FOODS.

Vegetable Nitrogenous Foods are of two kinds: cereals and legumens.

Cereals. These agree in containing the food-substance gluten. The principal cereals are wheat, barley, oats, rye, rice, and maize.

Wheat. The constituents of wheat, the most important cereal, may be determined by the following experiment:

Fill a small muslin bag with wheat-flour, and squeeze it repeatedly in a basin of water until the bag is found to contain **gluten**. Take a little of the milky fluid in the basin and add to it a few drops of tincture of iodine; a blue colour is produced, and this proves the presence of **starch**. Take a little more of the fluid from the basin and pour it through a filter paper; the clear liquid which is collected has a sweet taste, owing to the **sugar** it contains. Boil a third portion of the milky fluid, and it becomes whiter and more opaque, owing to the presence of **albumen.** If now a small quantity of flour be burnt on a tin over a flame, it will first turn black and finally burn away so completely that nothing but a grey ash of **mineral** matter is left.

By the above experiment, then, we find that wheat consists of gluten, albumen, starch, sugar, and mineral matter, in addition to water.

Wheat-flour is prepared from the grain by grinding. Fig. 17 shows a section of wheat as it appears highly magnified under a microscope. The outer coat or husk forms bran. Inside this is a row of squarish cells filled with gluten. Within these again are the starch cells filled with fine white starch.

During the process of milling, the bran and much of the gluten is removed, the proportion varying with the quality of the flour. Whole wheat-meal is the most nutritious, but the least digestible. "Seconds" flour has more nutritive power than the finest flour, for in the "best" flour, as it is called, very little gluten is left.

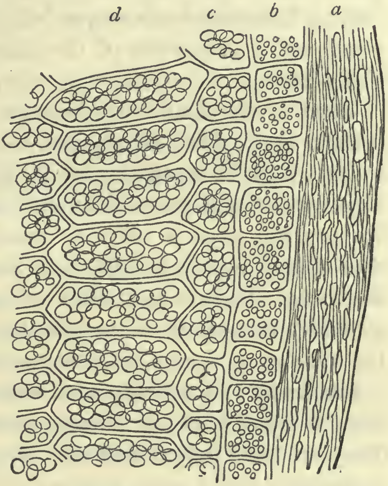


FIG. 17.—SECTION OF GRAIN OF WHEAT.

A good flour is white in colour, free from grittiness, acidity, or mouldy odour. It may be **adulterated** by the admixture of cheap starches, such as potato and rice starch. Such adulteration is readily detected under the microscope owing to the marked difference in the appearance of the different starch grains (Figs. 3, 4, 5, and 6).

Bread. White bread is made from fine white flour; brown bread and wholemeal bread are made from wheat-meal which contains more or less bran. White bread is more digestible, but brown bread is more nutritious.

Bread is made by mixing the flour with water and forming it into a dough by kneading; it is the presence of gluten in flour which renders this possible. The dough is made light by causing it to be permeated with carbonic acid gas produced either by fermentation, or by baking-powders, or by forcing the gas into the dough by pressure, a process which produces **aerated bread**.

Fermentation is effected in dough by the addition of yeast, which sets up a fermenting action in the starch, under the influence of warmth and moisture, and produces in the bread alcohol and carbonic acid gas, the latter causing the dough to be perforated by innumerable little holes, and rendering it light and digestible. During baking, fermentation is stopped by the killing of the yeast plant, and a proportion of the starch is changed into sugar and dextrine.

Good bread should be white in colour, and should not contain more than 50 per cent. of water. **Alum** is sometimes added to bread to give it a whiter appearance, and thus conceal the use of inferior flour. It can be detected by pouring over a slice of bread first a freshly made decoction of logwood chips, then a solution of carbonate of ammonia. If alum be present the bread is stained lavender or violet, according to the quantity of the adulterant; in the absence of alum a pink colour is obtained.

Macaroni, Vermicelli, and Semolina are preparations from a hard kind of wheat grown in France and Italy. They are used in puddings and soups, and are very rich in gluten.

Barley closely resembles wheat in its composition, the chief difference being in the character of the nitrogenous matter. Barley is deficient in gluten, and for this reason cannot easily be made into bread unless mixed with wheat flour, gluten being necessary to form a cohesive dough.

Uses of Barley. When the whole grain is ground it forms barley-meal, used for fattening fowls and pigs. When the husk is taken away and the grain polished and rounded it is known as **pearl barley,** and is used in soups and barley water. **Malt** is prepared from barley by subjecting the grain to heat and moisture until it germinates.

During this process the starch within the grain undergoes partial conversion into sugar, and to this change the sweet taste of malted grain is due. Malt is largely used by brewers in the manufacture of beer, ale, and porter.

Oats rank next to wheat in nutritive value. They are very rich in nitrogenous matter and fat. Like barley, they are deficient in gluten and so oatmeal cannot be made into bread.

Uses of Oats. The grain is ground into meal and made into porridge and oat-cake. These are staple articles of diet in Scotland and the North of England, where oats are largely grown. Though very nutritious they are apt to be indigestible, owing to their irritating action on the digestive organs.

Rye is not much used in England, though when mixed with wheat-flour it may be made into a fancy bread. In Germany it forms the black bread of the peasantry, and is of a dark colour and bitter taste.

Rice is very deficient in nitrogenous matter, fats and salts, but especially rich in starch. To this fact is due the very white appearance of rice-flour, which is sometimes mixed with wheat-flour to produce extra white bread.

Uses of Rice. Rice is chiefly used in England in conjunction with a nitrogenous food, such as milk or meat. Ground rice is made into cakes and buns. In India, China, Egypt, and other countries where it is grown, it forms the staple food of the natives.

Maize or Indian Corn, though little used in England, is an important food in America and Italy. It contains very little nitrogenous matter, but is rich in fat and starch.

Uses of Maize. In England it is used for feeding fowls and horses. In America, in a green state it is cooked as a vegetable.

Hominy, made from broken maize, oswego flour, corn flour, and maizena are all preparations of maize used for making cakes, puddings, etc.

Leguminous Foods include peas, beans, and lentils, all of which contain a large amount of the proteid **legumin**, or vegetable casein; owing to this their dietetic value is high. Leguminous foods are valuable too, because they form a

FIG. 18.—INDIAN CORN.

FIG. 19.—MAIZE.

cheap substitute for meat; they need prolonged cooking, however, to make them digestible. They are frequently associated with fatty and starchy foods; the Hindoos add foods of this kind to rice; and in England beans and bacon is a favourite combination in agricultural districts.

Starchy Foods. Of these the **potato** must be regarded as of the first importance. In chemical composition the potato is found to contain about 26 per cent. of solid matter, of which 19 per cent. is starch. Its value as an article of food lies not only in the starch it contains, but in its power as an antiscorbutic.

New potatoes are less digestible than old ones. The best potatoes form a floury mass when cooked. If boiled, potatoes should be cooked in their skins; they are better steamed than boiled.

Arrowroot. The term arrowroot was originally applied to the starch obtained from the tuber of the Maranta arundinacæ; it is now, however, applied to a variety of starches, *e.g.* the Canna and Tacca arrowroots. Arrowroot is a pure starch, easily digested and non-irritating; it is much used as a food for invalids.

Tapioca is prepared from the roots of the cassava, grown in Brazil. It is used for making puddings and thickening soups.

Sago is obtained from the pith of the stem of various palms. It forms a light and digestible food.

Green Vegetables and Fruits are valuable for their antiscorbutic properties, being specially useful in the prevention of scurvy. The cellulose or woody fibre of which green vegetables are mainly composed, though non-digestible in character, is useful in stimulating the action of the bowels, thus preventing constipation. Green vegetables and fruits are valuable articles of food, not because of the nutriment they contain, for their principal constituent is insoluble cellulose or woody fibre, but because of their mineral salts.

The Cabbage Family includes the cauliflower, broccoli, Brussels sprouts, etc. They are chiefly made up of cellulose, water, and salts.

Carrots, Turnips, and Parsnips contain sugar, and are valuable in preserving the purity of the blood.

Beet-root is grown for its sugar, and is used also for salad and a garnish.

Onions are among the most valuable of our vegetables. They form a nourishing and digestible article of food.

Garlic, Leek, and Shallot are used for flavouring purposes.

Celery is formed of the leaf stalk of the plant. It is very indigestible unless boiled.

Salads are invariably eaten raw, and great care must be exercised in preparing them for the table, to ensure their perfect cleanliness, otherwise parasitic forms of life may be introduced into the body. The chief salads are lettuce, endive, watercress, cucumber, and radish.

Herbs, such as thyme, sage, mint, and parsley are used for flavouring purposes.

Fruits. The chief English fruits are apricot, peach, apple, pear, plum, cherry, currant, strawberry, raspberry, gooseberry, blackberry.

Foreign Fruits include the banana, pine-apple, melon, orange, lemon, date, prune, fig.

The value of fruits lies in their sugar and mineral salts.

The Apple is a nourishing food. It is eaten either raw or cooked. The juice is made into cider.

The Pear is more wholesome stewed than raw. Perry is made from the juice.

Apricots, Peaches, Plums, and Cherries are classed as stone fruits. Care must be taken not to eat them over-ripe or under-ripe, as in these conditions they produce diarrhœa. Apricots and peaches are eaten raw, plums and cherries either raw or cooked.

The Strawberry is perhaps the most popular English fruit, and is generally eaten raw. Raspberries, too, have a delicious flavour.

The Gooseberry is cooked when green, and eaten raw when ripe.

Black, Red, and White Currants are usually cooked.

Blackberries are not cultivated, but grow wild in the hedges. They are eaten raw or cooked, and make good jam.

Foreign Fruits. **The Banana** is a nourishing food, and is imported into England in large quantities. It is always eaten raw.

Pine Apples have a delicious flavour, but except when tinned are rather expensive.

The Date has nourishing properties, and is largely eaten in the countries where it is grown. It has been called the Bread of the Desert.

Lemons are especially useful for the salts they contain.

Grapes are imported from the south of Europe, and form a wholesome and refreshing article of diet.

Figs, Raisins, Currants, and Prunes are dried fruits.

Nuts are possessed of considerable nourishing power, owing to the starch and oil they contain. Unfortunately they are very indigestible.

The chief nuts are the walnut, chestnut, hazelnut, cocoa-nut, Brazil nut, almond, and Barcelona nut.

Condiments. These are substances which, not being themselves foods, are taken along with food with the object of adding to and improving its flavour, and at the same time assisting digestion.

Four Groups of Condiments. These are (*a*) condiments proper, (*b*) spices, (*c*) flavouring agents, (*d*) acidulous substances.

Condiments proper include common salt, mustard, pepper, cayenne, capers, mint, mushrooms, and horse-radish. These are all eaten with savoury dishes.

Spices are such substances as ginger, cinnamon, mace, nutmeg, and cloves, which are all eaten with sweet dishes. This will help you to distinguish between condiments proper and spices.

Flavouring Agents are used, as their name implies, to add flavour. Examples of this class are vanilla, essence of lemon, oil of bitter almonds, etc.

Acidulous Substances include vinegar and lemon juice.

Sources of various Condiments. **Mustard** is prepared from the seeds of the yellow-flowered mustard plant, which grows plentifully in Yorkshire, Lincolnshire, and the county of Durham. It is prepared by adding wheat flour to the pure mustard, as the latter alone would be too pungent.

To Mix Mustard for Table. Put a teaspoonful of mustard into a glass and mix to a smooth paste with cold water, making it neither watery nor very thick.

Horse-radish is the tap-root of a cruciferous plant. The root is scraped into fine shavings for table use. It is eaten with beef, but is apt to cause indigestion.

Pepper is imported from the East and West Indies, and is prepared from the seeds of the pepper plant.

Cayenne Pepper is the seed pod of a plant, ground up into red powder.

Ginger, misleadingly called Root-ginger, is the underground stem or root-stock of a tropical plant. It is dried and powdered and used to flavour biscuits, cakes, etc. Preserved, green, or crystallised it forms a sweetmeat.

Cinnamon is cut off in strips from the inner bark of an evergreen tree grown in Ceylon.

Nutmegs are the kernels or seeds of an East Indian tree. They grow within a shell, which is surrounded by a soft pulpy fruit not unlike a peach. Outside the nutmeg, and within the shell, is the lace-like substance known as **mace**, which is used for flavouring various dishes.

Cloves are the dried flower buds of an evergreen tree grown in the West Indies.

Allspice obtains its name from its flavour, which is said to unite the flavours of several other spices.

Vinegar. The three kinds of vinegar are: wine vinegar, malt vinegar, and wood vinegar.

Uses of Condiments. Condiments are useful, if taken in moderation, in stimulating the flow of the digestive juices, and thus aiding digestion. If used in excess they irritate and injure the delicate lining of the digestive tract, and thus produce indigestion. Children should not use condiments at all.

Acidulous Substances are valuable, if not taken to excess, in keeping the blood pure. Lemon juice is particularly good for this purpose.

Questions.

1. What are the ingredients in a loaf of wheaten bread? What other kinds of bread are there, and why is one to be preferred to another? (*Scholarship*, 1890.)

2. What is the function of yeast in making bread? Discuss the merits of white and brown bread respectively. (*Scholarship*, 1894.)

3. Should children eat much or little fruit? Discuss the general value of fruit as food. (1894.)

4. Distinguish between the values of lentils, oats, and green vegetables as articles of food. Give full reasons for your answer. (*Scholarship*, 1897.)

CHAPTER VI.

BEVERAGES.

Classification of Beverages. Beverages may be divided into those which contain alcohol and those which do not. The former are known as alcoholic or fermented liquors, the latter as non-alcoholic or unfermented drinks.

Non-Alcoholic Beverages. The principal of these beverages are tea, coffee, cocoa, and aërated waters.

Tea consists of the dried leaves of an evergreen shrub called the **Camellia Thea,** grown in China, Japan, India, and Ceylon. If the dried tea-leaves are soaked in hot water and carefully uncurled, they will be found to be ovate in shape, with pointed apex and serrate margin. The arrangement of the veins is peculiar to the tea-leaf, and a knowledge of this is useful in determining whether or no foreign leaves have been mixed with the tea. Examine a tea-leaf carefully, by the help of a magnifying glass if necessary, and it will be seen that the large veins do not reach as far as the edge of the leaf, but turn inwards towards the mid-rib.

Varieties of Tea. The simplest division of teas is into **green** and **black**.

Black Teas owe their colour to the practice of allowing the leaves to lie in heaps for 12 hours, and then slowly drying over charcoal fires. **Green teas** are made from the young leaves, dried over wood fires when fresh.

In selecting a tea, pour a little hot water over the leaves, and determine whether the leaves are whole or have been cut into pieces.

The best tea is made from small, whole leaves, not large leaves cut up.

Composition of Tea.

Water,	8 per cent.
Theine,	3 ,,
Tannin,	14 ,,
Oil,	0·4 ,,
Insoluble matter and extractives,	74·6 ,,

A volatile oil, theine, and tannin are the parts that appear in an infusion of tea.

The Volatile Oil gives to tea its peculiar aroma and flavour; it is only drawn out by boiling water.

Theine is an alkaloid similar in nature to quinine. It is to the presence of theine that tea owes its restorative powers; it is essentially a stimulant to the brain and nervous system.

Tannin is an acid which is only drawn out in any quantity if the tea is allowed to stand on the leaves for a considerable time. The presence of tannin in an infusion of tea produces grave derangement of the digestion and induces constipation.

To make good Tea use a warm, dry teapot and **boiling** water. Let the tea infuse for three or four minutes, then pour it off into another warm teapot, by this means the danger of tannin is reduced to a minimum.

Adulterations of Tea. At one time it was a common practice to prepare and mix in leaves of the willow and sloe, which are not unlike the tea-leaf. Such adulteration is easily detected by examination of the leaves. At the present time the chief adulteration consists of the admixture of tea leaves which have been previously used; the weak and tasteless nature of the infusion, resulting from tea thus adulterated, is sufficient for detection for all general purposes.

Green teas have been known to be artificially coloured by a mixture of turmeric and indigo. Cheap teas are sometimes found to contain clay, lime, or sand.

Effects of Tea-Drinking. It must be remembered that tea has no value as a food, except that possibly it retards tissue-waste. As a beverage it acts as a stimulant to the brain, exciting it to further activity; it will often remove headache, but may cause sleeplessness. It promotes the action of the skin by causing an increased flow of perspiration; thus tea has cooling power in hot weather. Taken in excess, or badly made, it causes indigestion, constipation, palpitation of the heart, and loss of appetite. Tea should never be taken with meat, the effect of tannin being to harden the meat-fibres and render them difficult of digestion.

Coffee and Cocoa are both prepared from the berry of their respective plants—coffee from the Caffea Arabica, a plant grown in Arabia, Abyssinia, Ceylon, and the West Indies; and cocoa from the Theobroma Cacao, grown largely in the West Indies.

Coffee is prepared by roasting the seeds till they become chocolate brown in colour, and then grinding them into a powder in a mill.

Composition of Coffee.

Caffeine, - - - -	1·2 per cent.
Caffeic acid, - - - - -	32·7
A volatile oil.	
Water, fat, nitrogenous matter.	

In its composition coffee strongly resembles tea. **Caffeine** is similar in its properties to theine. **Caffeic acid** is identical with tannin, and a volatile oil, developed during roasting, gives to coffee its aromatic qualities.

Coffee is frequently adulterated with **Chicory,** a powder similar in colour, prepared from the root of the wild endive. To test whether coffee has been mixed with chicory, put a spoonful of the coffee to be examined into a tumbler of water. Coffee will float on the surface, but chicory sinks to the bottom, giving to the water a deep colour.

Effects of drinking Coffee. These are similar to those of tea-drinking.

1. Coffee is a stimulant, and has a power of exhilaration exceeding even that of tea.

2. It produces sleeplessness.

3. It increases the action of the heart.

4. It assists the excretory power of the intestines.

The ill effects of Coffee-drinking are that it produces a dry hot skin, and tends to bring about a disordered digestion.

To make good Coffee. Use one ounce of coffee to a breakfast cup of water. The mistake usually made in England is to use too little coffee. The beans should have been recently roasted and freshly ground, and the water must be boiling.

Cocoa is prepared by stripping the outer coverings or husks from the seeds of the Theobroma Cacao, which are then called cocoa-nibs, and breaking the nibs to pieces. These are next ground and "prepared."

Composition of Cocoa.

Water,	6 per cent.
Theobromine,	1½ ,,
Fat or oil,	50 ,,
Starch,	10 ,,
Gum, cellulose, and salts.	

Theobromine is an alkaloid, corresponding to theine in tea, and caffeine in coffee, but is not so stimulating in its action.

Fat is present in such great proportion that pure cocoa is too rich to be digested. For this reason cocoa is "prepared" by removing about 25 per cent. of the fat (cacao-butter), and substituting starch and sugar.

Value of Cocoa. In comparing the composition of cocoa with that of coffee and tea, we find some important differences.

The absence of an injurious acid such as tannin and caffeic acid renders it a more wholesome beverage; and the large proportion of starch, sugar, and fat gives it a positive food value.

Effects of drinking Cocoa. (1) It stimulates the nervous system, but not so much so as tea and coffee.

(2) It promotes the action of the skin.

(3) It forms a nourishing article of food. The only drawback to its use is that it is too rich for some digestions.

Chocolate is prepared by grinding cocoa to a powder, mixing it with sugar and flavouring matter, making it into a paste with water, and pressing it into moulds. It is occasionally used as a beverage, but more often as a sweet-meat.

Aerated Waters are prepared by forcing carbonic acid gas into water, and adding a saline or flavouring agent such as bi-carbonate of soda or lemon-juice.

The chief aerated waters are soda water, potass water, lemonade, appollinaris, and seltzer water. Much of the **soda-water** sold as such contains no soda at all, but is merely carbonic acid and water.

Lemonade is generally made with weak sulphuric acid, flavoured with oil of lemons and charged with carbonic acid gas. The best lemonade is made at home from fresh lemons.

Value of Aerated Waters. Carbonic acid, under pressure, is a poison to most of the micro-organisms which exist in water. For this reason the use of aerated waters is a safeguard against the water-borne diseases of which enteric fever and cholera are examples. Soda-water and lemonade are useful in cases of weak digestion.

Dangers of Aerated Waters. The use of impure water in the manufacture of aerated waters may lead to ill effects; lead, copper, and tin have been found in aerated waters, derived either from the vessels and fittings used in their manufacture, or from the imperfect washing of the gas; when the carbonic acid gas is prepared from impure materials the resulting beverage is impure. All these dangers can be obviated by care in the preparation.

Alcoholic Liquors all agree in containing more or less alcohol produced by a process of fermentation.

Fermentation is a process set up in a saccharine infusion by a minute fungus which exists in yeast, and in small quantities in the air. During fermentation the sugar is split up into alcohol and carbonic acid gas, the former remaining in the liquid, the latter escaping in bubbles into the air. The process may be explained in this way. One molecule of grape-sugar is represented by $C_6H_{12}O_6$; during fermentation it becomes split up into two molecules of alcohol ($C_2H_6O \times 2$) and two molecules of carbonic acid gas ($CO_2 \times 2$).

The process of fermentation may be watched by taking a little sugar, dissolving it in water, and adding a little yeast to it. Before ordinary cane or beetroot sugar can ferment, however, it must be changed into grape sugar; this is done by the action of the yeast.

Secondary Sugars. If instead of taking a natural sugar, we take ordinary starch and boil it in a 1 per cent. solution of sulphuric acid, the starch is converted into dextrine and afterwards into a variety of sugar closely resembling grape-sugar. Under the influence of yeast, fermentation is set up in such sugars precisely in the same way as in natural sugars. Secondary sugars prepared from potato starch are largely used in the manufacture of beers and cheap spirits.

Alcohol is a colourless liquid, having a distinctive odour. It is prepared in a pure form by repeatedly distilling fermented liquids.

Classification of Alcoholic Liquors.

1. Beers, ales, and porters, or malt liquors.
2. Wines.
3. Spirits.

Beers may be divided into two classes, (*a*) malt beers which are prepared from malt, and (*b*) non-malt beers in which the malt is replaced by sugar artificially made from starch.

Preparation of Malt Liquors. In the hands of the maltster barley is subjected to heat and moisture until it germinates; when the sprouting has taken place sufficiently the grain is dried over a kiln and further germination stopped. If tasted now, the malt is decidedly sweet, owing to the natural conversion of the starch in the grain into sugar by the action of the diastase ferment developed during germination. After the sprouts have been broken off by sifting the malt, it is handed over to the brewer, who crushes it, puts it into warm water for a time, then boils it and adds hops. The next step is to run off the sweet liquid into shallow vessels, where it is cooled to about 60° F. It is then put into fermenting tuns, yeast is added, and the liquid is left to ferment for six or eight days. During this time the sugar in the beer is split up into alcohol and carbonic acid gas; the former remains in the liquid, the latter escapes into the air. The amount of alcohol in beer varies from 1 to 10 per cent.

Effects of drinking Beer. Regarded as a food, beer cannot be said to have much nutritive value, though the various saccharine substances it contains give it some slight claim. The effects of beer on the system are mainly those of alcohol, which will be discussed later. It has, however, some effect, peculiarly its own. On some people, for instance, beer has a marked depressing influence; if taken in excess it undoubtedly produces sleep and stupor; it tends to produce obesity, gout, and rheumatism, and when drunk in excess has an injurious effect upon the digestion.

Wines are produced by the fermentation of the juice of the grape. The juice is pressed out of the fruit and exposed until fermentation takes place from the action of the germs present in the air upon the grape-sugar. During this process a part or the whole of the grape sugar is converted into alcohol and CO_2.

The amount of alcohol contained in wines varies from 6 to 22 per cent. When the alcohol in a fermenting liquid reaches 14 per cent. the fermentation immediately ceases;

any excess over that amount in any wine must have been artificially added; a cheap "potato" brandy is commonly used to increase the alcoholic strength of wines, more especially ports and sherries.

Like beer, wine is specially prone to produce gout.

Spirits are made by the distillation of wine or some other liquor which has previously undergone fermentation. The accompanying diagram will help you to understand how distillation is accomplished.

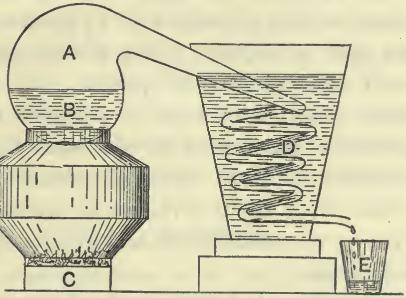


FIG. 20.—APPARATUS FOR ILLUSTRATING DISTILLATION ON A SMALL SCALE.

The retort (*a*) contains wine (*b*); (*c*) is a heating apparatus which boils the wine in the retort. Alcohol boils at a lower temperature than water, and therefore is earlier driven off as vapour.

The vapour passes down the tube of the retort into a "worm" (*d*) which is kept cold by being immersed in cold water. The vapour is thus re-condensed and the alcohol, in a liquid form, passes out into a receiver (*e*).

The chief spirits are: brandy whisky, rum, gin.

Brandy is made by distilling wine, though cheap brandies are made from potato spirit. When new it is colourless, but darkens with age.

Whisky is made from malted grain.

Rum is obtained by the distillation of fermented molasses, the scrapings of sugar barrels.

Gin is distilled from malted grain, flavoured with juniper berries and oil of turpentine.

The amount of alcohol contained in spirits varies from 40 to 60 per cent.

Effects of Alcohol upon the System.

1. **In Moderation.** According to Dr. Parkes the limit of moderation is set down as an amount of liquor containing not more than $1\frac{1}{2}$ fluid ounces of pure alcohol in 24 hours. Such an amount would be yielded by $1\frac{1}{2}$ pints of beer containing 5 per cent. of alcohol; $\frac{3}{4}$ pint of wine containing 10 per cent.; or 6 tablespoonfuls of spirits.

This amount taken with food at sufficient intervals is found to stimulate the **action of the heart**, causing the small bloodvessels to dilate, especially those of the skin. It is due to this that a slight reduction in temperature with a lessened power of resistance to cold follows the drinking of an alcoholic liquor.

Even in moderation the effect upon the **muscles** is not good, and the same is true of the **nervous system**. The **digestive organs** are strengthened and stimulated for a time, but the lasting results are not beneficial.

2. **In excess** the results of alcohol are disastrous in the extreme. **Indigestion** accompanied by acute **inflammation of the stomach** is one of the least of the evils. The habitual drinking of spirits leads to a **hardening of the liver** with obstruction to the flow of blood from the portal vein through the liver—a condition which results in **dropsy** and **vomiting of blood**. Besides this, the blood being insufficiently supplied with nutriment, the tissues are not properly nourished and **general degeneration** sets in. **Kidney disease** is far more prevalent among those who drink alcoholic liquors than among abstainers. The **nervous system** suffers in many

ways, of which **delirium tremens, paralysis,** and **insanity** are perhaps the worst examples.

Use of Alcohol. There can be no doubt that in the majority of cases a person is better without alcohol than with it. That harder work can be done without its use has been proved over and over again by the experience of soldiers and travellers in foreign expeditions. In hot countries spirits are especially hurtful to the liver; and in cold countries they tend to reduce the temperature as previously stated, and should therefore be avoided.

It is possible that to the brain worker a moderate dose at the end of the day's labours, taken with food, may be beneficial, also to the old and feeble. It must be remembered, however, that alcohol should never be taken when the stomach is empty, or during working-hours; and children should never under any circumstances be allowed to touch it.

Questions.

1. State what you know as to the ingredients, the chemical components, and the practical worth of the several beverages in common use amongst us. (*First Year Certificate*, 1894.)
2. What are the effects, beneficial or injurious, of alcohol upon the human body, when it is taken in moderate amount along with food? (*Second Year Certificate*, 1896.)

CHAPTER VII.

THE PREPARATION OF FOOD.

Reasons for Cooking Food.

1. By cooking **food is rendered more digestible.** The texture of the food is altered, fibres and cells are broken up and made softer and therefore more easy of mastication; a piece of meat, for instance, before being cooked is tough

and stringy, but after cooking the muscular fibres are softened and loosened. In the same way cooking renders vegetables softer and loosens their fibres so that they are easily penetrated by the digestive juices. Certain chemical changes take place during cooking; thus starch is partially converted into dextrine, and connective tissue into gelatine, both changes greatly facilitating digestion. Starch cells are broken up by cooking; in an unbroken state they almost entirely resist the action of the digestive juices.

2. Cooking has the power of destroying dangerous parasites in meat, thus making it fit for food.

3. Cooking helps to preserve meat from putrefactive changes, and to keep milk sweet for a longer period.

4. By means of cooking the **flavour** of food is improved, greater **variety** obtained, and the food rendered more **pleasant to the eye**. Some foods are habitually eaten uncooked: the oyster, eaten raw, is self-digesting, owing to a natural ferment contained in its liver; cooking destroys the ferment. There is, therefore, an excellent reason for not cooking oysters.

Salads and fruits undergo a ripening process which is almost akin to cooking; salads should, however, be well washed to free them from the risk of parasitic germs.

Methods of Cooking. The methods of cooking most commonly practised are roasting, baking, grilling, boiling, stewing, and frying.

Roasting. This may be regarded as our national method of cooking meat.

Joints of meat to be roasted must be of good quality, *e.g.* sirloin of beef, leg of mutton, loin of pork, etc.

Method of Roasting Meat. As roasting consists of exposing meat to rays of heat given off from a fire, it is essential that the fire be clear, bright, and smokeless. A good cook will attend to the fire first of all.

The joint to be roasted must be washed in clean cold water, or else wiped with a clean damp cloth. It is then placed on a jack before the fire, with a tin underneath to catch the dripping. If a jack is not to be had, the meat

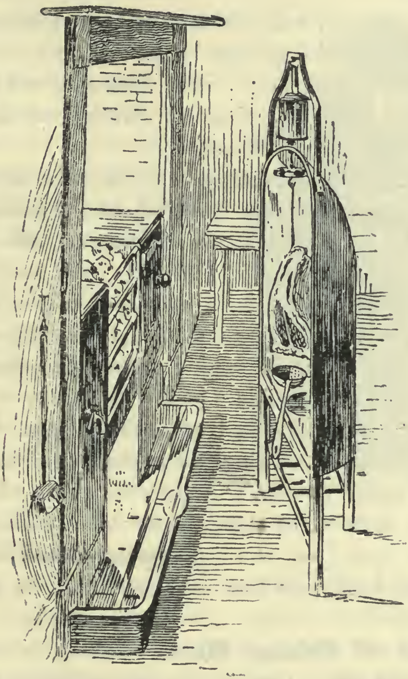


FIG. 21.—METHOD OF ROASTING.

may be hung on to a strong hook by several strands of worsted, which by twisting and untwisting keep the joint continually turning.

The meat must be placed close to the fire for the first fifteen minutes, the object of this being to harden the albumen on the surface, and thus form a coat which will keep in the juices. At the end of this time, however, the joint must be drawn back a little, or the outside will be burnt before the inside is cooked. While cooking, it must be frequently basted with the gravy which falls into the tin beneath.

There is an old rule which says that, for roasting, the cook should allow a quarter of an hour for every pound, and a quarter of an hour over. This rule will serve as an excellent guide, though time allowed for cooking will vary somewhat with circumstances.

Advantages of Roasting. The chief advantage of this method of cooking is that it draws out the flavour of good meat better than any other. Then, too, the juices are retained within the meat.

Its disadvantages lie in the fact that it entails a large amount of trouble, it is only applicable to choice joints, the meat loses considerable weight during the process, and is comparatively indigestible.

Baking. As a method of cooking meat baking has almost superseded roasting. The reason for this is that it is a much easier process, and that, with care, the flavour is nearly as fine. The meat must be baked in a well-ventilated oven, or the vapours produced during the process fall back into the meat, rendering it sodden and unpalatable.

Method of Baking Meat. Baking is cooking by means of hot air. Just as in roasting the cook must see that her fire is bright, so in baking the oven must be at the right temperature. The modern ovens are fitted with thermometers, so that this may easily be ensured.

Meat and pastry need a quick oven, bread a moderate degree of heat, and milk puddings and stews a cool or slow oven.

To test the heat of an oven. If a thermometer is not to hand the heat of the oven may be tested by sprinkling flour on the shelf. If it burns quickly, the oven is too hot; if it turns brown, the heat is suited to meat and pastry; and if it changes colour slowly, the oven is right for milk puddings and stews.

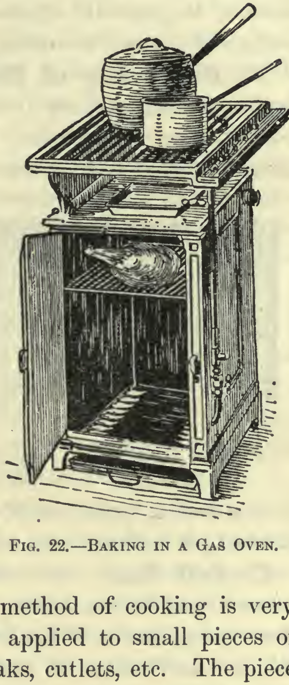


FIG. 22.—BAKING IN A GAS OVEN.

Having tested the oven, the meat should be put in the hottest part for about fifteen minutes, with the object of forming a coat to keep in the juices, and then removed to a more moderate part of the oven. Care must be taken not to open the oven door too frequently, as this tends to reduce the temperature. It is necessary to baste the baking joint occasionally, though not so frequently as in roasting. The time allowed for baking is similar to that for roasting.

Grilling or Broiling as a method of cooking is very similar to roasting. It is only applied to small pieces of meat or fish, such as chops, steaks, cutlets, etc. The piece of meat is placed on a grill or gridiron over a clear hot fire, and turned by means of special tongs or the flat blade of a knife. A fork must on no account be stuck into the meat for this purpose, or the juices will escape, and the meat be dry and tasteless. A well-cooked chop should be puffed out in the centre.

Boiling. This is a method of cooking in which heat is applied by immersion in a hot liquid, usually water, Before proceeding to boil a joint it is necessary to decide whether our object is to draw out the juices to make broth or soup, or to keep the juices in the joint.

For prime joints, such as leg of mutton, the latter method is generally adopted: less choice pieces, such as scrag end of neck of mutton, are chosen for making broth.

To Boil a Leg of Mutton. Plunge the joint into boiling water, and keep it at that point for the first five or ten minutes, during which time the necessary coating will have formed. Then reduce the temperature of the water

FIG. 23.—SECTION OF A POTATO, AS SEEN UNDER MICROSCOPE, SHOWING STARCH CELLS.

to simmering point (170°–180° Fahrenheit). The time allowed for boiling is the same as in roasting and baking.

To Boil Fish. In boiling fish you must remember never to put it into boiling water. The reason for this is that the agitation of the water during boiling breaks the fish up, and makes it unsightly when served. Salmon, being of firmer texture, is an exception to this rule.

Boiling has the advantage of being the most digestible method of cooking meat; it also serves to give variety.

Starchy Foods, such as potatoes and rice, must be boiled slowly, so that the starch grains may swell and burst.

Green Vegetables are best boiled quickly with the lid of the saucepan off, so as to keep them a good colour.

Puddings must be kept boiling briskly, and as the water evaporates, more must be added from a kettle of boiling water, or a burnt pudding will be the result.

Stewing is an excellent method of cooking tough, coarse, inferior pieces of meat. The meat is cut up into small pieces and put into an earthenware stew-pan with a little water. This is either put into a slow oven, or fitted into a pan of water which surrounds the jar, but never gets inside it.

The contents of the jar must never rise above simmering point, the slow and thorough cooking thus ensured makes the fibres soft and easy of digestion, and draws the juices into the liquid. Frequently, in making stews, vegetables are added, and the nutritive value thereby increased.

The advantage of Stewing lies in its economy, but if fat be put into the stew-pan, the stew is sometimes too rich to be easily digested.

Hashing is a means of using up meat which has been previously cooked; it is a good way of using up cold meat, but is unfortunately apt to be difficult of digestion.

Frying is of all methods the most abused. If it be well done in a proper manner it is a valuable and palatable method of cooking small pieces of meat and fish, but unfortunately comparatively few cooks understand how to use the frying-pan. The general practice is to melt enough fat in the pan to prevent the meat from sticking, with the result that the meat first becomes sodden with fat, and afterwards burnt on the outside and half-cooked within.

The proper method is to put into the pan enough fat to cover the meat, raise it to boiling point (taking care not to burn it), and then, and not till then, immerse the piece of meat. The hot fat forms a coat round the meat and keeps in the juices, the cooking being really performed by the hot steam which penetrates to the interior.

Soups and Broths.

The Stock-Pot. A well-organised kitchen is never without its stock-pot. Into this are put scraps of meat, crushed bones, cooked and uncooked, gravy, vegetables, if not old or sour, the liquor in which meat has been boiled, and, indeed, any wholesome scraps which a careful housewife considers too good to throw away.

If, when the time for making soup comes round, a sufficient supply of scraps is not to hand, bones and trimmings of meat may be bought from the butcher.

To make Stock. Having put in all the available material, fill up the pot with **cold** water and bring it slowly to the boil. By this means the nutriment in the bones and meat is drawn out into the liquid. Just before the stock comes to the boil add a teaspoonful of salt the object being to bring the scum to the top. This can then be removed with a spoon.

Add a few vegetables, such as carrots, onions, turnips, and celery, and to give additional flavour spices such as whole pepper may be put in.

The stock should be allowed to simmer gently for at least five or six hours, or even for a whole day, but it must never be left in the pan over night. When cold, the fat which forms on the surface should be removed.

To make Soup. Stock thus made is readily converted into soup.

The stock should be brought to the boil and then allowed to simmer for two or three hours. At the end of this time add vegetables cut small, then let the soup boil till the vegetables are quite soft.

Soup is much improved by passing it through a sieve, the vegetables being rubbed through with a spoon. After this it must be boiled up again, for cold soup is unendurable; powdered mint, pepper, and salt are added just before serving.

Soup may be thickened by the addition of tapioca (previously soaked) or flour.

Pea Soup. Soups may be made in endless variety. One of the cheapest and simplest is pea soup.

Ingredients. 2 quarts of stock; 1 pint of split peas; 1 turnip, 1 carrot, 1 onion; a small piece of celery and a dessert-spoonful of powdered mint; pepper and salt to taste.

The peas must be soaked all night in cold water. When ready to make the soup, strain the water off, put the peas into a saucepan with the stock, bring it to the boil, and then allow the soup to simmer for about two hours. At the end of this time add the vegetables, and follow the instructions given in the previous recipe.

Broth. Broths are made from fresh meat, such as neck of mutton or chicken.

The meat is put into cold water, which is slowly brought to the boil, the result being that the juices of the meat are drawn out into the water.

To make Mutton Broth. Put from 2 to 3 lbs. of the scrag end of neck of mutton into 7 or 8 pints of cold water. Bring the water slowly to simmering point, and keep it at this degree for 2½ hours. At the end of the first half hour add 2 carrots, 1 turnip, 2 small onions previously prepared and cut up, and just before serving season with pepper and salt. The meat may be served with the broth; and all fat should be carefully removed.

The Cooking of Eggs. No article of food needs more careful cooking than an egg. A raw egg is easily digested; lightly cooked eggs can be digested by most persons; but a hard-boiled or fried egg is extremely difficult to digest. This is because during cooking the white or albumen hardens, and if subjected to boiling water for even a short time, becomes tough and almost impervious to the digestive juices.

To Boil an Egg. The common method of boiling an egg is to drop it into boiling water, and allow it to boil for $3\frac{1}{2}$ minutes. By this means the white is set hard, while the yoke is only half cooked.

A better way is to place the egg in boiling water, draw the pan to the side of the fire, and leave the egg to simmer for 5 minutes. The cooking is thus slower, and, as a result, the white is not too hard, and the yolk is more perfectly cooked.

Hard-boiled eggs are used for salads, veal and ham pies, sandwiches, etc. The eggs should be put into cold water, which is then brought to the boil. After they have been boiling for a quarter of an hour they should be plunged into cold water; when quite cold, the shells may be easily removed.

Poached eggs are very digestible, and if one is possessed of an egg-poacher—a small pan divided into compartments, each large enough to hold one egg—they are easily prepared.

If, however, this utensil is not available, the egg, having first been broken into a cup, may be deftly slipped into a shallow sauce-pan or frying-pan about half full of boiling water. As soon as the white is set the egg is cooked. Care must be taken in removing the egg from the pan, or the yolk will break. A small egg-slice can be bought for a few pence, and with this there is little difficulty in keeping the egg whole.

Poached eggs are served on buttered toast or with bacon.

Buttered eggs are easily cooked and form a nice breakfast dish.

Break the eggs into a basin and beat them up thoroughly with a little salt and pepper. Melt the butter ($\frac{1}{2}$ oz. to an egg) in a small saucepan and add the beaten eggs. Stir well for about two minutes and serve on buttered toast.

Fried eggs are considered very difficult to digest. Yet, because of the ease with which they are cooked, they retain much of their popularity, and are frequently served with ham or bacon.

To fry an egg, break it into a cup and slip it into the pan after the ham has been removed. Baste the egg with the fat contained in the pan, and as soon as the white is firmly set remove it by means of a slice and serve.

The indigestibility of fried eggs is due to the fact that the albumen is coated with fat and cannot therefore be properly digested in the stomach.

The Preparation of Vegetables. It is of the utmost importance that vegetables be fresh. There is no comparison between a green vegetable, just cut from the garden, and one which has lain in the greengrocer's shop for two or three days. In choosing vegetables remember that firmness indicates freshness, whereas a limp and faded appearance signifies staleness.

Cabbages should be chosen with hard hearts, and peas with well-filled pods.

To Prepare Potatoes. New potatoes are scraped, washed in cold water, and put into boiling water with a little salt and a piece of mint. Old potatoes should be thinly pared, and put into cold water with a little salt. In each case boil the potatoes till soft.

To Prepare Peas and Beans. Remove peas and broad beans from the pods, and put them into boiling water.

Kidney beans are prepared by removing the ends and strings and cutting the beans into small pieces.

Cabbages are freed from their outer leaves and stalks, cut into halves or quarters according to their size, and well washed in cold water and salt. The object of this is to draw out the various insects which infest the cabbage. A caterpillar or a slug in a vegetable dish is a disgusting object.

Cabbages and all green vegetables are boiled fast, with the lid of the saucepan off.

Turnips are pared thickly because of the woody rind, **carrots** are thinly scraped. Remember that all fresh vegetables except old potatoes are put into boiling water.

Starchy Foods include rice, sago, arrowroot, tapioca, macaroni, semolina, vermicelli, corn-flour, etc.

As a general rule foods containing a large proportion of starch must be cooked very slowly, in order to give the starch-grains time to absorb moisture, swell out and burst. Half-cooked starchy foods are very difficult to digest as well as unpalatable. Most of the starchy foods mentioned above are used chiefly for making milk puddings.

To Make a Rice Pudding. Take 1½ tablespoonfuls of well-washed rice, put it into a greased pie-dish with a teaspoonful of chopped suet, a tablespoonful or less of moist sugar, and a pint of new milk; mix well together and bake in a slow oven for two hours. A mixture of milk and water may be used instead of whole milk, but the pudding will not be quite so nutritious. Eggs should not be added to milk puddings; they spoil the nature of the pudding and make it less digestible.

Simple Recipes.—Porridge. In Scotland oatmeal porridge might almost be called the staple article of diet; and in England, though its use is less general, it forms in many instances the foundation of the day's exertions. To be appreciated, porridge must be well made. Use coarse oatmeal, allowing an ounce of meal to half a pint of water. Put the water into a saucepan and bring it to the boil, then sprinkle the oatmeal very gradually into the boiling water, stirring all the while with a wooden spoon. Add salt to taste, and let the porridge simmer gently for about half an hour Serve as hot as possible in soup or porridge plates, with plenty of new milk and either salt or sugar.

Shepherd's Pie is a good way of using up cold meat and potatoes. To 1 lb. of meat allow 3 lbs. of potatoes. Mince the meat finely, season it with pepper and salt, and put it into a pie-dish with three or four tablespoonfuls of gravy. Mash the cold potatoes with an ounce of dripping and a little milk, season with salt, and spread in a thick layer over the meat, making the top either quite smooth by the aid of a knife, or ridged by means of a fork. Bake in a quick oven for half an hour and serve in the pie-dish decorated with a paper frill.

Irish Stew. This is a convenient dish of which most mothers of families are glad to avail themselves. Scraps of cold meat, scraps of uncooked meat, tinned meat, and the scrag end of neck of mutton may each be used for Irish stew.

To each lb. of meat take 2 lbs. of potatoes, 2 onions, a pint of water, and salt and pepper to taste.

Having prepared the potatoes, partly boil them; and, having cut them into thick slices, put a layer into a saucepan. Then cut the meat into small pieces and lay it in the pan upon the potatoes; slice the onions and add in the same way, with the pepper and salt; add the rest of the potatoes, pour in the water, and let the whole simmer gently for about two hours.

Rissoles. This is another method of using up cold meat and cold potatoes. Cut the meat from the bone, and mince it finely either by means of the mincing-machine or by the use of a sharp knife. Mash the potatoes quite smoothly, and mix them with the meat; add seasoning and a little chopped parsley. Make the mixture into spherical or oval shapes about as large as an egg, dip each one into egg and bread crumbs, and fry it in hot dripping. Serve with thickened gravy.

To Make Thickened Gravy. Remove the sausages from the pan and dredge a little flour into the fat in which they were fried. Stir the flour well in to prevent lumps, and then add a little hot water; stir well together until the gravy is thickened, then pour over and round the sausages.

Fish Pie is a method of using up the cold fish that may have been left from dinner. To ½ lb. of fish use ¾ lb. of cold potatoes, ½ oz. of dripping, and 1 tablespoonful of milk.

Mash the potatoes well; melt the dripping into half the quantity of milk, and stir the potatoes in.

Break the fish into small pieces, put it into a pie-dish, and season with pepper and salt. Add the rest of the milk and a teaspoonful of anchovy sauce; mix all well together, and cover over with the mashed potatoes. Bake in a moderate oven for about half an hour, until the top of the potato crust is nicely browned.

Smoked Haddock. An excellent way of cooking smoked haddock is as follows: Boil the fish in a frying pan or sauce-pan until the fish begins to leave the bones. Then remove it from the pan, separate the flesh from the skin and bones, put it on a hot dish, and break it up into small pieces. While the fish is cooking make some melted butter, and when the fish is ready pour this over and serve.

To Make Melted Butter. Mix together into a smooth paste ½ oz. of flour and 1 oz. of butter. Add ½ pint of boiling water, stirring in a little at a time, and about a quarter of a teaspoonful of salt. Put the sauce into a small saucepan and boil for two minutes, stirring all the time.

Vegetarian Stew. Prepare 1 lb. of potatoes by peeling and quartering. Cut up finely ½ lb. of onions and 2 leeks, slice a small turnip, and put all into a stew-pan with 1 pint of boiling water, and salt and pepper to taste. Stew for an hour, then add ½ lb. of haricot beans, previously boiled till soft. Put on the lid of the pan and stew for another quarter of an hour. A little salad oil should be added with the beans.

In this dish the beans furnish nitrogenous matter and thus take the place of meat; fat is furnished by the oil, and starch is provided by the potatoes as well as by the beans.

Macaroni in Batter forms a cheap and highly nourishing dish. Break up 6 oz. of pipe macaroni into short lengths and drop it into boiling water; add a little salt and pepper, 1 tablespoonful of salad oil, and an onion cut into slices. When the macaroni is soft, drain off the water, and make the batter in this way: Put into a basin ½ lb. of flour; beat up two eggs and mix gradually with flour, stirring all the while; add to this a little at a time, a pint of the water from the macaroni, stirring to avoid lumps. Chop finely a small onion and add it to the batter. This done, rub the inside of a deep pie-dish with salad oil, put in the macaroni, season with mixed herbs and a little nutmeg, pour the batter over, and bake in a quick oven for about three quarters of an hour, or until the top is browned. Serve with a plain white sauce made in the same way as the melted butter described in Chapter I., substituting milk for water.

Questions.

1. Name the materials and the proportional quantities for (*a*) pea-soup, or (*b*) a rice pudding. (*Scholarship*, 1888.)

2. What are the different methods of cooking butcher's meat? State why one method may not suit a particular piece so well as another, and give an example. (*Scholarship*, 1889.)

3. What are the advantages of *stewing* meat? Give a recipe for an Irish stew; and say how you would choose the pieces of meat most suitable for your purpose. (*Scholarship*, 1890.)

4. A leg of mutton, weighing 8 lbs., is purchased for a family of 6 persons. How would you provide 3 savoury dinners for the whole family from this joint? (*Scholarship*, 1893.)

5. State briefly the chief reasons for cooking our food.

(*Scholarship*, 1896.)

6. Give the recipe for boiled mutton and caper sauce. What changes would take place during the cooking of meat and what use could be made of the liquor in which it had been cooked?

(*Scholarship*, 1899.)

7. Give general directions for cooking green vegetables.

(*Second Year Certificate*, 1892.)

8. What are the main objects of cooking our food?

(*Second Year Certificate*, 1895.)

9. Describe the methods of making short crust, flaky crust, puff paste, and paste for raised pies. (*Second Year Certificate*, 1897.)

CHAPTER VIII.

CLOTHING.

Uses of Clothing. 1. **To keep in the heat of the body.** The temperature of the body in health is 98·4° F. If this varies ever so slightly it is an indication of a deranged system.

The source of heat in the body is the oxidation of the various heat-producing substances supplied as food, and the ever recurring necessity for warmth-giving foods is owing to the fact that heat is being constantly lost from the body. It is clear that the greater the amount of heat lost, the more food will be required to make good the loss. Any practice, therefore, which tends to reduce the loss of body-heat, also involves a corresponding reduction of the amount of heat-giving food required.

Heat is lost mainly from the skin; it is also lost from the lungs, expired air being much warmer than inspired air; with the excreta; and with the food taken when this is cooler than the body.

Heat is lost from the skin in three different ways. (1) By radiation; this goes on more rapidly when the surrounding air is much cooler than the body. (2) By conduction, when the surface of the body comes into contact with colder surfaces. (3) By evaporation of the perspiration which is being constantly excreted in smaller or greater amount.

The clothing with which we cover our bodies greatly reduces the amount of heat lost from the skin, by interfering to a very considerable extent with both conduction and radiation of heat.

2. Clothing is used **to protect the body from injury.** The feet are protected by boots and shoes; the head is guarded from the effects of the weather by hats; the hands are protected by thick gloves in work which is calculated to injure them.

3. Clothing is used **for purposes of adornment.** Many articles of clothing serve no other purpose than that of ornament.

4. **Clothing serves as a mark of civilisation.** Civilised nations wear clothing because they consider it proper to do so. The march of civilisation is always accompanied by an increased use of clothing even where the climate does not demand it.

Properties of Clothing. The most important property of any material used for clothing is its power of maintaining the heat of the body. Some materials allow the heat to pass through them much more readily than others. If we arrange the various clothing materials in the order of their power of conducting heat we get linen, cotton, silk, feathers, fur, and wool. Broadly dividing the above into two classes, we place linen and cotton among **conductors** of heat, and wool, fur, feathers, and silk among the **non-conductors**; the latter being, of course, the materials which best keep in the heat of the body.

The warmth or coolness of a material, or in other words the degree in which it serves to keep in the body-heat, is determined partly by its texture and its colour. Loosely-woven materials are much warmer than closely-woven fabrics, because the former retain air in their meshes, and air is a bad conductor of heat. In the same way extra layers of clothing increase warmth, because of the extra layers of air imprisoned between them. **The influence of colour** depends upon its heat-absorbing power; thus white, which reflects heat, is the coolest of all colours, and yellow comes next; black is the warmest colour, and then comes red. Colours can, of course, only exert influence when worn outside; a coloured undergarment is no warmer than a white one; but has on the other hand many objections against it.

Porous and Non-Porous Materials. Furs and waterproof materials prepared from indiarubber and guttapercha completely resist the passage of moisture, and are described as non-porous. Such materials are unhealthy to wear, because they prevent the escape of perspiration, which is thrown back upon the skin, causing an uncomfortable, hot, moist condition followed by a chilled skin and subsequent colds.

Woollen materials, being porous, allow moisture to pass away from the skin; they also are capable of absorbing a fair amount of moisture without their surface becoming uncomfortably wet. **Linen and cotton,** though porous, quickly become saturated with perspiration, if worn next the skin, and in this condition feel cold and clammy.

Materials of Clothing. The various materials used for clothing are obtained partly from the animal world and partly from the vegetable world. The former include wool, fur, silk, leather, and feathers; the latter, cotton, linen, hemp, jute, guttapercha, and indiarubber.

Wool is obtained from sheep, goats, and camels. **A wool-fibre** is from 3 to 8 inches long, and about $\frac{1}{1000}$ of an inch thick. Under the microscope it is seen to be covered with fine scales which run in one direction and give it a serrated appearance. (See Fig. 24.) The scales of a woollen fibre have considerable bearing on the manufacture of woollen goods. Some fibres have more scales than others, and the more numerous they are the more closely matted the wool

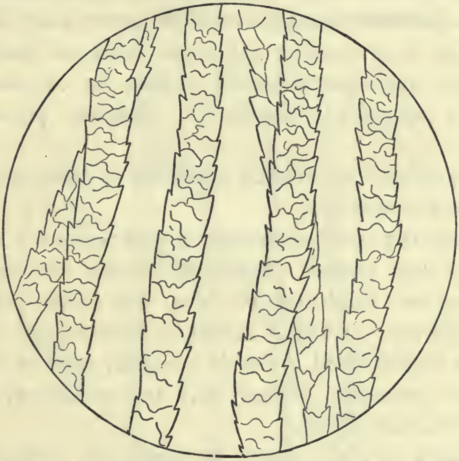


FIG. 24.—WOOL FIBRES AS SEEN UNDER THE MICROSCOPE.

becomes. Wool with many scales, therefore, is made into close thick cloth; wool with fewer scales into looser materials, known as worsted goods.

Varieties of Woollen Goods. Woollen goods include blankets, flannels, various kinds of cloths, serges, etc. **Cashmere** is made from the fine, soft wool of the Thibet goat. **Mohair** braid and dress materials are made from the wool of the Angora goat. **Alpaca** comes from the Peruvian sheep. **Llama** and **Vicuna** are made from the hair of animals of the same name as the cloth. **Camel's hair** is a fine wool, now used in the manufacture of "Jaeger" underclothing. **Felt** is wool matted together instead of being woven.

Value of Woollen Clothing. Woollen materials are the most useful of all. Wool is the worst conductor of heat, it does not become wet with perspiration, and its rough surface has a beneficial action in freeing the skin from an accumulation of waste matter. For these reasons woollen materials should always be worn next the skin; their value in preventing chills and colds and maintaining a healthy condition generally cannot be overestimated; they are specially valuable for delicate persons and children.

The drawback to woollen materials is that they shrink and harden in washing.

Furs are the skins of animals of cold regions. The chief are bear, seal, ermine, beaver, chinchilla, fox, and sable. Fur is a bad conductor of heat, but being non-porous is not healthy to wear. Sealskin jackets and fur-lined coats are best avoided. Fur is generally used as trimming for winter garments. Cheap furs are exclusively used in the manufacture of felt.

Feathers are used chiefly for ornament. They are still used, however, for pillows and beds, being both soft and warm.

Silk is the thread spun by the silkworm, and ejected from two small openings in its lower lip to form a protective covering called a cocoon. The silk thread from one cocoon measures some 4000 yards in length.

A silk fibre consists of a central core covered over with colouring matter of a waxy nature; under the microscope it is glossy and structureless, without markings of any kind; it is about $\frac{1}{2000}$ inch thick (see Fig. 25).

Varieties of Silk Materials. Silks are the woven materials corresponding to plain cloths in woollen goods.

Brocades and **figured silks** are woven into designs. **Satin** has a smooth glossy surface; **velvet** has a pile; **plush** resembles velvet, but has a longer pile. **Crape** is made from raw silk gummed and twisted. **Ribbons** are woven in narrow lengths in a special kind of loom.

Silk hosiery includes gloves, stockings, vests, etc.

Value of Silk Materials. Silk, being a non-conductor of heat, is regarded as a warm material of clothing.

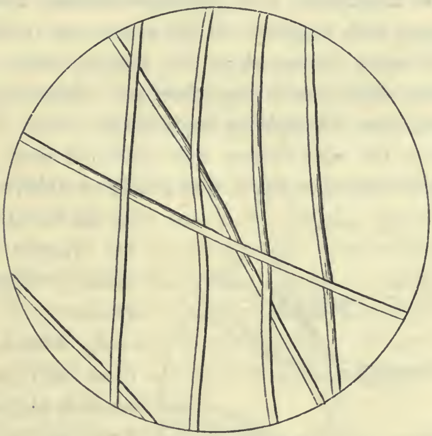


FIG. 25.—SILK FIBRES HIGHLY MAGNIFIED.

Its fine, soft texture renders it valuable for underwear where woollen is regarded as too irritating to the skin; it is, too, very absorbent of moisture; its expense, however, puts it beyond the reach of the average person.

Leather is made from the skins of animals from which the hair has been removed. In their fresh state the skins are tough and flexible, but as they dry they stiffen, shrink, and become pervious, and if exposed to moisture rapidly decompose. For these reasons they are subjected to a process known as tanning, which consists of steeping the skins in an infusion of oak bark or any substance rich in tannic acid. By this means leather is rendered tough and waterproof, yet soft and pliable.

Varieties of Leather. Thick leathers are made from ox hides, thinner leathers from the skins of the sheep, calf, lamb, goat, kid, deer, pig, antelope, etc.

Light leathers are not tanned, but soaked in a mixture of alum and salt.

Uses of Leather. The stronger leathers are used for heavy boots and leggings. Calf skins are used for the uppers of boots, sheep skins for aprons, lamb skins for gloves, deer skins for riding breeches. Other varieties of leathers are used for making fancy goods.

Cotton is the soft downy hair obtained from the seed-pods of the Gossypium plant, which is grown more especially in the Southern States of North America, Brazil, Egypt, and India.

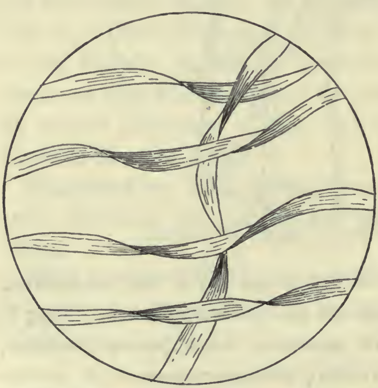


FIG. 26.—SLIDE SHOWING MAGNIFIED COTTON FIBRES.

A cotton fibre is from half an inch to an inch in length, and from $\frac{1}{800}$ to $\frac{1}{2000}$ inch in width; under the microscope it appears flat and twisted (see Fig. 26).

Raw cotton is imported into England, and after being freed from the seeds by machinery it undergoes the various processes of cleaning, carding, spinning, and weaving. The manufacture of cotton goods is chiefly carried on in Manchester and other Lancashire towns.

Cotton materials include sheeting, calico, towelling, muslin, print, turkey-red, jean, fustian, corduroy, velveteen, flannelette, etc. Mixed with wool, cotton constitutes merino, "union," and innumerable varieties of cheap cloths; it is also mixed with silk to form cheap so-called silk goods.

Value of Cotton Materials. Cotton does not shrink when washed, but, on the other hand, frequently looks as good as new; it is cheap and durable. On the other hand, it is a good conductor of heat, and absorbs moisture badly, and should therefore never be used for under garments, as it readily induces chill. It is, moreover, very inflammable, and has been the cause of much loss of life from burning; children's cotton pinafores are special offenders in this respect.

Flannelette. The popularity of flannelette as a material of clothing is enormous, owing, doubtless, to its soft texture and its cheapness and durability. It must be remembered that flannelette, being a cotton material, has only the properties of cotton, even though it may have, when new, the appearance of woollen. Flannelette must not be regarded as a satisfactory substitute for flannel; it is, too, highly inflammable.

Cellular Cotton is warmer than ordinary cotton fabrics, owing to the air which is retained in the large inter-spaces.

Linen is made from a fibre obtained from the stalks of the flax-plant (Linum usitatissimum), which is largely grown in Ireland and Russia.

Manufacture. The stalks are gathered one by one and laid in bundles to dry in the sun. Then the seed-pods are separated from the stalks by drawing the flax between the teeth of a large iron comb; this is termed **rippling.** Next the stems are steeped in shallow pools of water for ten or twelve days, and then **retting,** or rotting, takes place, by means of which the pulpy parts of the stem are separated from the fibres. After pounding the stalks with mallets the tough fibres alone remain. The flax is next passed through a series of combs, and the long fibres separated from the short ones. Cleaning and bleaching follows, and then the flax is ready to be spun and woven into cloth. Only the fine fibres are used for linen, the coarser ones are made into ropes and strings.

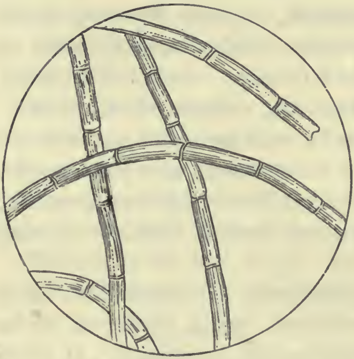


FIG. 27.—LINEN FIBRE AS SEEN UNDER THE MICROSCOPE.

A linen fibre is round and smooth, like a silk fibre, but differs from silk in being jointed. It is owing to the structure of the fibre that linen takes its characteristic gloss. It is $\frac{1}{2000}$ inch in width.

Varieties of Linen Materials. Plain linen is made in varying degrees of fineness, the finer being used for handkerchiefs and table-linen, the coarser for sheets and towels.

Damask is woven in patterns; it is used for table-linen. **Holland** is a coarser linen used for dresses, aprons, etc. **Lawn** and **cambric** are very fine varieties of linen used for surplices, handkerchiefs, dresses, etc.

Value of Linen. Like cotton, linen is a good conductor of heat and a bad absorbent of moisture, and is therefore unsuitable for wear next to the skin. It is very durable, and possesses a lustre and smoothness, for which reasons it is unrivalled as a material for shirt-fronts, collars and cuffs, and table-linen. Linen sheets, though durable and smooth, are too cold to be popular.

Indiarubber and guttapercha are both derived from the vegetable kingdom. They are non porous materials, and are used as clothing in the manufacture of waterproofs, goloshes, over-shoes, bathing-caps, etc. Indiarubber or caoutchouc is the milky juice of several plants grown in Africa, Asia, and South America.

Guttapercha is the juice of certain trees which are only grown in the Malay Peninsula. It is chiefly used for the soles of waterproof shoes.

Errors in Clothing. It is important in dealing with clothing that its relation to health should be studied. Owing to the dictates of fashion certain injurious practices have become common, and it is not infrequent to find that clothing has been directly responsible for ill-health.

Tight Clothing. The worst of these practices is the custom of wearing tight clothing. Corsets, garters, dresses, boots, and gloves are all liable to be worn too tight. **Tight clothing is not so warm as loose clothing**; the looser clothing is the more air it imprisons in its meshes, and as air is a non-conductor of heat it assists in keeping in the heat of the body.

Tight Clothing interferes with muscular action. Every part of the body is supplied with muscles, and the more they are used the stronger they become. If, however, the clothing is so tight that the muscles cannot be exercised, they become weak and soft.

Tight Sleeves interfere with the free action of the arm; **tight skirts** impede the action of the feet and legs; **tight bodices** prevent free play of the muscles of the back and chest.

Tight Corsets are responsible for serious injury to health. The accompanying diagram shows the natural shape of the twelve pairs of ribs which surround the heart and lungs. Immediately underneath the lungs, and separated from the

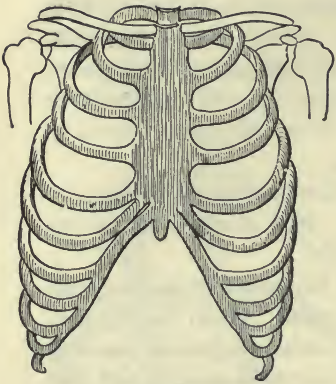


FIG. 28.—THE NATURAL SHAPE OF THE RIBS.

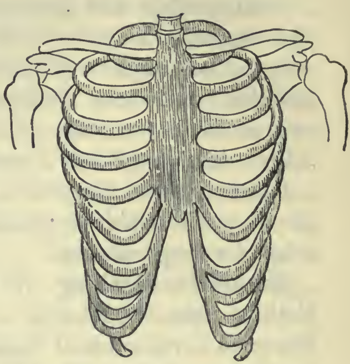


FIG. 29.—THE RIBS DEFORMED BY TIGHT-LACING.

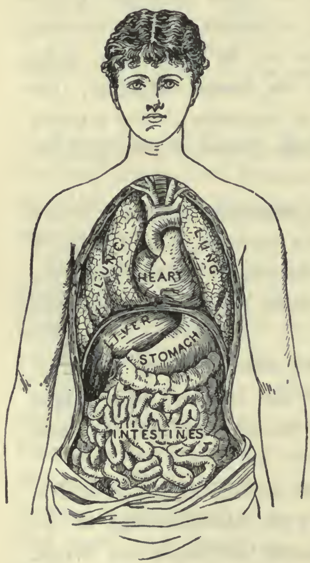


FIG. 30.—A NATURAL FIGURE.

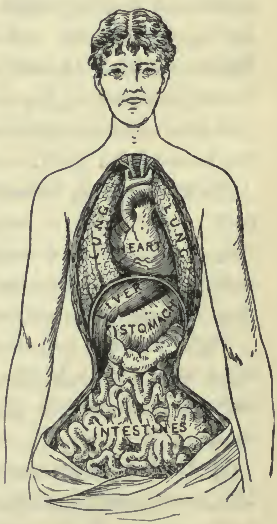


FIG. 31.—FIGURE DEFORMED BY TIGHT-LACING.

diaphragm or midriff, are the stomach, liver, and other vital organs. When tight-lacing is practised the ribs are crushed inwards, the size of the chest is diminished, the lungs cannot expand properly, and the important organs of digestion are pushed out of place and compressed. The consequence of such serious derangement is that none of the organs work well, and disease may set in.

Tight Boots and Shoes prevent free circulation of the blood through the blood-vessels of the feet, and chilblains

FIG. 32.—A NATURAL FOOT.

FIG. 33.—A FOOT DEFORMED BY TIGHT BOOTS.

are caused. Corns and bunions are produced wherever the boot presses against the foot. The toes are forced one over another, and the foot becomes deformed (see Figs. 32 and 33). The muscles of the foot have not free play, the ankles are weakened, and an awkward gait is produced.

Lastly, the action of walking is so painful that the wearer of tight boots never takes sufficient exercise to keep her in health. **High heels**, too, are objectionable. They throw the whole weight of the body upon the toes, thus destroying the balance of the body and straining the muscles.

Thin Soles tire the feet and do not keep out the damp.

Tight Garters prevent free circulation of the blood through the blood-vessels of the leg, and thus bring about **varicose veins**, which are both painful and dangerous. If a large varicose vein burst, the patient is liable to bleed to death. Suspenders are preferable to garters, as constriction is thus avoided.

Heavy Clothing is open to objection; it tires the wearer in proportion to its weight. Clothing may be warm without being heavy. **The weight of clothing** should be borne by the shoulders and not by the waist. The practice of hanging heavy skirts from the waist is a bad one. The important organs in the lower part of the body are liable to be displaced by the pressure.

Amount of Clothing required. The amount of clothing required varies with season, climate, age, sex, and constitution.

Season. In summer less clothing is required than in winter, because the amount of heat lost from the skin is not so great as in the former season.

Climate. In hot countries less clothing is worn than in cold countries. If you compare the costume of a Laplander with that of a Hindoo, you will find that while the former is protected from head to foot by thick furs, the latter wears little besides a piece of cotton cloth The reason for this is found in the difference of the surrounding air and the consequent difference in the amount of heat lost by radiation.

Age. In infancy and old age more clothing is required than at any other period of life. **Infants** are delicate, and have not the power of producing heat to such an extent as older persons. Then, too, they lose a greater proportion of heat from the skin than adults do. The reason for this is simple. A small body has a larger surface in proportion to its bulk than a large body has. A one-inch cube has six square inches of surface to one of bulk; whereas a two inch cube has twenty-four square inches of surface to eight of bulk. The small cube has six times as much surface as bulk, the large one only three times as much.

Children should be well wrapped up about the arms, legs, and neck. It is a great mistake to dress them in short sleeves and low-necked frocks. Heat is lost from these bare surfaces, the blood becomes chilled, and the child catches cold.

Aged Persons require warm clothing because they are feeble. Their circulation is slow, and heat is not produced so powerfully as in earlier life, hence the necessity for economising their supply of heat.

Sex and Constitution. Delicate persons require warmer clothing than those of strong constitution, for much the same reason that the aged must be well clothed.

As a rule women need warmer clothing than men.

The Choice of Clothing. It is the duty of every woman to dress as well as her means allow, taking care, however, never to step beyond her means. To be well dressed one must be **suitably** dressed according to one's age, station, and circumstances; the various articles of dress must be in harmony with each other, and the materials good of their kind. There is no economy in buying cheap, flimsy materials which will stand neither the ravages of time nor the wash-tub.

While not altogether neglecting the dictates of fashion it is wise to avoid extremes unless one's purse admits of a frequent change of costume. A well-dressed woman studies her own individual style, and aims rather at securing becoming clothes than at the *ultra-fashionable.*

Hints on Buying. As a rule it is wise to avoid "bargain-hunting" at the periodical sales. One is apt, at such times, to purchase low-priced goods for which one has no use; such goods are dear at any price. Occasionally useful articles can be bought cheap at sales, but many women find it difficult to confine their purchases to such articles as they really want, and money is wasted instead of being saved, by their "bargains."

Dress-Materials. In buying dress-materials have regard to the use to which the dress is to be put. Serges, home-spuns, and tweeds make good dresses for hard wear; cashmeres and merinos make more elaborate dresses and are serviceable; alpacas and mohairs are durable, light in weight, and pretty; they form good summer dresses and are more economical than muslins and cambrics, which cost a great deal for washing. A good silk is durable, but cheap silks are apt to crack and wear greasy; glacé silks do not wear so well as soft silks. Mixed materials, *i.e.* mixtures of silk and wool, or wool and cotton, do not, as a rule, wear well, and are completely spoilt by rain.

It is a wise plan to buy dress materials of the best quality; they always look good even when the newness has been worn off, and they make up much more satisfactorily than cheap materials; the initial expense is more than justified by the length of time they can be worn without looking shabby.

Stockings and Gloves should be of good quality; low-priced stockings wear out very quickly, and cheap gloves are ill-fitting and soon look shabby. Home-knitted stock ings are most satisfactory for winter wear, being cheap, warm, and durable.

Boots and Shoes should also be good. Cheap leather quickly cracks and the shoes lose their shape; cheap, ill-made boots do not keep the feet dry.

Underclothing should be home made. The cheap ready-made undergarments which fill the shops of to-day are of poor material which does not wear; their purchase is, moreover, an encouragement of the "sweating system." Undergarments can be made much more cheaply at home from good, durable materials.

Colours. Care and taste must be exercised in choosing the colour of a costume. Some tints, charming in themselves, do not stand the weather, and make the costume look shabby before it is half worn out. Other colours are too startling for any one to wear who must make a costume last for any length of time. For the woman of average means, a quiet, serviceable colour which will harmonise with her complexion and hair should be chosen. Too many colours must not be introduced into the costume, and care must be exercised to select colours that blend or harmonise; a hat pretty in itself will look in very bad taste if worn with a dress of the wrong colour. Skilful choice of colour has much to do with tasteful dress.

Outfits. It is rarely that a person needs a complete outfit, garments being generally replaced as they are worn out. Girls going to service, or to school or college, occasionally find it necessary to purchase many new articles of clothing.

A Typical Outfit for a girl going to Service:

Material for 3 sets combinations, 10 yds. at 5d.,	£0	4	2
,, ,, 3 nightgowns, 10 yds. at 5d.,	0	4	2
,, ,, 2 flannel petticoats, 5 yds. at 1s.,	0	5	0
,, ,, 2 ,, vests, 3 yds. at 10d.,	0	2	6
,, ,, 1 outer petticoat, 3 yds. serge at 1s.,	0	3	0
Wool for 3 pairs knitted stockings,	0	3	0
3 print dresses at 5s. each,	0	15	0
1 black dress for afternoon wear,	0	12	0
6 white aprons ,, ,,	0	7	6
Material for 6 working aprons,	0	6	0
4 caps at 3½d.,	0	1	2
4 sets collars and cuffs at 7½d.,	0	2	6
1 pair house-shoes,	0	2	6

1 pair boots, - - - - - - - -	£0	8	6
1 sailor hat, - - - - - - - -	0	1	0
1 trimmed hat, - - - - - - -	0	5	0
1 jacket, - - - - - - - - -	0	8	0
1 waterproof, - - - - - - - -	0	8	0
1 pair gloves, - - - - - - - -	0	1	0
Total, - - - - - - -	£5	0	0

Questions.

1. Summarise the advice you would give to a young girl going into service as to the choice of sensible, suitable, and economical clothing. (*Scholarship*, 1888.)

2. What kind of covering for head, body, and feet would you recommend for a damp, cold climate? Give your reasons. (*Scholarship*, 1889.)

3. Write out the sketch of a lesson on silk; its production, qualities, and uses. (*Scholarship*, 1890.)

4. Describe as fully as you can the origin, preparation, and use of the two principal vegetable products used in this country for clothing. (*Scholarship*, 1891.)

5. What are the chief materials of which clothing is made? which of these is most essential in our climate, and why? (*Scholarship*, 1893.)

6. Give a list (with cost) of the articles of wearing apparel required for a female teacher about to enter a training college. (*Scholarship*, 1893.)

7. Enumerate, with reasons, the point in which present fashions in women's dress appear to you to violate known laws of health. (*Scholarship*, 1894.)

8. Discuss the respective merits of getting expensive materials that last a long time for clothing, or cheaper ones that do not last so well. (1*st Year Certificate*, 1893.)

9. Compare flannel with flannelette, as regards cost, durability, application, and general utility. (1*st Year Certificate*, 1896.)

CHAPTER IX.

WASHING.

Materials used in Washing. I. **Water** is used to dissolve the dirt in clothes. It is found in actual practice that hot water is a better solvent than cold water, and that soft water is more satisfactory than hard water.

Hard and Soft Waters. Water is generally described as hard or soft. The hardness of water is due to the presence of salts of lime and magnesia. If the lime is in the form of calcium carbonate (chalk) it may be removed and the water thereby softened. Calcium sulphate (gypsum) and magnesia salts are fixed hard salts.

Hard water is objectionable for washing purposes for the following reasons: (1) It is more wasteful than soft water, because much soap is used in neutralising the hardness before a lather can be obtained. (2) It entails much more labour. It is advisable, therefore, to use soft water for washing, if it can be obtained. If the water of the district is hard, rain water should be collected, care being taken to secure it in as clean a state as possible. Failing this, means should be adopted to soften the hard water before using it for laundry purposes.

To Soften Hard Water. (1) **Boiling** has considerable power of softening water. Calcium carbonate is held in solution by the presence of carbonic acid gas in water; during boiling the carbonic acid is driven off and the chalk deposited; it is this substance which forms the "fur" or crust inside kettles and boilers.

(2) **The Use of Soda and Borax** is effectual in softening water for domestic purposes.

(3) Water is softened on a large scale by the use of a definite quantity of **milk of lime**, the amount being regulated

by the degrees of hardness of the water. When milk of lime is so added to hard water it combines with the excess of carbonic acid gas to form chalk, which is precipitated along with the carbonate of lime originally held in solution, and falls as a sediment. It is necessary to know exactly the degrees of hardness, and to use only so much milk of lime as will combine with the carbonic acid holding chalk in solution, or lime will find its way into the service pipes. Sufficient time must be allowed for the sediment to settle before the softened water is used.

II. **Soap** is made by boiling together a fat and an alkali. It will be remembered that a fat is a compound of fatty acids and glycerine; during the process of boiling the alkali splits up the fat, unites with the fatty acids to form soap and sets free the glycerine.

Ordinary hard soaps are made from tallow and certain vegetable fats and oils, soda being the alkali used. **Soft soaps** are largely made from whale or seal oil and linseed oil, by the action of potash. **Marine soaps** are made from cocoanut oil; **yellow soap** is made from a mixture of resin with tallow and palm oil; **glycerine soap** is ordinary soap to which glycerine is added; **toilet soaps** are specially refined, coloured, and scented; **brown Windsor** is a toilet soap of an inferior kind.

Soap may be Adulterated:—(1) **By the addition of too much water**, by which means fictitious weight is obtained. (2) By an excess of alkali; soap thus adulterated is injurious to the skin and to wearing apparel. (3) By the presence of fats upon which the alkali has not acted. Soap of this kind is of a greasy nature and does not effectually cleanse.

The Action of Soap. Water alone is not sufficient to dissolve the dirt and grease out of soiled linen; to do this satisfactorily soap is used. The alkali in soap unites with the greasy matter to form an emulsion, which is easily removed by the help of water and friction.

Soda. Ordinary washing soda is commonly manufactured from chloride of sodium (common salt). It is useful in washing very greasy articles, but if used in excess it is hurtful to materials; it must never be used for washing coloured articles, its chemical action on the dye being injurious.

Borax is a saline substance found in many salt lakes. It is used (1) to soften water; (2) to dissolve dirt, which it does very readily; (3) to give a gloss to starch. It does not injure fabrics and dyes as soda does, and may therefore be regarded as a useful though expensive substitute.

Washing Powders are prepared from soda, borax, and chloride of lime. They are certainly useful in whitening and cleansing clothes, but their use is not to be recommended owing to the fact that they weaken and destroy the fabrics.

Blues are sold in solid and liquid form; the solid form is most generally used. Indigo blue is prepared from the indigo plant grown in India. **Aniline blues** are largely used, and, if of a good make, are thoroughly satisfactory. Blue is used to restore the white tint to linen which has turned yellow under the action of soda.

Paraffin is useful in washing very dirty articles. The objections to its use are that it may burst into flame if a light be brought too near or too much paraffin used, and that the smell of paraffin clings to the articles unless they are thoroughly rinsed. Two tablespoonfuls of paraffin and half a pound of yellow soap are sufficient for a copper of ordinary size half-filled with water.

Laundry Starch is obtained from rice and potatoes, though at one time wheat starch was very largely used. It is used to stiffen various articles; cuffs, collars, and shirt fronts require strong starch to make them very stiff; table-linen is slightly starched; and muslins and laces should be merely dipped in a very weak solution of starch.

Washing Utensils. The number of utensils required varies with the size of the establishment and the amount of washing to be done periodically. For a small family-wash two or three washing tubs, a pan for rinsing, a copper for boiling, a linen-stick to lift the clothes from the copper, and one or two brushes for rubbing the linen should be found sufficient. A clothes-cord, props, pegs, and two or three clothes-baskets are required for drying. **Washing machines** of various kinds may be bought to save hand-labour, but many of them tend to wear out the linen. **Wringing machines** are useful to get the water out of wet clothes, and to smooth out dry linen which does not need ironing, such as sheets, towels, etc.

Method of Washing. I. **Preparation for the Wash.** It is generally acknowledged that Tuesday is the best washing-day, because the needful preparation may be made on Monday.

Sorting. The clothes are first sorted into heaps as follows: (*a*) muslins, lace, and fine articles; (*b*) collars, cuffs, and starched things; (*c*) white body linen, table-linen, sheets, and pillow-cases; (*d*) coarse things, such as kitchen towels, dusters, aprons; (*e*) coloured articles and stockings; (*f*) flannels.

Stains and Spots. When the clothes are sorted, they must be examined to see if any of them are stained or spotted, and ink spots, fruit stains, etc., removed.

To remove Ink Stains. If the stain is quite fresh, it may be removed by rubbing salt in, holding the stained part over a basin, and pouring boiling water over it. If the stain has been allowed to get dry, soak it in a weak solution of chloride of lime, and afterwards wash out.

To remove Grease Spots. Make a ring round the spot with benzine, and then rub the spot with the same liquid.

To remove Mildew. Rub the affected part with soap, and then rub finely-powdered chalk into the linen and hang it in the sun. Repeat the process until the spots are removed.

Fruit and Wine Stains should be washed at once in clean, soft, cold water; if this is not effectual spread the stained part over a basin, rub in salts of lemon, and pour boiling water over until the stain is removed. Common salt may be used to remove wine stains.

Rust Spots may be removed from linen and cotton by rubbing with salts of lemon, and pouring boiling water over the parts.

Soaking. The linen should be soaked in cold or tepid soft water for several hours before being washed. For very dirty linen the water should be warmer, and contain a little dissolved soap or borax; very soiled parts, such as neckbands and wristbands, should be rubbed with soap before being put in to soak.

It is a good plan to fill the copper and lay the fire underneath the day before the wash.

II **Washing Day**. Having lit the copper fire, wring out the linen previously put to soak.

Order of Washing. 1st, Flannels, woollens, and coloured articles; 2nd, fine things, muslins, and laces; 3rd, collars, cuffs, body-linen, bed-linen, and table-linen; 4th, coarse things.

To wash Flannels. Remember that flannels are **not** put to soak, because of their tendency to shrink. For this reason, too, much care must be exercised in washing flannels and woollens. Make a good lather of soap, with **warm** water, neither very hot nor too cold, and move the flannels about in the water, to and fro, backwards and forwards, until they are clean. Flannels must not be rubbed with the hands, soap must not be rubbed upon them, nor must soda be used. If these precautions be neglected, the flannels will shrink and harden. When they are clean they must be well rinsed in warm water to free them entirely from soap, and then squeezed with the hands, but not wrung, as this also is a cause of shrinking. Lastly, they are hung out to dry quickly.

To wash Coloured Things. Coloured things must not be soaked, boiled, or washed with soda, because any of these proceedings will cause the colour to run. A lather should be made in tepid water and the clothes washed in this, first on the right side, then, after changing the water, on the wrong side. Rinse in cold, hard water, to which has been added salt or alum, with the object of fixing the colour. Wring them out, and dry in a shady place, because the sun causes them to fade.

Fine Things are washed in warmer water than flannels or coloured things. Make a lather in fairly hot water, and wash the articles very carefully, to avoid tearing. Fine things may be boiled, and when this is done they should be tied loosely into a bag, to prevent them being injured in the copper. After rinsing in warm soft water, they are ready to be blued.

Body, Bed, and Table Linen. These articles are washed in warm water with soap and a little soda. If hand labour is used the soap is rubbed on each article, and the scrubbing-board and brush are called into service; it must be borne in mind that too much rubbing wears out the linen. If a washing machine is used the soap and soda must be dissolved in warm water before being put into the wash-tub.

It is found necessary to give soiled linen a second

washing in clean warm water, after which they are ready to be boiled.

Boiling is done in the copper; the water must be soft, warm but not boiling, and contain dissolved in it chips of soap. It is a good plan to boil linen in bags, having a bag for each kind of linen. When the linen is all in the copper the water is brought to the boil, and the linen boiled for 10 to 15 minutes, being stirred from time to time with the copper-stick. When this process is complete the linen is ready for rinsing.

Rinsing must be thoroughly carried out in clean water if the linen is to be kept of a good colour. The first rinsing water should be warm, and all soap should be removed before the second rinsing in cold water takes place. Imperfect rinsing is responsible for the cloudy, streaky appearance of badly-washed linen.

Blueing follows rinsing. If solid blue is used it is put into a bag and dipped in clean cold water until the required tint is obtained. Linen must not be allowed to lie in blue-water or it will be streaked with blue; it must be quickly rinsed and wrung out.

Wringing must be done skilfully or the linen may be injured. If the wringing is done by hand, avoid too much twisting and wrenching. If the wringing is done by machinery the articles must be folded selvage-way before being put between the rollers. Articles wrung by hand should also be twisted according to the selvage to avoid stretching the fabric. Delicate materials should be folded in clean cloths before being gently wrung.

Drying in the open air is much better than drying indoors. Linen should be dried wrong side out and pegged firmly to a clean line; a shady spot with free circulation of air should be selected where possible. Wet linen should be dried at once; if allowed to remain in wet heaps the colour is spoilt and the fabric rotted. Coloured things should be dried quickly, but must not be hung in the sun or too near the fire or the colours will fade.

Finishing Processes—Folding. The articles are first turned to the right side and then pulled straight, so that they can be laid edge to edge. A large table covered with a clean cloth is necessary to fold the clothes upon. Large sheets, counterpanes, and tablecloths require two persons to fold them. They are first folded in half lengthwise, wrong side outwards, then into four lengthwise, taking care to bring corner to corner and edge to edge, and turning one fold backwards so as to bring the right side outwards; halve the length, and fold into convenient size for putting away. Garments should be folded with buttons inside to protect them from being broken. If the linen is very dry it should be slightly damped by sprinkling with clean cold water.

Mangling is best done by two persons, one to turn and the other to put the articles carefully between the rollers. The object of mangling is to smooth out creases; the linen should be quite damp or the effect will not be satisfactory. Sheets, counterpanes, towels, coarse aprons, etc., are mangled and aired, and are then ready for use. Other articles are mangled to make the ironing process easier.

Starching. There are two kinds of starch: (1) cold-water starch, (2) hot-water starch.

To prepare cold Starch. Take a tablespoonful of starch and put it into a clean basin; add a breakfastcupful of clean soft water, and mix the two together to a creamy consistency; add to this half a teaspoonful of borax, and a quarter of a teaspoonful of turpentine. These additions give a gloss to the linen, and prevent the irons from sticking.

To make hot Starch. Mix a tablespoonful of starch with a little cold water, as for cold starch; then add one pint of boiling water, stirring the starch all the time with a wooden spoon; a little borax, a small piece of wax, or a lump of sugar may be added to give a gloss.

Collars and Cuffs are put into cold starch one by one, rinsed in cold water, squeezed and pulled straight again, and laid inside a clean cloth to await ironing.

To Starch a Shirt. Be careful to starch only the front, collar, and cuffs; gather the body of the shirt in one hand, and use the other to rub the starch into the stiffened parts. Squeeze out, rinse, roll up tightly inside a clean cloth, and lay on one side.

Muslins and Laces require very thin hot starch.

Table-linen is merely dipped into the starch.

Ironing. First see that the fire is clear, bright, and brisk. A smoky fire makes dirty irons.

Apparatus. An ironing board, covered with flannel and calico and presenting a perfectly smooth surface, is a great help. Failing this, lay an old blanket folded once or twice over the table, and cover with a clean white cloth; old sheets are often used. Irons, holders, and stands are also needed.

Irons are of two kinds: the **box-iron**, which contains a heater which slips in and out, and is heated in the fire, and the **flat-iron**, which is solid and is itself heated. **Flat-irons** must be cleaned after heating, by rubbing them with a cloth or on finely-powdered bathbrick spread on brown paper. Test the heat of the iron on an old cloth to make sure it will not scorch the linen.

Process of Ironing. Have ready a basin of clean water and a soft clean rag to remove any starch stain which may appear on the linen. Unroll the starched things, lay them one by one smoothly on the ironing board, and iron first the wrong side and then the right, giving a final pressure to produce a gloss. Put the ironed articles on a clothes-horse near the fire to dry and stiffen.

To Iron a Shirt. Lay the shirt on the table with the front downwards, the collar to the left hand of the ironer, and the length of the shirt parallel to the long edge of the board. Iron the collar lightly on the wrong side, and heavily on the right side. Pin the ends of the collar together and iron the yoke and back. Next iron the cuffs in the same way as the collar. Turn over to the front, iron first the unstarched and then the starched parts. To iron the front, place a piece of flannel or a small ironing board under one half at a time, and iron until stiff.

To Fold a Starched Shirt place it front downwards, and fold each side to the middle of the back. Fold the sleeves parallel to the folds of the shirt and double them in two with the cuffs upwards. Then fold the shirt across into two or three folds, leaving the starched front visible. Air at once and put away.

Collars and Cuffs should not be allowed to get too dry before being ironed. Take them one by one from the cloth in which they have been wrapped and iron lightly on the wrong side, then more heavily on the right side; a polishing iron may be used to give a gloss. Bend into shape, and air quickly to fix the starch.

Washing Dresses and Skirts. The bodice and sleeves of a dress are ironed first, and then an ironing board is slipped inside the skirt, the waist being to the left. The skirt is ironed in strips from hem to gathers; extra care will be needed if there are tucks. Goffering irons are used for frills and trimmings of lace.

Muslins and Laces are ironed on the wrong side; they should be quite damp and protected by a clean soft cloth. The edges of the lace will need picking out with the fingers.

Handkerchiefs are ironed first on the wrong side, then on the right; they are folded into small squares, care being taken to fold edge to edge and corner to corner, and to keep the name uppermost.

Underclothes and tablecloths are only ironed once, on the right side.

Care of Utensils used in Washing. Much time, labour, and money may be saved by taking proper care of utensils. The copper should be left dry and clean; the wash-tubs, if of wood, should be kept in a shady place to prevent shrinking and consequent leaking; in very dry weather it is advisable to keep a little water in wooden wash-tubs; clothes-pegs need scrubbing from time to time, and should be kept in a bag; the clothes-line should be wiped dry and clean, rolled up and put in the peg-bag; the linen baskets and ironing board and clothes must be kept in a place free from dust, and the irons should be put in a dry place to prevent rust.

Questions.

1. Describe the method to be adopted in washing a pair of blankets. (*Scholarship*, 1888.)

2. What are the preparations and materials needed for a mixed washing? State shortly the advantages and disadvantages of soda. (*Scholarship*, 1889.)

3. What is the difference between soft and hard water? For what special purposes is each of them best suited, and why? (*Scholarship*, 1890.)

4. Two teachers live together in the country, and have their washing-day once a fortnight. Describe how they would manage with the help of a girl of 14, remembering that their school duties must not be neglected. (*Scholarship*, 1891.)

5. What is the material of which soap is made? (*Scholarship*, 1892.)

6. Describe the order and method of carrying out a weekly washing in a poor man's house. (*Scholarship*, 1892.)

7. What kind of water is best (*a*) for drinking, (*b*) for cooking, (*c*) for washing? How would you make hard water suitable for washing clothes, and what is the chemical process involved? (*Scholarship*, 1893.)

8. Explain the process of washing (*a*) flannel garments, and (*b*) coloured cotton garments, giving reasons in each case.

(*Scholarship*, 1894.)

9. There are two ways of making starch; give clear instructions for each, and explain for what purposes each is suited.

(*Scholarship*, 1895.)

10. How would you keep clean and fit for use the following laundry utensils: copper boiler, wooden tubs, pegs and clothes line, irons? (*Scholarship*, 1900.)

11. How can oil and water be made to mix, and how does the principle involved in that mixing bear upon washing clothes? What is soap? Mention some other substances useful for washing very dirty or greasy clothes. (1*st Year Certificate*, 1894.)

CHAPTER X.

THE DWELLING—SITE AND CONSTRUCTION.

Choice of a Site. In building or selecting a dwelling the greatest care must be bestowed on the choice of a site.

It is one of the first essentials that a house be free from damp. A damp house is an unhealthy house, and the occupants of such a house are frequently sufferers from such diseases as rheumatism, coughs, colds, and serious affections of the lungs. Consumption (phthisis), the worst of all lung diseases, if not actually caused, is greatly aggravated by a damp atmosphere.

In the face of these facts it is easy to recognise the importance of securing a dwelling the walls and floors of which shall be free from damp.

Soils. Regarding soils purely from a hygienic point of view, we may divide them into two classes: (1) Pervious or Permeable; (2) Impervious or Impermeable.

A Pervious Soil is one which, being porous, allows moisture to percolate through it. Examples of pervious soil are furnished by gravel, sand, sandstone, and chalk.

An Impervious Soil will **not** allow moisture to pass through it, consequently water must remain on the surface of such a soil. Of this kind of soil, clay, granite, and limestone are examples.

Experiment. (*a*) Fill a large glass jar with gravel, and pour a little water into it. Notice with what rapidity the water sinks through the upper layers to collect at the bottom of the vessel. (See Fig. 34.)

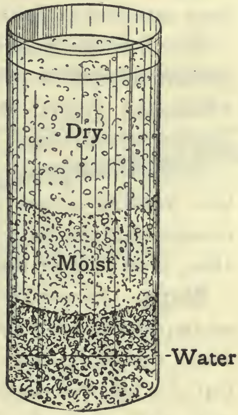


FIG. 34.

(*b*) Fill a shallow tray with clay, pour water over it, and notice how it lies on the surface; the bulk of the water may afterwards be drained off.

It is easy to learn from this experiment that if a house be built on a porous soil the water which falls on the earth as rain will sink rapidly to the lower layers or strata, leaving the upper stratum on which the house is built quite dry; whereas rain falling on an impervious soil remains on the surface, and can only be drained away by artificial means.

A house built on such a site would therefore be damp, for, as we shall see presently, floors and walls, unless specially constructed, do not resist moisture, but take it into themselves.

Made Soils. This name is given to soils formed by filling up excavations, such as disused quarries and brick-fields, with waste materials from dust-bins, road-sweepings, ashes, and town refuse generally. Such a soil is full of decaying animal and vegetable matter, and gives off foul and injurious gases.

Too frequently houses are built upon made soils, with the result that noxious gases are drawn into the atmosphere of the house to the detriment of the health of the inhabitants.

Drainage of the Soil. Though permeable soils are naturally drier, and therefore healthier than impermeable soils, the latter may, by means of drainage, be made to form satisfactory building sites.

The best method of draining the soil is to lay down a system of pipes of porous material, such as red brick, into which the ground water passes, and is conveyed to the nearest water-course.

In some towns the sewers are used for this purpose, but this method is not to be recommended; inlets for water become outlets for sewer-gas, and, as you will learn hereafter, sewers must essentially be water-tight.

Slope. In selecting a site the slope of the ground forms an important point for consideration. As a general rule, a house should be built on high ground. A clay soil at the top of a hill will doubtless form a better site than a gravel soil at the foot of a hill, for the simple reason that water drains naturally from a high level to a lower one.

Aspect. A healthy house must be a sunny house. Light and warmth are as essential to the health of human beings and animals as they are to plants.

In selecting a house, therefore, choose one whose principal windows face west and south, and, above all, avoid a north aspect.

Surroundings. It is of importance, too, that there shall be free circulation of air round the house, and to this end the dwelling should not be too closely surrounded by trees, or hemmed in by larger buildings. If lakes, ponds, or rivers are near the house, they should be at a lower level.

To ensure a dry house certain precautions should be taken in building it.

If not properly constructed damp will rise through floors and walls. Ordinary building bricks are porous to such an extent that each one is capable of absorbing a pint of water. Further, they possess the power of conducting moisture from one to another. This can be easily illustrated in the following manner :

Pile four or five lumps of sugar one upon another. Let the bottom lump stand in a little water, and observe how

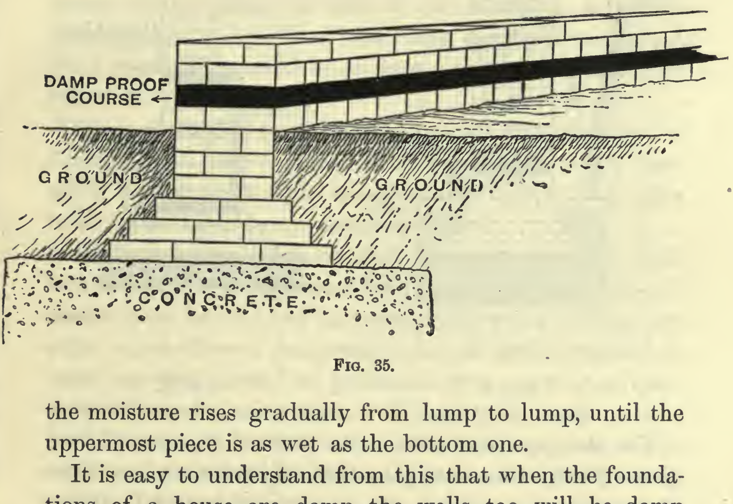


FIG. 35.

the moisture rises gradually from lump to lump, until the uppermost piece is as wet as the bottom one.

It is easy to understand from this that when the foundations of a house are damp the walls too will be damp throughout their length and breadth.

Dry floors and walls may be secured in the following way:

(1) **A bed of concrete** from 12 to 18 inches thick should be laid underneath the foundations; this serves the double purpose of cutting off both ground air and moisture.

(2) **A damp proof course** should be inserted into the walls just above the level of the ground. (See Fig. 35.)

Experiment. Make a pile of 5 or 6 lumps of sugar, as before; half-way up the pile insert a thin piece of tin or earthenware. Spill a little water round the base of the pile, and you will find that the moisture will rise up through the sugar as before, until it reaches the layer of tin; the lumps above this point will remain dry.

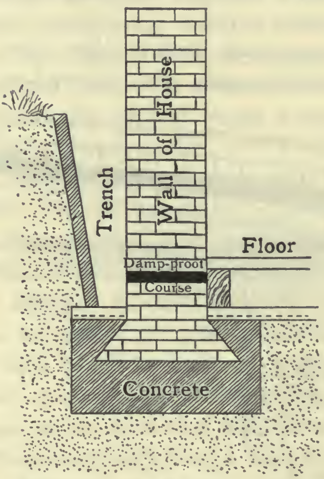


FIG. 36.

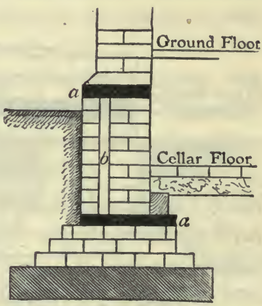


FIG. 37.

The damp-proof course may consist of a layer of blue-glazed Staffordshire bricks, a sheet of lead, slate in cement, glazed tiles, or, indeed, any impervious material; in the above experiment it is represented by the piece of tin.

By this means the dryness of the walls above ground is ensured. But, where there are cellars, a **dry area** must be constructed, by which means contact between the surrounding earth and the walls below ground is avoided. A dry area may be secured by digging a trench round the walls, as in Fig. 36, or by building double walls, and leaving an air space between the two, as in Fig. 37. If the latter plan is adopted, a damp-proof course must be inserted in the wall both above and below the dry area.

Construction of the Dwelling. Walls. The materials generally used for building walls of houses are bricks, stone, and wood. If of good quality **brick** is the most satisfactory material for walls of houses, for, having been well burnt during manufacture, it stands fire better than any other material. It is, too, a warmer material than stone, being a poorer conductor of heat. Brick is very porous, and readily admits of the passage of both air and moisture; a brick of ordinary size is capable of absorbing a pint of water. A good outer wall should be at least a brick and a half thick (14 ins.).

Stone resembles brick in being porous and absorbent of moisture, but not to such an extent. It is colder than brick, but as stone walls are generally built thicker than brick walls this is partly counterbalanced.

Walls, whether brick or stone, must be carefully built with a layer of good mortar between each course. Special means must be adopted to prevent dampness arising from other causes than a damp soil. A wall much exposed to wind and rain should be protected by a covering of slate, painted boards, or cement. Window-sills must project beyond the walls, so that rain falls from them clear of the walls. Rain-water gutters and pipes must be kept clear and in good condition to avoid overflows. Roofs must be well constructed, and should in all instances project beyond the walls, so as to protect them from rain.

The internal walls of a house need to be covered in some way, although this, to some extent, interferes with ventilation.

Whitewashing is the simplest and cheapest method, but walls thus treated are unsightly, and a rough surface is left on which dust collects.

Glazed tiles are non-absorbent and easily cleaned, but are cold-looking, expensive, and unsuitable for the walls of sitting-rooms.

Painted walls are non-absorbent, easily cleaned, and very durable. They are, however, expensive in the first instance, and are cold and cheerless in appearance.

Papering is the most common method of treating inside walls. It is the most cheerful and decorative method and is not expensive, but, unless the paper is varnished, it cannot be washed and the wall is dirty. The practice of putting a clean paper on the top of a dirty one cannot be too strongly condemned. In all instances the old paper should be removed before the new one is put on. In selecting papers care must be taken to select one which does not contain **arsenic**; such papers are certain to cause ill-health among the inmates of the house, owing to the fact that the arsenic gets into the air and thence into the system.

Floors should be made of impervious material which can be washed. Stones, tiles, and hard bricks are best for sculleries, pantries, and passages, but are not warm enough for sitting-rooms and kitchens, and for these wood is generally used. A well-made wood floor should be laid down with well-seasoned planks, carefully fitted together so as to avoid gaping cracks in which dust will collect.

If carpets are used for covering floors they should take the form of a square small enough to leave a border of uncovered floor all round the room. Squares of carpet are easily taken up to be shaken, and dust does not so readily accumulate in the corners of the room as when the carpet covers the whole floor. The uncovered border may be stained and polished. The healthiest method of treating a floor is to stain and polish the whole surface, and lay down a number of small rugs which are very easily freed from dust; this method is specially recommended for bedrooms.

QUESTIONS.

1. How may walls above ground be kept free from the injuries caused by damp? (1*st Year Certificate*, 1896.)

2. What are the rules to be followed in choosing a house? What number of rooms ought a school-house to contain?

(1*st Year Certificate*, 1890.)

3. What is meant by "jerry-building"? Name the defects and dangers of such a mode of constructing houses.

(1*st Year Certificate*, 1889.)

4. Name the chief considerations under the heads Foundation, Site, Light, and Drainage, which ought to be kept in view in building a house. (1*st Year Certificate*, 1888.)

CHAPTER XI.

THE DWELLING—METHODS OF WARMING AND LIGHTING.

The necessity for Warmth in the Dwelling. It has already been stated (see Chapter VIII.) that the warmth of the body is produced by the oxidation of food in the system, and that much of the heat so produced is lost from the skin. The use of clothing does much to economise the loss of heat, but if the surrounding air is cold a greater amount of heat is lost than if the air is warm. It is necessary, therefore, to warm the air in our dwellings to prevent an undue loss of heat from our bodies, and, possibly, resultant chills. Prolonged sitting in cold rooms has a marked effect in lowering the general health; particularly is this the case with delicate or aged persons and with young children.

The temperature of a living-room should be from 55° to 65° F. The former will, as a rule, be warm enough for an adult in health; the latter will be too warm for any but old people or delicate children. Every sitting-room should be provided with a thermometer, so that the temperature may be accurately recorded.

Distribution of Heat. Heat is distributed in three ways: (*a*) by radiation, (*b*) by conduction, and (*c*) by convection.

Radiation. Radiant heat is sent out from the source of heat in straight lines which radiate in all directions and heat the objects they strike against, but not the air through which they pass. Heat is given out in this way from the sun—the great heat-giver of the universe—from an open fire, and, indeed, from any hot body.

Conduction. Heat is conveyed by conduction from one particle of a body to the next, the heat passing from the warmer to the colder parts. Substances which transmit heat easily in this way are called good conductors; such substances rapidly give off their heat to the surrounding air or any colder body in contact with them, and, on the other hand, quickly withdraw heat from bodies warmer than themselves. Conduction, being a slow method of heating, does not play an important part in the warming of dwellings.

Convection is the process by which heat is propagated in liquids and gases. When a liquid or a gas is heated, the portions nearest the source of heat, becoming warm, expand and rise, carrying warmth with them. Their place is at once taken by colder portions, which in turn become heated, and a sort of circulation of the liquid or gas is set up, by means of which the whole mass becomes warmed.

Methods of Warming.—Open Grates. 1. The most popular way of heating an English house is by means of open grates, the fuel used being either coal, coke, or wood, or sometimes a mixture of all three.

Advantages. There is much to be said both for and against this method of heating. The chief points urged in its favour are (1) that it has a bright and cheerful appearance, and (2) that it aids in ventilating the room.

It may also be added that the heat from an open fire is radiant heat, which heats the objects near it, but does not make the air of the room either too hot or dry.

Disadvantages. The disadvantages attending the use of an open fire are many :

(1) Possibly the greatest of these is the difficulty of obtaining uniform heat. Near the fire the room may be too hot to be comfortable, while in the further parts it is equally cold ; this is owing to the fact that in radiation the intensity of the heat decreases according to the square of the distance, *e.g.* heat given off from an open fire will be a hundred times less ten feet from the fire than at a distance of one foot.

(2) An open grate is extravagant, for, in the first place, only the best coal can be used, because inferior coal makes too many ashes, and does not give a bright fire ; and secondly, seven-eighths of the heat produced goes up the chimney and is lost.

(3) Open fires are dirty. Every housewife knows how much greater is the quantity of dust and dirt in a room with a fire than in one without.

(4) The rush of cold air to the fire is apt to produce draughts, which in their turn cause cold feet.

The Construction of Open Grates. Much may be done to remove these drawbacks by careful construction of the grate. The following points should be borne in mind :

(1) Use as little iron as possible ; iron is a good conductor of heat, and draws heat away from the room instead of throwing it back into it.

(2) Make the back and sides of fire-brick, which is not a good conductor of heat.

(3) Glazed tiles used for the front and hearth will assist in radiating heat into the room.

(4) The back of the fireplace should lean forward so as to check the escape of heat up the chimney, and the "throat" of the chimney should be made small.

(5) The bars should be close together in front and at the bottom of the grate, to prevent half-burnt fuel from dropping out.

(6) The space between the floor and the bottom of the grate should be enclosed or air will enter at this point, and the fire burn away too rapidly.

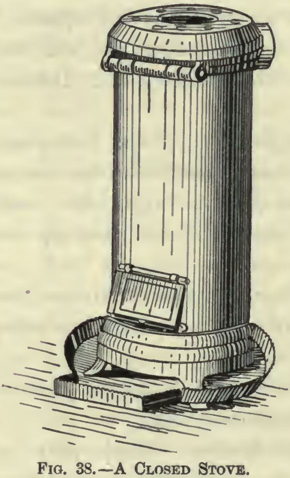


FIG. 38.—A CLOSED STOVE.

Closed Stoves. As an alternative to open grates, closed stoves may be used for heating the dwelling.

The fuel used may be coal or gas, and as a rule the fire is detached and so placed that the smoke and other products of combustion escape by a flue to the outer air, while the heat produced radiates in all directions round the stove.

Gas Stoves. These may be had in various forms. **The Reflector Stove** is one of the commonest. In this, rows of gas jets are backed by a bright metal reflector, which is intended to throw out the heat.

Gas stoves of this nature are cheerful in appearance, but do not throw out heat in proportion to the amount of gas consumed. Frequently they are left unprovided with a flue, and in that case the air of the room is contaminated by injurious products of combustion.

Asbestos Stoves are sold in great variety. In one of the best the asbestos is in the form of hollow balls, which may be laid in an ordinary open grate. When the asbestos becomes heated by lighted gas, it sends out a glow not unlike that of a coke fire.

As in the reflector stoves, the amount of gas consumed is great compared with the small amount of heat radiated into the room.

Condensing Stoves are so constructed that the water vapour produced by combustion is condensed by passing through upright tubes, and then caught in a tray beneath. In falling, the water carries down with it most of the noxious products of combustion. The carbonic acid gas produced is not removed in this way, and unless a flue be provided, which is rarely the case with this kind of gas stove, the carbonic acid escapes into the air of the room. As in the other gas stoves named, the amount of heat given out into the room is small in proportion to the gas consumed.

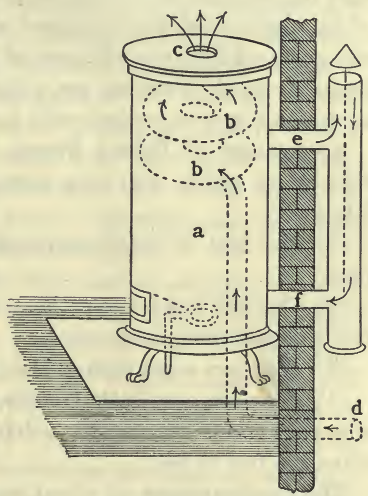


FIG. 39.—GEORGE'S CALORIGEN STOVE.

George's Calorigen Stove is specially constructed with a view to obtain the largest amount of heat with the smallest amount of fuel (see Fig. 39).

It consists of a cylindrical iron case (*a*) which contains a coiled iron tube (*b*) opening into the room (*c*). The stove is placed against an outer wall through which the lower end of the tube passes into the open air (*d*). Beneath the tube is a gas flame which forms the source of heat.

The action of the stove is as follows:—Fresh air enters the tube at its lowest point, rises upwards, is heated in its passage through the stove, the coils of the tube lengthening the journey with this purpose, and finally escapes into the room.

The products of combustion are carried away by another tube (*e*), which is so divided as to serve the second purpose of supplying fresh air to support combustion (*f*). Heat is also given off from the iron case of the stove. This becomes heated from the burning gas within, and in turn heats the air which comes in contact with it.

Advantages of Closed Stoves. Comparing gas stoves with open grates we may sum up the advantages as follows:

(1) The heat is distributed uniformly to all parts of the room.

(2) There is less waste of heat with closed stoves, therefore they are more economical.

(3) They are much cleaner than open fires.

(4) They are very little trouble, needing no replenishing when the fuel is gas, and less attention than open fires even when the fuel is coal.

The disadvantages of closed stoves are these: (1) They are not cheerful, there being no appearance of life or action as there is with an open fire.

(2) The heat is distributed by convection, consequently the air is rendered hot and dry. (A pan of water placed on or near the stove will do something to remedy this defect.)

(3) They do not assist in ventilation.

(4) Injurious gases (*e.g.* carbonic oxide) are given off into

the room if the stove be allowed to get too hot, and headaches are caused.

Hot Air is sometimes driven into the rooms of large buildings by means of mechanical contrivances such as fans. This method is, however, very costly, and the atmosphere is apt to become too dry to be pleasant.

Steam and Hot-Water Pipes are used to heat large rooms such as those in schools, factories, hotels, and the halls and corridors of large houses. Though steam is sometimes used, hot water is rapidly superseding it in the public favour, owing to the ease with which it can be applied, and its comparative cheapness. The apparatus in connection with this mode of heating consists of a large boiler, which is generally placed in the basement of the building. From the upper part of the boiler a main pipe runs, branching into smaller pipes which go to every part of the building, and then return underneath and parallel to the first set of pipes; the returning set forms eventually into one pipe, which enters the boiler at its lower part.

The circulation of water, like that of air, depends upon the fact that hot water is lighter than cold; consequently, as the water in the boiler gets hot it rises into the upper pipe and flows through the first set of pipes, returning as it cools by the lower set of pipes to the boiler. The heat of the pipes is regulated by a valve which can be opened or shut as may be desired. Sometimes the pipes are arranged in stacks at one end of the room. As in the case of closed stoves the heat is distributed by convection. The air of the room comes into contact with the hot pipes, becomes heated, and rises; colder air takes its place to become heated in turn. A constant circulation of the air of the room is thus kept up, and uniformity of temperature secured.

Lighting. Light is almost as necessary to health as fresh air is. Dwellers in narrow alleys, with high buildings shutting out the light of the sun, are invariably pallid and unhealthy; human beings, like plants, cannot flourish if deprived of light.

It is, therefore, essential to health that the windows of a dwelling-house be large enough and sufficiently numerous to admit an abundance of light to every part. The windows should not be darkened by an undue amount of window blind and curtain, nor should creepers be allowed to overshadow them. The windows of living-rooms should face south or south-west, so as to get the maximum of sunlight; a sitting room facing north cannot be regarded as conducive to health.

Artificial Light. It is, unfortunately, necessary to employ some means of artificial lighting in our houses. The chief methods are electric lighting, coal-gas, oil, and candles.

The Electric Light is the only one of these which does not vitiate the atmosphere. It is, however, too costly at the present time to be generally used in dwelling-houses.

Coal-gas is obtained from coal by distillation. It consists of a mixture of several gases, and varies greatly in character according to the kind of coal used and the method of purification employed. Its illuminating power is greater than that of either oil or candles in proportion to the cost. The drawback to the use of coal-gas is the injurious effect it has upon the atmosphere. The usual products of combustion of coal-gas are: carbonic acid, carbonic oxide, various sulphur compounds, compounds of ammonia, and watery vapour. The sulphur compounds are especially dangerous to health, and it is important that ventilation should be good in all rooms where gas is the illuminant. The greatest danger from the use of gas occurs from the possibility of its escape, due to carelessness or imperfect fittings. Mixed with air, coal-gas forms an explosive mixture; it is, too, highly poisonous, and if present in the air of a house in the smallest quantities, causes ill-health among the inmates. In larger quantities it proves rapidly fatal, due chiefly to the carbonic oxide it contains.

Candles are made of tallow, spermaceti, or wax. The best for health are the hard kinds made of stearine, wax, paraffin, spermaceti, etc., because these substances do not melt so quickly as tallow, and combustion is, therefore, less imperfect.

Oil. Various kinds of oil have been used for lighting purposes, notably colza oil, obtained from rape-seed, but the cheapness and high-illuminating power of paraffin has led to its general use. Care must be taken to select a good paraffin-oil, the cheaper ones being liable to explode at a low temperature. The lamp used should have a reservoir of metal, not glass or china, which may break and cause an explosion by escape of the oil. The reservoir should not be filled up to the top, nor should it be allowed to burn dry; if the former the oil may overflow; if the latter there is danger of an explosion of the mixture of hot air and oil vapour inside the lamp. Only "safety-lamps" which extinguish themselves if overturned should be used; such lamps can now be bought at a low price. If a lamp should be overturned and continue to burn, put it out with rags or other woollen articles; water is useless, for paraffin continues to burn on the surface of water.

Effects of Artificial Lighting upon the Air of Rooms. Persons who sit for many hours together in rooms where there are many gas-burners suffer, not only from the presence of the injurious products already mentioned, but from a diminution in the amount of oxygen and a corresponding excess of carbonic acid gas.

It is stated that two hard candles or one good oil-lamp vitiate the atmosphere to the same extent as the respiration of one individual, and that a gas-burner of average size consumes as much oxygen and gives out as much carbonic acid gas as four or five men. It is clear from this, that provision must be made for increased power of ventilation in all rooms where much artificial light is used.

Questions.

1. What should be the temperature of a bedroom, and how should it be maintained? (1893.)

2. What average temperature should we aim at maintaining in our living, sleeping, and cooking rooms? What are the difficulties in the way of this, and how would you propose to overcome them? (*Scholarship*, 1895.)

3. Compare the use of hot-water pipes for house-warming with that of open fire-grates, in respect of cost and efficiency. (*Scholarship*, 1896.)

4. When and where may coke be used with advantage in place of coal for domestic purposes? (*Scholarship*, 1897.)

5. What are the principal faults in fire-grates, and how would you remedy these defects? (*Scholarship*, 1900.)

6. What dangers are especially incident to the use of paraffin lamps, and how may they be avoided to a great extent? (*2nd Year Certificate*, 1895.)

7. What special impurities arise from (*a*) respiration, (*b*) a coal fire, (*c*) ordinary gas light? How are these affected by ventilation? (*Scholarship*, 1898.)

CHAPTER XII.

THE DWELLING. VENTILATION. THE LUNGS AND RESPIRATION.

To understand the need of ventilation in the dwelling it is necessary to know something of the lungs and their work.

The Structure of the Lungs. The lungs are two spongy bags occupying nearly the whole of the cavity of the thorax or chest. (See Fig. 40.) The right lung is divided into three lobes by deep depressions, the left lung into two. The substance of the lungs is made up of elastic tissue, air-tubes, air-cells, and blood-vessels.

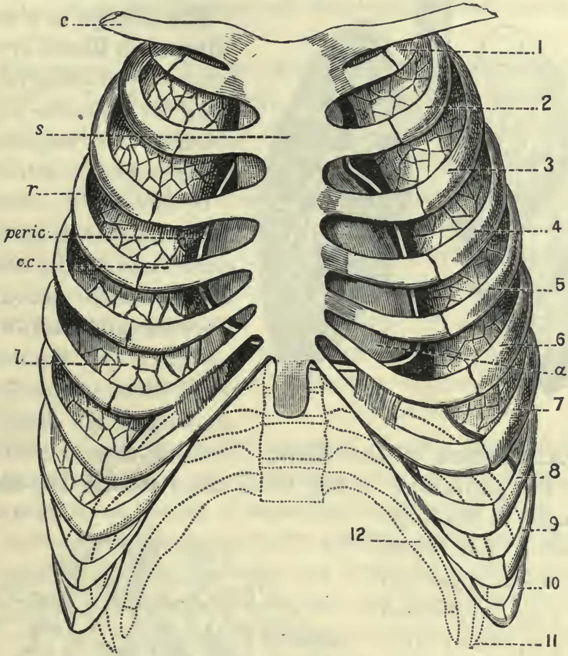


FIG. 40.

The Trachea or Windpipe is a tube about $4\frac{1}{2}$ ins. long, kept open by rings of cartilage shaped like the letter C, the incomplete portion of the rings being placed at the back of the windpipe where the œsophagus lies. The trachea branches into the two bronchi (see Fig. 41) one entering each lung. In the substance of the lungs the bronchi divide and subdivide into smaller and smaller passages, the smallest tubes, called bronchioles, having no cartilage in their structure. The tubes finally end in bunches of air-cells called infundibula. (See Fig. 42.)

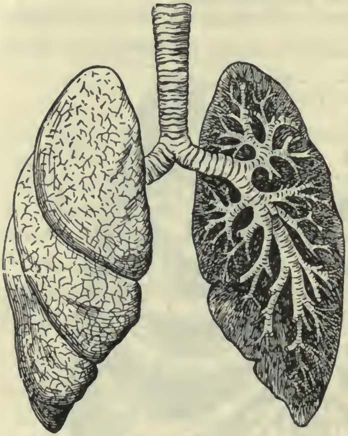


FIG. 41.

The Lungs are supplied with Blood by the pulmonary arteries, which bring dark, venous blood charged with impurities to the lungs to be purified.

In the lungs the arteries divide and subdivide into smaller and smaller blood-vessels which penetrate every part and finally form networks of capillaries which surround and lie on the walls of the air-cells.

Purification of the Blood. It is in these capillaries that the purification of the blood takes place. The blood brought to the lungs contains too much carbonic acid gas and too little oxygen, and it is separated from the air in the air-sacs only by a very thin, moist membrane. The consequence is that an exchange takes place between the blood and the air, the former giving up carbonic acid gas, the latter parting with oxygen. The blood in the capillaries is

FIG. 42.

thereby changed from venous blood of a dark purple colour to bright red arterial blood. The air in the air-sacs, however, is no longer of normal purity, and in order that the work of purification may be continuous it is necessary to get rid of the used-up air and obtain fresh air in its place.

Respiration. This is effected as follows : The walls of the chest are formed by the vertebral column behind, the breast-bone or sternum in front, the twelve pairs of ribs with the intercostal muscles at the sides, and the diaphragm below. The lungs are enclosed in a double membrane, the pleura, one layer of which is closely pressed against the inner surface of the thorax, while the other adheres firmly to the surface of the lungs. The two surfaces of the membrane are preserved from friction by a watery fluid known as serum. The chest is thus an air-tight chamber, having no communication with the atmosphere, except through the lungs.

The act of respiration consists of two movements :— **Inspiration**, or the act of drawing air into the lungs, and **Expiration**, or the act of expelling air from the lungs.

In the former movement the external intercostal muscles contract and raise the ribs and breast-bone, thus making the chest wider from side to side and from front to back. At the same time the diaphragm—the partition between the chest and abdomen—contracts and becomes flatter, thus adding to the depth of the chest from the neck downwards.

The size of the chest is therefore increased in every direction, and did not the expansion of the lungs immediately follow a vacuum would be produced between the lungs and the walls of the chest. To prevent this air rushes into the trachea, thence into the air-cells, and so enlarges the lungs that they fill the whole space.

When this has taken place the muscles relax, the ribs fall, the elastic air-cells partially collapse, and a portion of the air in them is forced out of the lungs; this is called **expiration**. In **forced expiration** the internal intercostal muscles are brought into use, also the muscles of the abdomen, which, by acting on the abdominal organs, exert an upward pressure on the diaphragm.

Composition of Air. Air is a material substance which can not only be felt when in motion, but can, by the help of proper apparatus, be weighed. It consists of a mixture of 3 gases—oxygen, nitrogen, and carbonic acid gas. Though the amount of oxygen and carbonic acid gas varies under different conditions, it is found that the average or normal composition of air is:

By volume—	Oxygen -	20·94	per cent.
	Nitrogen -	79·02	,,
	Carbonic acid	0·04	,,
		100·00	

In addition to the above gases air always contains a certain amount of watery vapour and various impurities.

Changes produced in Air by Respiration. The composition of **inspired air** may be taken in round figures to be

79	per cent.	nitrogen.
21	,,	oxygen.
0·04	,,	carbonic acid.

Expired Air, however, is found to contain

79	per cent.	nitrogen.
16	,,	oxygen,
and 4 to 5	,,	carbonic acid.

In addition to this it is always saturated with moisture, is much warmer than the air breathed in, and contains certain impurities of an organic nature. In the lungs, therefore, the blood gets rid of water and heat as well as carbonic acid gas and organic matter.

Impurities found in Air. Although air is normally a mixture of the gases aforementioned, it is rarely that a sample of air is examined which does not contain various impurities of a gaseous or solid nature. Such impurities mainly result from combustion, respiration, effluvia from sewers, and decomposing matter, or are given off from various manufacturing processes.

Gaseous Impurities. Of these, carbonic acid is the most important. In pure air it exists, as has been previously stated, to the amount of 0·04 per cent. When it is present in any greater quantity than this it must be considered an impurity. Carbonic acid gas is, as has been shown, given off largely from the lungs of human beings and animals; it also results from all processes of combustion and putrefaction; it is found in large quantities in certain kinds of soil which part with it to the atmosphere; it is increased by fogs, but diminished by rain, wind, and by means of vegetation. When carbonic acid gas in the air of an inhabited room exceeds 0·06 per cent. the air is regarded as unfit to breathe. It is not, however, so much owing to the carbonic acid itself as the indication this gas gives of the corresponding diminution of oxygen and the presence of those organic impurities which it is especially injurious to breathe over again.

Pure carbonic acid gas is fatal when existing in air to the amount of 7·5 per cent.; 1·5 per cent. will produce such symptoms as giddiness, faintness, and headache; below 1 per cent. it cannot be said to have any injurious effect upon health.

Carbonic Oxide is produced by the combustion of carbon in an atmosphere of carbonic acid; it is frequently formed on the surface of a charcoal stove, more especially if there is no flue, and is found in the air of rooms where coke is burnt in an open grate, or where there is an escape of coal-gas. Carbonic oxide is much more deadly than carbonic acid; as little as 1 per cent. in air proves rapidly fatal, and even $\frac{1}{2}$ per cent. has been known to produce fatal results; its presence in air to the extent of 0·5 per cent. will produce symptoms of dizziness, headache, a confused mental condition, and irregular action of the heart. It has a remarkable affinity for the red corpuscles of the blood, and causes suffocation by displacing the oxygen from them. General depression of the health invariably results in those who breathe an atmosphere containing even the slightest portion of this gas, and it is chiefly owing to this fact that closed stoves and the use of coke are not hygienically advisable.

Carburetted Hydrogen Gas is found in air as the result of the combustion of coal. In small quantities it is comparatively harmless.

Sulphurous Acid and Sulphuretted Hydrogen are found in air as two of the products of combustion; the latter is found in larger or smaller quantities in the air near gas-works, chemical works, sewers, and marshes. As a rule these gases produce no serious effects, though occasionally anæmia, diarrhœa, and sickness may result.

Sewer-Gas, which emanates from sewers, contains not only sulphuretted hydrogen and other gases, but also putrifying matter of a volatile nature which may give rise to such diseases as typhoid fever and diphtheria.

Suspended Impurities. The solid impurities of air are found suspended in the form of dust. A beam of light passing through the chink of a shutter into a darkened room makes visible to us some of the minute particles which comprise this suspended matter.

Dust is made up of both organic and inorganic matter.

Among the former may be instanced pollen grains, starch cells, the spores of fungi, the germs of animal and vegetable life, wood dust, fine particles of flax, silk, cotton and wool and dead scales of the epidermis.

Inorganic Dust is made up of particles of fine sand, coal, soot, clay, common salt; and in the air near the various manufactories, marble dust, stone dust, steel dust, etc., are produced.

Effects of breathing Dust-laden Air. Workers in any trade producing dust, frequently suffer from affections of the lungs or other diseases. Thus tin miners, needle-makers, cutlers, etc., suffer from phthisis and asthma; potters develop an asthmatic cough; workers in white lead works suffer from colic; brass and copper workers are subject to a specific form of ague; match-makers are liable to disease of the jaw-bones due to the fumes and particles of phosphorus they inhale.

Among **organic matters** present in air, the dust given off in the manufacturing processes of various fabrics produces lung-trouble in the workers, among woolsorters the irritation to the air-passages is so great as to set up the disease commonly known as wool-sorter's disease. Hay fever or summer catarrh results from breathing air laden with the pollen of grasses. The particles of hair and skin which float in air are frequently responsible for the spread of the various infectious diseases.

Effects of breathing Respired Air. Air which has once been breathed should not be breathed again; it contains too little oxygen, too much carbonic acid, is too moist, too warm, and holds, moreover, certain injurious organic impurities. The habitual breathing of vitiated air is always followed by poorness of blood, resulting in anæmia and imperfect nutrition of all the tissues, headache, palpitation of the heart, hurried breathing, and loss of strength. The tendency to colds is increased, and consumption (phthisis) is so prevalent among persons living in vitiated atmospheres that over-crowding is regarded as one of the chief causes of the disease. In very foul atmospheres, typhus fever finds the conditions under which it flourishes.

Questions.

1. What is meant by respiration? Describe the process and the use of it. Say also what common practices interfere with proper respiration, and how such practices may be corrected. (*Scholarship*, 1892.)

2. In a dwelling-house what are the causes that operate against purity of atmosphere. (*Scholarship*, 1895.)

3. What special impurities arise from (*a*) respiration, (*b*) a coal fire, (*c*) ordinary gaslight? How are these affected by ventilation? (*Scholarship*, 1898.)

4. Define what is meant by "pure air," and show from the nature of our body the need for a constant supply. (*1st Year Certificate*, 1890.)

5. By what process is inspiration of air effected in the lungs? (*1st Year Certificate*, 1896.)

6. How is breathing affected by great dryness in the air? (*1st Year Certificate*, 1897.)

CHAPTER XIII.

THE DWELLING—VENTILATION.

Quantity of Air Required. To escape the dangers arising from breathing a foul atmosphere it is found necessary to secure efficient ventilation, and to this end we must know what quantity of air is required. As has been previously stated, when the amount of carbonic acid in the air of a room exceeds 0·06 per cent., which is 0·02 per cent. or 0·2 per 1000 above the amount in pure external air, the air is considered unfit to breathe.

Each individual on an average, breathes out ·6 of a cubic foot of carbonic acid per hour, or 3 times ·2; it follows, therefore, that to counteract this vitiation and reduce the amount of carbonic acid to 0·6 per 1000 the air expired by each person must be diluted with 3000 cubic feet of fresh air per hour. This can only be done by changing the air of occupied rooms. It is found that the air of rooms cannot be changed more often than 3 or 4 times per hour without producing draughts. If the air is changed only 3 times, 1000 cubic feet of air space is required for each individual; if it be changed 4 times, 750 cubic feet are sufficient to ensure the necessary 3000 cubic feet of air per hour.

In hospitals it is usual to allow from 1000 to 1500 cubic feet of air space, and an allowance of 2000 cubic feet would not be too much. For soldiers in barracks 600 cubic feet is the smallest amount allowed; in elementary schools the minimum allowance sanctioned by the Education Department is 80 cubic feet of air space and 8 square feet of floor-space per scholar. In model lodging-houses 300 cubic feet of air-space are required; anything under this constitutes over-crowding.

It must be remembered that height in a room is of very little advantage unless means be adopted to carry off the bad air at the top of the room. Above 12 ft. the air of a room is apt to become stagnant.

To Secure Successful Ventilation the following points must be borne in mind:

1. The entering air must be pure.
2. It must pass continually into the room.
3. It must not cause a draught.
4. It must not be too cold.
5. It should be equally distributed to all parts of the room.
6. Outlets must be provided for the escape of foul air.

Natural Agents of Ventilation. The interchange between internal and external air is affected, as a rule, by certain natural forces which determine the movements of air.

Diffusion of Gases. It is the nature of gases of different density to intermingle if brought into communication with each other, until both are of equal density; thus when pure air is introduced into a room containing impure air the two mix together, and the air of the room is to some extent purified.

The Wind is a valuable agent in securing ventilation. As it passes over the tops of chimneys it draws the column of air in the chimney upwards, thus producing a vacuum, which the air of the room rushes to fill. Naturally fresh air passes into the room through all available inlets to take the place of that which has just escaped. The wind may be used to change the air of an unoccupied room by opening opposite windows so that the current of air may sweep through.

Sylvester's Method of Ventilation makes use of the wind to effect the ventilation of the holds of ships, mines, and basements of large buildings.

A cowl is placed on deck or above ground, as the case may be, and is so arranged as always to face the wind from whatever direction it blows. The air thus received is conducted to the rooms requiring ventilation.

Movements of Air produced by Differences in Temperature. Warm air is lighter than cold air, therefore we may expect to find that warm air will rise to the top of the room, while cold air sinks to the bottom. Air which is admitted from outside is generally cold, but when it has been in the room some time it becomes heated by fire, lights, etc., and rises to the top of the room, where, if outlets are provided, it will escape, and cold air will enter at a lower point to take its place. In this way a constant circulation of the air of a room is kept up, aided, as previously explained, by the action of the wind.

The movements of the air of a room may be simply proved. Slightly open a door leading into the outer air, or into a corridor or room containing colder air. Hold a

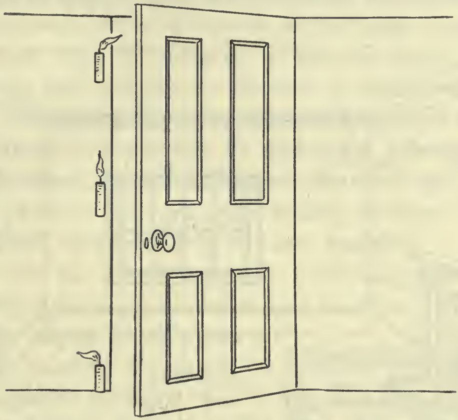


FIG. 43.—SHOWING MOVEMENTS OF AIR PRODUCED BY DIFFERENCES OF TEMPERATURE.

lighted candle in the opening towards the top of the door, and observe that the flame is blown outwards, showing that warm air rises and escapes from the top of the room.

Now move the candle to the bottom of the opening near the floor, and the flame will be blown inwards, showing that cold air enters at the lower point. Half-way down there will be little motion either way. These movements will only take place if the air on the two sides of the door be of different temperature. When the temperature is equal no movements will occur. (Fig. 43.)

Ventilation secured by means of the above forces is known as **natural ventilation**; when mechanical means are adopted for controlling the movements of the air in rooms the term **artificial ventilation** is applied.

Methods of Ventilation.—How an Open Fire helps Ventilation. It has been said in an earlier chapter that an open fire is an aid to ventilation. The reason for this is easily understood. As the fire burns it draws the air of the room towards it, partly to obtain a supply of oxygen to

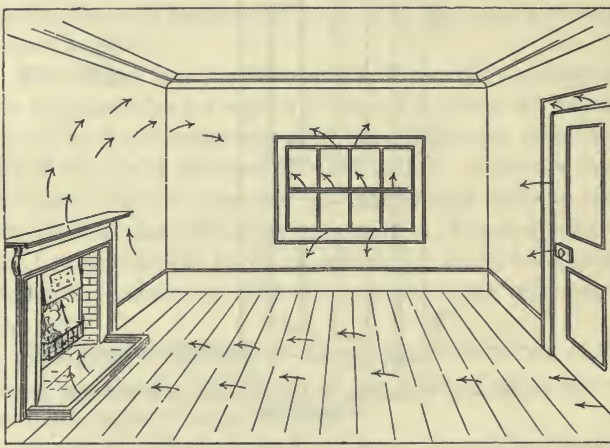


FIG. 44.—SHOWING MOVEMENTS OF AIR IN A ROOM PRODUCED BY AN OPEN FIRE.

support combustion, and partly because of the up-draught in the chimney. Of the air thus attracted some escapes up the chimney; the remainder, becoming heated by proximity to the fire, rises to the top of the room, and fresh air rushes in through every available inlet to take its place. (See Fig. 44.)

To prove that a fire does really cause these movements, throw a small piece of cotton wool into the air near the fire and it will pass either up the chimney or to the top of the room. Next put a piece of cotton wool in the chink at the bottom of the closed door, and it will be puffed inwards.

The Position of Inlets and Outlets. Since fresh air enters naturally near the floor, it would seem advisable to place inlets low down in the room; but in actual practice it is found that air thus admitted rushes in too forcibly and causes a draught. Inlets, therefore, are best placed well above the heads of the occupants of the room, some eight or nine feet up. If, however, a hole be made straight through the wall and the air allowed to enter as it will, it falls in a cold stream upon the heads of the people beneath. It is necessary to avoid this by giving the entering air an upward direction, so that it **rises** into the room, and, mixing with the warmer air near the ceiling, becomes slightly warmed itself, and less likely to cause draughts.

Inlets for air which has been previously warmed by artificial means should be placed near the floor.

Outlets should in all cases be placed near the top of the room, since it is there that the warmed and vitiated air accumulates. It is not advisable for inlets and outlets to be placed facing each other, or fresh air may enter at the one to find its immediate escape by the other.

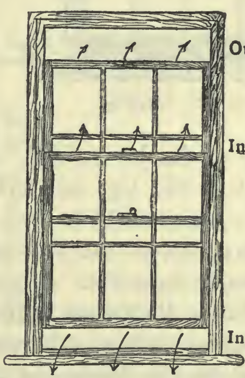


Fig. 45.—Ventilation by Window.

Ventilation by the Window. When a window is made to open top and bottom, as all windows should be, they form excellent ventilators in themselves, for warm and impure air escapes by the opening at the top, and fresh air enters at the bottom and between the two sashes. (See Fig. 45.)

Sometimes, however, draughts are produced, so other methods are adopted.

For the bedroom, the ventilation of which should be beyond reproach, the following plan is recommended :

Open the bottom sash a few inches and closely fit a block of wood into the aperture. Fresh air will continually pass into the room between the two sashes, as shown in Fig. 46, the necessary upward direction being given by the upper

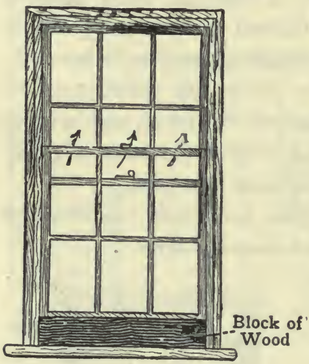


FIG. 46.

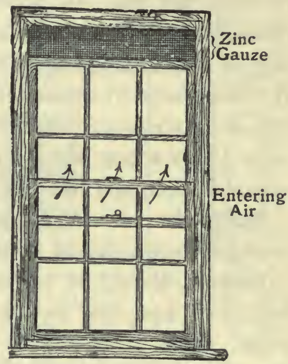


FIG. 47.

part of the lower sash. As an alternative to the above method, the top sash may be lowered a few inches and the opening filled in with zinc gauze. Air is admitted as before between the two sashes, and impure air may escape through the gauze. (Fig. 47.)

Where **Venetian Blinds** are used they may be made to act as ventilators in this way : First open the window, then, having drawn the blind over the opening, turn the laths so that they slope upwards and inwards. Entering air is thus directed upwards and will not cause a draught.

The Louvre Ventilator. Very similar in action to the Venetian blind is the Louvre Ventilator. A pane of glass is removed from the window and its place filled by strips of glass arranged like the laths of the Venetian blind turned upwards and slanting towards the room. Fig. 48 shows the side view of this ventilator.

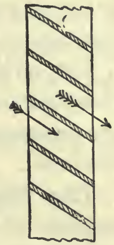


Fig. 48.—The Louvre Ventilator.

Its great advantage lies in its simplicity, but unfortunately it can never be closed.

Moore's Ventilator is like the Louvre, but is made to open and shut by means of a pulley.

Cooper's Ventilator is frequently seen in the windows of dwelling-houses. It consists of a glass disc in which are five oval holes. This is fixed on a pivot to a window pane which has been pierced by five similar holes. When the ventilator is open the holes of the disc are over the holes.

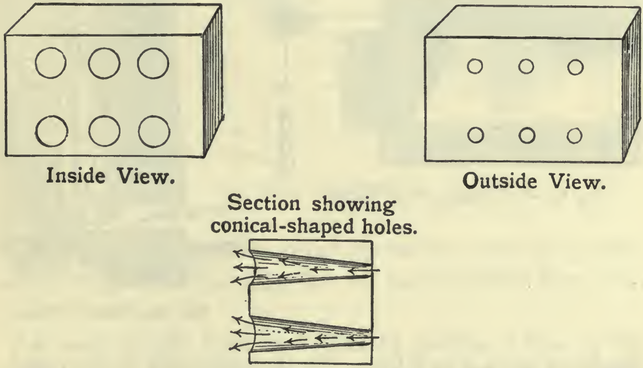


Fig. 49.—Ellison's Inlet.

The Walls of a room are often made use of for purposes of ventilation. The following are among the principal ventilators thus placed :

Ellison's Inlet. This consists of a perforated brick which is fixed in the wall in the place of an ordinary brick. The holes with which it is pierced are of conical shape (see Fig. 49), the small end of the cone being on the outer side. Air, entering as it does at the small end of the hole, spreads out as it passes through the brick into the room, and by this means the draught is diminished.

The advantage of this form of ventilator lies in its cheapness and durability; the air does not, however, receive the necessary upward direction and draughts are sometimes produced.

The Sheringham Valve is a well-known inlet. It consists of an iron box which is placed in the wall at a

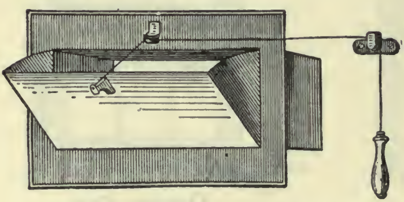


Fig. 50.—The Sheringham Valve.

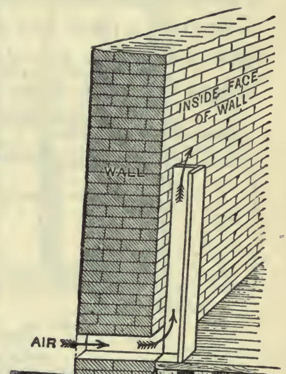


Fig. 51.—Tobin's Tube.

height of some 6 to 9 feet. On the outer side of the ventilator is an iron grating through which the entering air passes; and on the inner side, flush with the wall of the room, is an iron valve, fitted with cheeks, which falls forward at will, worked by a pulley, or supplied with a knob. (See Fig. 50.)

The fresh air is thus directed upwards when the valve is open, and excluded altogether when it is shut.

Tobin's Tube may often be found in the class-rooms of schools. A brick is removed from the wall, just above the level of the ground, and a grating fixed on the outside of the hole. This communicates with a square wooden tube, which runs up the wall to a height of six feet, and is covered by a lid. (See Fig. 51.)

Fresh air enters through the grating, passes into and up the tube, and rises into the room like a fountain.

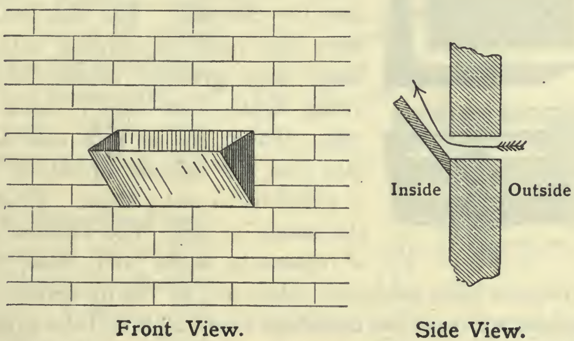


FIG. 52.—A SIMPLE INLET.

The ventilator may be closed by the lid; and by putting cotton-wool into the tube the air may be freed from suspended matters.

A very simple inlet is formed by making a hole in the wall about six feet from the ground, and covering it on the outside by a grating, as in other inlets. On the inside a board is fixed at an angle, and supplied with cheeks, imitating in form the hinged window when open. (See Fig. 52.)

Such a ventilator may be made to close by supplying it with a lid.

Outlets. When there is an open fire-place in a room the chimney forms an excellent outlet, for reasons before shown;

and on no account should a chimney ever be stopped up by stuffing it with paper, or covering the grate with a board.

Where it is found that the chimney alone is not sufficient, outlets are sometimes fixed into that part of the wall which leads into the chimney.

Boyle's Mica Flap is in common use in schools. This is an iron box, not unlike the Sheringham valve in size and shape; it is fixed high up in the wall with its face to the room, and opens into the chimney. The side visible from the room is covered with a fancy iron grating, behind which swing lightly four flaps of mica or talc. These are so thin and delicate that the lightest breath of air is sufficient to move them. Briefly, the action is this: The vitiated air of rooms is warm and rises, the movements thus produced, aided, too, by the up-draught in the chimney, make the mica-flaps swing back, and the impure air passes out of the room into the chimney. The iron grating prevents the flaps from swinging forward into the room, but notwithstanding this, smuts and smoke sometimes escape from the chimney into the room. (Fig. 53.)

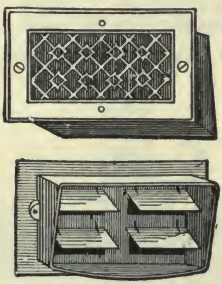


Fig. 53.—Boyle's Mica Flap Ventilator.

Arnott's Valve is placed in a position similar to that of the mica-flap ventilator. In shape, too, it resembles it, but instead of the grating and the flaps of mica, there is an iron valve which swings back into the chimney but not towards the room. Its action is similar to that of the mica-flap. (Fig. 54.)

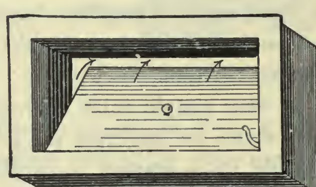


Fig. 54.—Arnott's Valve.

Its drawback lies in the fact that the valve, in action, makes a disturbing, clicking noise.

A better outlet than either of the foregoing is secured by running a separate shaft up the side of the chimney. An opening into it is made from each room near the ceiling, and as the air in the shaft becomes heated by its proximity to the chimney it rises and draws with it the warm air of the rooms opening into it.

The Ceiling is used as a means of escape for foul air, in buildings of one storey only; or in any large room having no other room above.

M'Kinnell's Ventilator, on the roofs of buildings, is a familiar sight. A glance at the accompanying sketch explains its action. The two tubes, one within the other, pass through the ceiling. The heated impure air of the room rises to the top, and passing up the inner tube, as shown by the arrows, escapes into the outer air. Fresh air passes downwards between the two tubes, and being directed horizontally by the curved rim of the inner tube, does not fall immediately downwards. The cover above the ventilator prevents rain from falling down the tubes.

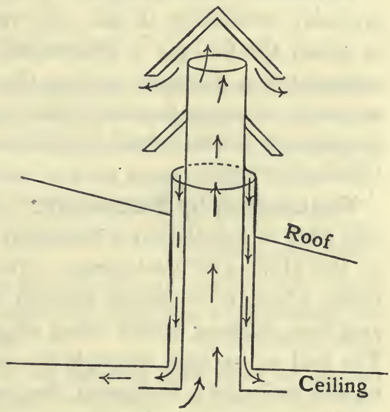


FIG. 55.—M'KINNELL'S VENTILATOR.

The door cannot be relied upon for ventilation, because, as a rule, there is not sufficient difference in temperature in the air on both sides of it for any exchange to take place.

The Size of Ventilation Openings. For proper ventilation of an inhabited room it is necessary to allow 24 square inches of inlet, and the same of outlet, or 48 square inches per head. The size of each opening must be regulated, in part, by the size of the room, but no single inlet should have an area greater than 60 square inches, nor an outlet greater than 144 square inches.

Artificial Ventilation. There are two systems of artificial ventilation in use: (*a*) **ventilation by extraction,** in which the foul air is drawn out of the building by the action of fires, furnaces, or fans, the fresh air being allowed to enter through various inlets; and (*b*) **ventilation by propulsion,** in which fresh air is driven into the building by mechanical contrivances such as bellows, pumps, or fans.

Ventilation by Extraction. An excellent example of this kind of ventilation is furnished by the system employed in the Houses of Parliament. Fresh air enters the basement, where it is filtered through screens of damp canvas and then warmed, before being allowed to enter the rooms. The foul air escapes through the ceilings, being drawn out by the action of a furnace at the base of the clock-tower.

Mines and steamships are commonly ventilated much in the same way, furnaces being used to extract the foul air.

When machinery is used for the purpose of extraction, a fan, shaped like a paddle-wheel and enclosed in a chamber, is placed in the roof and made to revolve by a gas-engine. By means of the revolutions of the fan the vitiated air is drawn out of the building.

In Ventilation by Propulsion fans are used to force air into the basement of the building and thence along ducts or channels into the various rooms.

This method, though less popular than the extraction methods, has the advantage of controlling the air which is supplied, so that it may be cooled, warmed, or filtered according to the requirements of the case. In the extraction methods the air may possibly be drawn from objectionable sources, and unless special precautions are taken there is no possibility of purifying it. For large buildings such as factories and workshops, where there is generally machinery, artificial ventilation is certainly cheaper and more efficient than natural ventilation.

Questions.

1. Show the importance of proper light and ventilation in schools. What is needed in a schoolroom in order to secure these conditions, and how would you, as a mistress, obtain ventilation without draught? (*Scholarship*, 1889.)

2. Describe the best ways you know of keeping the air in a schoolroom pure and wholesome: and say what evils result from negligence in this respect. (*Scholarship*, 1890.)

3. How would you provide for a regular and uninterrupted supply of fresh-air in an ordinary bedroom? Why does a lofty ceiling not always ensure due ventilation? (*Scholarship*, 1896.)

4. Give a brief account of the principle underlying the several contrivances aiming at successful ventilation. (*Scholarship*, 1898.)

5. What is meant by natural ventilation? Explain the terms "exhaust" and "intake." Describe the action of Tobin's tubes, and mention some cases for which they are unsuitable. (1*st Year Certificate*, 1895.)

6. Why is it needful that bedrooms should be ventilated, and how may this object best be effected? (1*st Year Certificate*, 1887.)

7. If children are taught in ill-ventilated rooms, why should any harm result to them? By what methods and appliances may good ventilation be best secured in a schoolroom. (2*nd Year Certificate*, 1886.)

CHAPTER XIV.

THE DWELLING: RULES FOR CLEANING. THE REMOVAL OF HOUSE REFUSE.

The Necessity of Cleanliness.—Cleanliness implies the speedy and complete removal from the dwelling of all kinds of dirt and refuse.

The waste matters produced in a dwelling include: (*a*) The water that has been used for washing, cooking, and cleaning, collectively termed **slop-water**; (*b*) **kitchen refuse,** including ashes, empty tins and bottles, egg-shells, potato-parings, etc.; (*c*) **dust**; and (*d*) the solid and liquid **excreta** of the inmates.

Where waste matters are retained within or near houses for any length of time, the health of the inhabitants is endangered. Refuse of an organic nature speedily decomposes, and gives off into the air noxious gases; moreover, foul liquids from rotting heaps of refuse percolate into the soil under the houses, rendering the ground foul and unhealthy, or into neighbouring wells, making the water unfit to drink. Thus air, soil, and water are contaminated, and the inhabitants surrounded by dangers to health on all sides. It is not surprising to find that epidemics rage most furiously, and a high death-rate prevails in towns where the refuse is allowed to remain in heaps about the premises, instead of being removed as soon as produced.

The Removal of Dirty Water. Slop-water is usually poured down the kitchen sink, and is in this way removed from the house without delay. It is, however, possible for the sink itself to be a source of contamination of the air of the house, owing to faulty construction and insanitary connection with the house-drain.

It used to be the custom to carry the waste-pipe from the sink directly into the house-drain (see Fig. 56). The consequence was that foul gases were drawn, by the heat of the kitchen, up the waste-pipe into the house, making the air both offensive and dangerous to health.

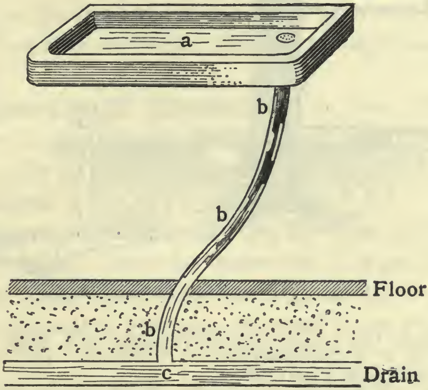


FIG. 56.—AN INSANITARY FORM OF SINK.

A Sanitary Sink should be constructed as follows: It should, preferably, be made of non-absorbent material such as glazed stoneware which can be easily kept clean. It should be fixed against an outside wall, so that the waste-pipe may pass through the wall into the open air. The waste-pipe should be provided with a syphon trap, having an inspection opening fitted with a screw-cap, so that it may be cleaned out when necessary. The waste-pipe should end in the open air over a grating, beneath which is a gully-trap (see Fig. 57) leading to the drain (see Fig. 58).

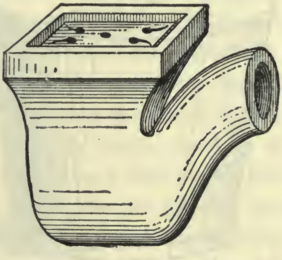


FIG. 57.—A SYPHON GULLY.

By these precautions sewer-gas is prevented from entering the house, for even if it rises from the drain and forces its

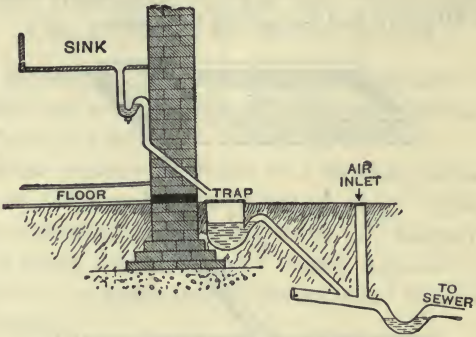


FIG. 58.—A SANITARY KITCHEN SINK.

way through the gully trap it escapes, not into the waste-pipe, but into the open air.

Kitchen refuse should be got rid of in various ways, according to its character. Vegetable matter should be dried and then burnt; bones may be buried or sold; and refuse of a mineral nature may be put into the dust-bin. On no account should animal or vegetable matters be put into the dust-bin, because as they decay foul odours will be produced. Neither should liquids be thrown into the dust-bin, for moisture hastens the process of decay.

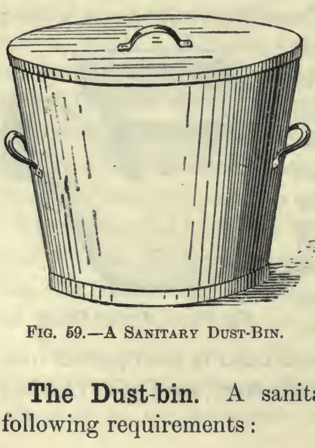


FIG. 59.—A SANITARY DUST-BIN.

The Dust-bin. A sanitary dust-bin should fulfil the following requirements:

(1) It must be placed at least six feet from the house.

(2) It must be small, of some non-absorbent material, such as galvanised iron, and be provided with a well-fitting lid to keep out the rain and to keep in any bad gases.

(3) It must be emptied not less often than once a week.

Fixed dust-bins of large size are dangerous to the community.

The Removal of Excreta. The two systems in general use for the removal of the excreta from the dwelling are (1) The dry or conservancy methods, and (2) the water-carriage system.

The Conservancy Methods. In all these methods the excreta is retained about the house for a longer or shorter period. In many places the excretal matter is collected into heaps and mixed with the dust and ashes produced in the house; this constitutes a **midden-heap**; or it may pass into pits dug in the earth, known as **cesspools.** In porous soils the cesspool is permanently covered and never requires to be emptied, the excreta percolating into the soil all round. Needless to say such methods are dangerous in the extreme; and are only in vogue where the public health is not considered. An improvement on the cesspool and midden-heap is found in the various **Tub and Pail Methods.** In these a small tub or pail is placed beneath the seat of the closet; the floor and sides of the space occupied by the pail are lined with impervious material; and the pail is emptied once a week. In order to prevent foul smells the plan of adding some absorbent material to the excreta has been adopted in many places, ashes and dried earth being most commonly used for this purpose. In what are known as **earth closets**, about 1½ lbs. of dry earth are thrown upon the excreta, automatically from a hopper every time the closet is used. For this plan to be successful in deodorising the contents of the pail, the earth must be absolutely dry; it should be loamy soil, vegetable mould or dry clay—sand and chalk are useless; and care must be taken to keep the hopper well supplied with earth.

Disadvantages of the Dry Methods. The great defect of the conservancy system lies in the fact that the waste matters are retained about the house to the contamination of air, soil, and water. The excreta is only valuable as manure when it is left unmixed with earth, the compost resulting from the addition of dry earth being little more than a rich mould. Extra provision has to be made for the removal of slop water, which must on no account be added to the excretal matter.

The earth closet is the only one of the conservancy methods which can, with safety, be adopted, and this should be used where the water-carriage system is not practicable, as in camps, for instance.

2. **The Water-carriage Method.** In this system the excreta is removed as soon as produced, by the aid of water.

The necessary fittings include (*a*) the water closet with cistern, (*b*) the soil-pipe, (*c*) the house-drain.

Water-closets. The best forms of water-closets are the short hopper, the wash-out, and the valve.

The **short hopper** (see Fig. 60) has a nearly vertical back and sloping sides, a shape which is easily kept clean. The basin is continued into an earthenware syphon. Its advantages are that it is simple in construction, does not easily get out of order, there are no metals to corrode and cause leakage, it has an excellent water-seal provided by the syphon-trap, and the basin is provided with a flushing rim from which the water flows in such a manner as to keep the basin clean.

The Wash-out Closet (see Fig. 61) is not unlike the short-hopper, but it has a bend in the basin which is capable of holding water. Its advantages are similar to those of the short-hopper, but it has an additional water-seal provided by the shape of the basin.

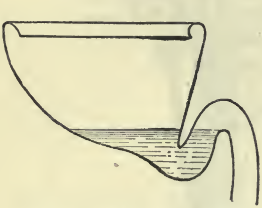


FIG. 60.—THE SHORT HOPPER WATER-CLOSET.

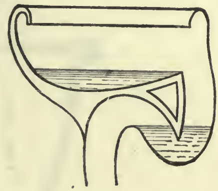


FIG. 61.—THE WASH-OUT WATER-CLOSET.

The Valve Water-closet, though a good form of closet, is more complicated than the foregoing, and is not so generally used.

The Pan Water-closet is found in old-fashioned houses, and is invariably associated with a foul condition of the atmosphere. As shown in Fig. 62, it consists of a conical basin, below which is a metal pan holding a little water. The edge of the basin dips into the pan, which is moved at will by a handle or chain, and precipitates its contents into the large iron container beneath. By means of the short pipe leading from the container, it is connected with a leaden "D" trap which communicates with the soil-pipe.

The disadvantages of this form of closet are many. It is so complicated that one part or another is continually getting out of order; there is always a collection of foul water in the "D" trap; foul air collects in the container and rises into the house whenever the closet is used; the container gets very dirty from splashings on its sides; the basin is difficult to keep clean owing to its shape; the water in the "D" trap is apt to fall below the bottom of the short pipe, and there is then nothing to prevent foul gas being drawn into the house from the soil-pipe.

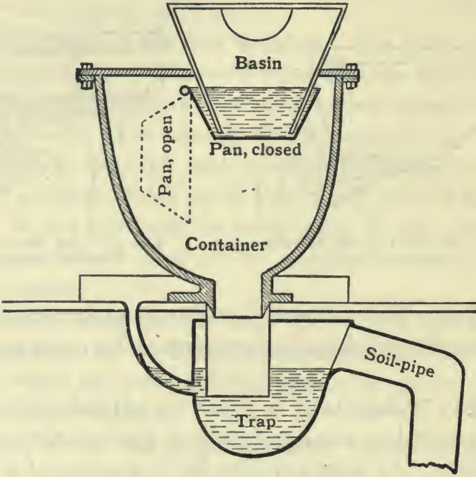


FIG. 62.—THE PAN WATER-CLOSET.

The model bye-laws of the Local Government Board prohibit the fixing of the pan water-closet in any new closet, so that before long it will, fortunately, become a rarity.

Water-closets should be supplied with water from a special cistern; on no account should the water be drawn directly from the main water-pipe or from the drinking-water cistern, or there is danger of foul gases contaminating the water supply.

The Soil-Pipe, which receives the discharge from the water-closet, should be a drawn lead pipe 4 inches in diameter. It should be carried down **outside** the house, and to facilitate this, water-closets should be fixed against an outer wall. The pipe should be continued upwards, as shown in Fig. 63, to form a ventilating shaft, which ends

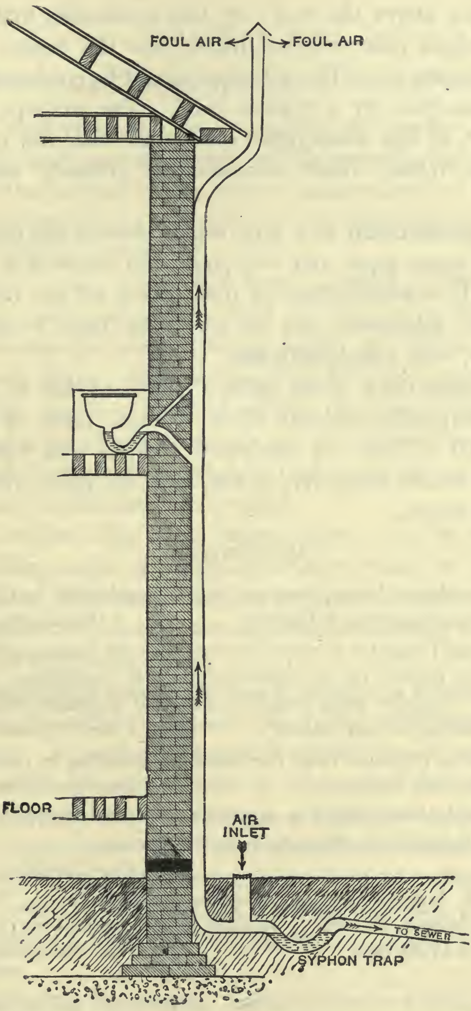


FIG. 63.—THE SOIL-PIPE AND ITS CONNECTION WITH THE HOUSE-DRAIN.

wide open above the roof; by this precaution foul gases, which might otherwise be drawn into the house, escape into the open air. The soil-pipe should be connected with the house-drain by a syphon bend. The soil-pipe is the only one of the waste pipes connected with the disposal of house refuse which communicates directly with the drain.

The House-Drain is a pipe which receives the discharge from all waste-pipes and soil-pipes and conveys it to the sewer. It is made either of iron, glazed on the inside, or of glazed stoneware, and is not more than 6 inches in diameter, with 4-inch branches.

The house drain must have a sufficient fall to ensure speedy emptying into the sewer. Joints must be water-tight, and it must be efficiently trapped and ventilated where it enters the sewer, as well as at the point where the soil-pipe enters.

QUESTIONS.

1. In building a house, what would you consider the best arrangement for waste-pipes and drains? (*Scholarship*, 1900.)

2. It is said that for a sound system of house drainage attention is specially needed to (*a*) disconnection, (*b*) ventilation, and (*c*) trapping. Explain, using simple diagrams if necessary, the nature and importance of these points. (*2nd Year Certificate*, 1886.)

3. Give the principal rules for keeping a dwelling in cleanliness, healthiness, and comfort. (*1st Year Certificate*, 1889.)

4. What is "draining" as applied to a house? Explain what is meant by defective draining, and show its danger. (*1st Year Certificate*, 1890.)

5. What dangers can you mention arising from (1) dustbins, (2) water-cisterns, (3) sinks? Explain the precautions which should be taken to avoid them. (*1st Year Certificate*, 1892.)

CHAPTER XV.

HOUSEHOLD MANAGEMENT: THE DUTIES OF SERVANTS.

The comfort of the home depends so largely upon the efficiency and general conduct of the servants belonging to it that the subject of the proper management of servants must be regarded as important to all those who are called upon to direct a household.

Of late years there has been increasing difficulty in securing good servants, owing to the unpopularity of domestic service among young people who have to earn their own living. The reasons given for such unpopularity are many: the long hours of service, the scanty liberty, the exacting ways of mistresses are all put forward on the one side; while mistresses complain that servants are careless, ignorant, unreasonable, and selfish.

It is evident that if an improvement is to be made on the existing state of things concessions must be made on both sides. Mistresses must be prepared to grant a reasonable amount of liberty, servants must in return study the wishes of their mistresses.

In engaging Servants much friction is avoided if the mistress is careful to explain the duties pertaining to the situation. A personal interview should in all cases take place before an engagement is made, and care must be taken by the mistress to secure a reliable "character" from the last employer. Mistresses should understand that in giving a servant a character nothing should be stated which is not perfectly true, nor is it straightforward or fair to employers to withhold information of grave defects of character.

Dismissing Servants. Servants are, as a rule, engaged for an indefinite period to be terminated by one month's notice on either side, or by the employer on paying one month's wages in lieu of notice. A servant can be dismissed without either notice or wages for gross faults such as insobriety, dishonesty, disobedience or impropriety of conduct, though it is possible that an action for damages would follow such a proceeding. A servant, on the other hand, may leave without notice if insufficiently fed or improperly treated.

System in Domestic Management. The wheels of the household move much more easily if the mistress draws up a time-table, in writing, for the work of each servant. There is no possibility of confusion of work, each servant knows her own work, and when she is expected to do it. The mistress is able to keep a check on the work without much difficulty.

It is advisable, too, that each servant should be furnished with a list of the properties placed in her charge; more especially should this be done with glass and china, which is too frequently broken without the mistress's knowledge of the occurrence; and from time to time the list should be checked by the mistress in the presence of the servant.

The Characteristics of a Good Servant. A good servant is distinguished by (*a*) capability, (*b*) cleanliness, (*c*) neatness of appearance, (*d*) good temper, (*e*) willingness to oblige, (*f*) obedience, (*g*) punctuality and quickness, (*h*) straightforwardness of character, (*i*) trustworthiness.

The Number of Servants employed varies very considerably with the size and character of the establishment, from the maid-of-all-work of humble households to the thirty or forty indoor servants employed in many large houses. Notwithstanding this difference in the size of establishments the duties of each kind of servant are unvarying. A cook, for instance, always attends to the cooking, a house-maid to housework, a nurse to the children, and so on.

It is not necessary, here, to concern ourselves with the duties of men servants such as house stewards, butlers, footmen and pages, who are only employed in large establishments; but every housekeeper who expects to have servants under her should know the respective duties of the cook, housemaid, parlourmaid, and nursemaid.

The Duties of a Cook. The cook holds a most responsible and important position, for not only is she capable of contributing in no small degree to the comfort and health of the members of the household, but she is, to a large extent, able to regulate the expenditure. A careful, conscientious, and capable cook will turn to account scraps and remnants of food which an extravagant or heedless cook will throw away. A good cook is further characterised by cleanliness, method, and punctuality. A dirty cook is intolerable; a disorderly cook is sure to be dirty, and wasteful too; an unpunctual cook is the cause of much worry, annoyance, and waste of time. In small households, where only two or three servants are kept, the cook generally undertakes some of the housework. She is, as a rule, made responsible for the cleaning of the front steps, halls and passages, and dining-room or breakfast-room; and where there is no kitchen-maid she cleans the kitchen, scullery, pantries, larders, etc., as well as the kitchen utensils and kitchen crockery. The cook is, of course, responsible for the kitchen grate, and the condition of the flues and ovens. She answers tradesmen's bells, cleans the knives, and frequently the boots, too. The cook must see that the cistern is kept clean, and that the kitchen sink is in good condition. Cabbage-water should not be poured down the sink inside the house, or a disagreeable smell pervades the house.

A cook should be an early riser, for upon her devolves the duty of lighting the kitchen fire, getting hot water, and generally setting the wheels of the household in motion. A slothful cook is the cause of much unnecessary hurry and bustle with all their attendant discomforts and extravagances. Much time is saved in the morning if the kitchen is made tidy, dirty crockery washed, coals brought up, and as much preparation for breakfast made as is possible overnight. An economical cook will keep the stock-pot constantly in use, for almost every meal will contribute something to that useful article. It should rarely be necessary to buy meat for soup, unless the best clear soup is required, though bones may be bought with advantage to add to the stock produced in the kitchen. All fat obtained by cooking processes should be clarified and used instead of lard, thus saving the expense of buying lard. Scraps of bread should not be allowed to accumulate, but should be baked and stored as bread crumbs. A careful cook, however, will see that many odd pieces of bread are not produced.

In short, a good cook will study her mistress's interests as though they were her own, and will endeavour by skilfulness and care to keep expenses down as low as possible.

The Housemaid. Where only two servants are kept, the housemaid undertakes the responsibility of all the rooms except those cleaned by the cook. She is also expected to take charge of the glass, silver, and fine china, and may be required to wait at table. The housemaid answers all bells except tradesmen's bells; in many houses the cook answers all outside bells before luncheon. If her time is not fully occupied by the above duties, she is required to do some of the mending and sewing.

Strictly speaking, the duties of a housemaid consist in putting the rooms in order every day, doing what sweeping and dusting is necessary for that purpose, and thoroughly cleaning them once a week.

First thing in the morning she attends to the cleaning of the breakfast-room, lights fires, carries hot water to the bedrooms, sets the breakfast-table, and serves breakfast.

This done, she proceeds to the bedrooms while the family is at breakfast, opens the windows if this has not been done, strips the beds, removes the slops, washes the crockery, and fills the ewers. After clearing the breakfast-table she goes back to the bedrooms, makes the beds, and puts the rooms in order. She is then at liberty to attend to the special work of the day. If a housemaid is to act as parlour-maid too, she must be dressed before luncheon. Her duties for the rest of the day consist of setting tables, washing glass and china, and cleaning silver. At sundown she goes to each room, closes the windows, draws down the blinds, lights the lamps or gas, and in bedrooms turns down the bedclothes, puts nightdresses ready, and attends to the wash-stand, taking particular care that the drinking water is fresh. In many houses she is required to take hot water to the bedrooms half an hour before dinner.

The Parlour-maid. A good parlour-maid should be tall, of good appearance, and have pleasant and quiet manners. She must be neat in her person, wearing a pretty print dress with white collar, cuffs, and apron in the morning, and a black dress with smart cap and apron, collar, and cuffs in the afternoon.

The special duties of a parlour-maid consist in setting the table for meals, clearing the table, waiting at table, keeping glass, china, and silver in good condition, answering bells, etc. In some houses she attends to the lamps, lights up the hall and landings, and attends to the fires in the sitting-rooms. She also, as a rule, is responsible for one of the sitting-rooms, usually the drawing-room, which she dusts and puts in order each day and thoroughly cleans once a week.

How to Wait at Table. The parlour-maid does not, as a rule, wait at breakfast or luncheon, but she must be ready to answer bells. At dinner she is invariably expected to wait. The details of waiting vary greatly, the one universal rule being that the parlour-maid should know the order of the dinner, so that she may be prepared for the various courses and have everything necessary to hand. She must move about quietly and quickly, giving her whole mind to the business in hand; she must on no account appear to be listening to the conversation at table.

Having placed the first dish before the carver, she will go to his left hand and remove the cover. Soup is usually served first, the waitress carrying a plateful to each person, handing it with the left hand on the left-hand side, and beginning with the lady to the right of the carver. When all have been served, the waitress stands by the sideboard ready to fetch anything that is wanted. As each person finishes, she advances to ask if more is required; if it is, she carries the plate to the carver; if not, the plate is removed to the sideboard.

As each course is finished the dirty plates, knives and forks, etc., are removed quietly, and the next course brought in. Fish and joints are put on the table before the carver; sweets are placed before the mistress; entrées are not put on the table, but are handed round; vegetables served with meat are carried round by the waitress at the same time as the meat.

After cheese has been handed round, the crumbs are taken off the cloth, and dessert plates, knives and forks, and finger-bowls set before each person. Dessert is usually put on the table when the cloth is laid, and helps to decorate the table. The waitress does not remain in the room while dessert is eaten.

Wine is handed round as soon as the course has been served, the maid pouring it into the glass for each person as desired.

To Wash Glass. Glass should be washed in warm water (**not hot**, or the glass may crack), allowed to drain, and then dried quickly with a soft, dry cloth. Rinsing in cold water is sometimes practised to get a good polish. Decanters are often difficult to get clean. Stains may be removed with crushed egg-shells, salt and warm water, or chips of raw potato or fine coal dust have been found to answer. When free from stains, wash the decanter in warm soapy water, rinse thoroughly in cold water, polish the outside, and turn the decanter upside down to drain into a jug, or put it in a bottle-rack to drain.

To Wash China. Have a plentiful supply of warm water, a soft dishcloth, and a small brush. Empty all dregs from cups and saucers, wash them well in the water, using dishcloth and brush where necessary; drain for a few minutes, and dry with a soft cloth.

To Clean Silver. Silver should be washed in hot water with soap and flannel, dried with a soft cloth, and polished with a leather every day. Once a week it should be cleaned with plate-powder or precipitated whiting. Make a paste of the powder with methylated spirits, rub it on with a flannel, when dry rub it off with the plate brush, and polish with a soft leather. Care must be taken not to leave the powder in crevices.

The Nursemaid. The utmost care should be exercised in selecting a children's nurse. It is not enough that she be capable; she must also be patient, cheerful, good-tempered, and really fond of children, otherwise she is not a suitable person to take charge of them. More important than all other points, however, is it that she be a person of good character, recognising the value of truthfulness and integrity. It is in the early years of a child's life that his character is formed, and if, at the most impressionable age, he is in daily companionship with a person of low character he can scarcely fail to be influenced for evil.

A nurse should be free from any marked peculiarity of appearance or speech, for children are unconscious mimics, and acquire bad habits more easily than they drop them. The practice now coming into vogue of engaging lady-nurses cannot be too strongly recommended; it opens up a new field of enterprise for educated girls, and at the same time gives to the children a companion of cultivated tastes and habits in place of the too often rough-spoken and illiterate nursemaid.

The special duties of a nurse include the washing and dressing of the children; the care of their clothing, with such making of under garments as may be desired; the arrangement and supervision of nursery meals, and the cleaning of the nurseries. Where there are upper and under nurses, the under-nurse does the rougher work of cleaning; the upper-nurse takes entire charge of the baby.

In all nurseries, however, the will of the mother must be supreme, and a good mother is careful to exercise constant supervision over the nurses.

In most nurseries the nurse is expected to wash some portion of the baby's clothing. This must be done while the baby is sleeping. Ironing and mending should be done in the evening when the children are in bed.

The Kitchen-maid is an assistant to the cook, and does the rougher work of the kitchen, scouring saucepans and other cooking utensils, washing dishes, scrubbing pantries, etc. She also prepares vegetables, and in large households where a scullery-maid is kept for rough work, she makes bread, prepares sauces, and does the cooking of servants' meals.

The General Servant. Although the position of general servant is regarded by some as one of drudgery, it affords a valuable training in domestic work of all kinds. Where only one servant is kept, the "general" is expected to do everything the mistress herself does not do. As a rule, the mistress undertakes most of the cooking, and opportunities are afforded to the servant to learn plain cooking. The experience a girl gains in a situation of this kind is useful to her, not only in taking higher situations, but in managing a home of her own, should she marry. A good general servant is frequently treated with the utmost consideration by the members of the family, and has many little privileges which are not extended to servants where more than one is kept. She has, moreover, no one to interfere with her but the mistress, and has not to put up with the ill tempers of other servants.

A general servant must take especial pains to keep herself neat; she is constantly coming in contact with her employers, and has, too, to answer the door-bell. She should be well supplied with large coarse aprons to put on over the white apron when doing rough work; and when she is called to answer bells the coarse apron should be quickly slipped off.

Method and order are above all things necessary to a general servant. She must rise early in the morning to get the kitchen fire lit, the kitchen swept, the breakfast-room put in order, the breakfast-table laid, and the front steps cleaned before the members of the household come down. While the family is at breakfast she will go to the bedrooms, remove the slops, wash the crockery, and open the beds to air; the windows should have been opened by the occupants of the rooms. Her next task will be to clear away the breakfast things and wash them up, after which she will return to the bedrooms, make the beds, and put the rooms in order. She will then be at liberty to attend to the special cleaning for the day. The following plan has been found to work well in a small household :

Monday—Help with the washing.

Tuesday—Clean drawing-room and servant's bed-room.

Wednesday—Clean other bedrooms.

Thursday—Clean dining-room.

Friday—Clean kitchen, scullery, and pantries.

Saturday—Clean hall and staircase and outside premises.

Ironing will be done on Tuesday afternoon or evening. All linen washed at home should be put away by Wednesday evening.

The general servant should take pains to make herself neat to carry in the mid-day meal. When this is over it must be cleared away, the plates and dishes washed up, and the kitchen and scullery put in order. The maid will then change her dress for a black one, with collar, cuffs, and apron similar to those worn by a housemaid. She will then be ready to serve tea. Her evenings may be spent in sewing, cleaning silver, or attending to any light work for which time has not been found during the day. She will probably be allowed to take walks in the evenings to keep her health in order.

QUESTIONS.

1. What qualities constitute the character of a good maid-servant? How may such qualities be best encouraged during school-life?
(*2nd Year Certificate*, 1889.)

2. Give an account of the ordinary duties of a housemaid in a family where three servants are kept. (*2nd Year Certificate*, 1890.)

3. What are the duties of a kitchen-maid in a gentleman's house?
(*2nd Year Certificate*, 1895.)

4. Make out a weekly plan for the special work of a general servant in a small household, apart from her ordinary *daily* duties.
(*2nd Year Certificate*, 1896.)

CHAPTER XVI.

DOMESTIC CLEANING.

THE work connected with keeping a house clean may be divided as follows: (*a*) the work which must be done every day; (*b*) work which is done once a week; (*c*) work which is done at longer periods, *e.g.* the "spring cleaning."

The Daily Routine. The first duty of the day is almost invariably to light the kitchen fire. Simple as this may seem there are many persons who do not succeed in making the fire burn until after repeated attempts involving much loss of time and temper.

To Light a Fire. First clean the grate, not forgetting to sweep down any soot which is visible. Then lay a few cinders at the bottom of the grate, and upon these some pieces of paper loosely crumpled, and a few pieces of dry wood; the paper must not be rolled into tight balls, and the wood should be so placed as to leave spaces between the pieces. Next put on small pieces of coal, still remembering to leave spaces in which the air may circulate, for free circulation of air is the secret of successful fire-lighting. Finally apply a lighted match to the paper at the bottom of the grate, and if the air is able to pass into the grate the fire should burn up quickly.

To Put a Room in Order. The sitting-rooms of the house need to be made tidy each day in addition to the weekly cleaning they receive. Such 'tidying' includes cleaning the fireplace, lightly sweeping the carpet, putting things in their places, and dusting the furniture and ornaments.

To Clean a Fireplace. Care must be taken in cleaning out the grate not to scatter dust and ashes over the room. Roll the hearthrug back or take it up altogether, spread a piece of paper over the carpet thus exposed, and then proceed to rake out cinders and ashes.

Carry these outside and sift the former from the latter.

Dust the iron-work of the grate and then black-lead it, having first mixed the black-lead with water or turpentine. Put the black-lead on thinly, and brush with energy until a high polish is obtained.

To Clean Steel, fine emery-paper may be used, or a mixture of fine bath-brick dust and methylated spirits may be rubbed on with a soft flannel, and the steel polished with a leather.

How to Dust. Good dusting takes time. Hold the duster loosely crumpled in the hand, not tightly rolled up, nor with flapping corners which will waft the dust from one article to another. Dust each piece of furniture thoroughly, not omitting ledges and mouldings, nor the legs of tables and chairs. Ornaments must be handled carefully to avoid breakages. Remember to shake the duster in the open air at frequent intervals. For carved furniture a brush should be used to remove the dust from crevices.

In tidying a room do not omit to put pictures straight, window curtains and blinds in order, and books in their places, right side up, such details make or mar the appearance of the room.

To Clean Stone Steps. If a house is to look cared-for the door-steps must receive daily attention. First sweep the steps, then wash them clean and rub over from side to side with hearthstone or pipe-clay, wiping it smooth with the floor-cloth. Avoid smearing the wood-work or door-posts. Milk-stains on the door-step may be removed by covering with a paste of fullers' earth and water, which is not washed off for 24 hours.

To Clean Brass. Bells and knockers are frequently made of brass, and may be cleaned with whitening, monkeysoap, sapolio, or any of the brass-polishes sold. A soft flannel is used to rub on the paste, and a leather for polishing. **Tinware** is cleaned in the same way.

Bedrooms are attended to in most houses immediately after breakfast. The slops are removed as previously described, the beds made, and the rooms put in order according to the directions given above.

To make a Bed. The bed should be stripped and the mattress exposed to the air from the open windows for some time before it is made. The person who makes the bed must have clean hands and wear a clean, white apron to avoid soiling the bedclothes. A feather bed should be turned, well shaken, and smoothed out again; a wool or hair mattress should be turned daily. The under-blanket covers the mattress, and is tucked in all round. The bolster is placed at the head of the bed and covered with the under-sheet, unless a bolster case is used. The under-sheet is smoothed out and tucked in, and the pillows arranged at the head, after having been well shaken. The upper-sheet is next put on, care being taken to leave enough at the top to turn down over the blankets. Blankets are arranged over the sheet, and are well tucked in at the foot and sides. The quilt covers all, and should be large enough to hang over each side and at the foot so as to hide the blankets; the quilt is not tucked in, and is best removed at night when the bed is occupied, for, as a rule, quilts are heavy without being warm.

To Wash Dishes. The most important thing in washing dishes is to have plenty of hot water. It is a good plan to have a bowl of hot water and another of cold side by side. Wash the dishes one by one in the hot water, using a clean dish-cloth for the purpose, then dip each one as finished into the cold water and set it to drain. Dry afterwards with a clean cloth, and you will be surprised to find how your dishes shine. If plates are very greasy, a little soap or soda may be used, and extra care taken in rinsing.

Fine china needs very careful handling or it may be chipped. Our grandmothers used to have a wooden bowl of water brought to the table, in which they washed their egg-shell china with their own hands.

Knives should never be put into water, or the handles will be loosened. In drying, keep the back of the knife against the cloth, or cuts will be made.

To Wash Saucepans, use plenty of hot water and soda, and wash them outside as well as inside, using dish-cloth and saucepan-brush when necessary.

If anything has been burnt to the sides or bottom of the pan, fill it with water and soda, and let it boil itself clean. Be careful to dry the pans well before putting them away, or they will rust.

To Clean Knives. Knives should be cleaned each time they are used, they are then little trouble. Use fine bath-brick or knife-polish; put a little of the powder on the board and rub the knives vigorously from side to side, keeping the blade as level as possible to avoid wearing the knives at the point. A final polish may be given with a leather, and all powder removed with a clean duster.

The Weekly Routine consists chiefly of cleaning thoroughly each part of the house in turn, taking the various rooms on successive days, as described in the previous chapter.

To Clean a Room. In cleaning out a room remember to shut the door so as to prevent the dust rising to other parts of the house. A little forethought saves a great deal of labour. Open wide the window, pin up long curtains, take off table-cloths and any movable drapery, and take them outside to be shaken. Remove ornaments, photograph frames, etc., from the mantelpiece or other place of rest, dust them carefully, stand them on the table, and cover with a dust-sheet.

Take small pieces of furniture out of the room, and gather the rest as far as possible into the middle of the room.

Having removed the cinders and ashes from the grate, sweep the walls down, using a long broom over which is pinned a clean duster.

Dough mixed with a little paraffin is useful to remove stains from wall-paper.

Sprinkle damp tea-leaves over the carpet to prevent the dust rising, and sweep towards the fireplace; do not use the brush too heavily, or the nap of the carpet will be removed. When the room has been swept round the sides put the furniture into place, and sweep the middle of the floor.

Clean the fireplace, then the window, and when the dust has settled, dust mirrors, pictures, ornaments, and put the room in order again.

To Polish Furniture. To keep furniture in good condition it must be well polished from time to time.

A good Furniture Polish is made by mixing equal parts of vinegar and linseed oil, and adding a little turpentine, or bees'-wax and turpentine may be used instead; but whatever the polish, good vigorous rubbing is necessary to produce satisfactory results. An old silk hankerchief may be used for the final polish.

To mix Bees'-wax and Turpentine. Finely shred one ounce of bees'-wax, put it in a jar, and slowly melt it either in the oven or on the top of the stove.

Add an ounce of turpentine, stir well, and heat again on the top of the stove, not in the oven, until the two ingredients are mixed together. This is a good polish for stained floors, oil-cloth, and linoleum.

To Clean a Window. Dust the frame and ledges, and then wash the glass with a wet leather, taking care to go well into the corners of the panes. Squeeze the leather and dry the panes with it; give a final polish with a soft duster free from fluff. A sponge or soft cloth may be used instead of a wet leather for washing the glass.

To Wash Paint. Use soft warm water in which a little soap has been dissolved, and a soft flannel. Wash the paint quickly, using only as much water as is necessary, or you will have dirty streaks of water running down to the floor. Dry with a clean cloth. Avoid the use of soda, and do not use a brush unless the dirt cannot be removed without it, for soda and brush will remove the paint as well as the dirt.

To Scrub a Floor. First sweep the dirt towards the hearth or the door. Then get a pail of warm water, a little soft soap, a floor-cloth and a piece of mottled soap, a scrubbing brush, and a mat to kneel upon.

Wet only as much of the floor as you can conveniently reach, then soap the brush and rub the boards briskly in the direction of the grain, backwards and forwards, until they are clean.

Wipe up the dirty soapy water with the floor-flannel, and dry the boards as much as possible. Change the water frequently, or you cannot make the boards white. Dry the floor as quickly as possible by opening windows and doors, and letting currents of air pass through.

To Clean Marble. Mantelpieces or tables of marble may be efficiently cleaned with Sapolio or Monkey-brand soap, or a mixture of 1 oz. powdered chalk, 1 oz. powdered pumice-stone, and 2 ozs. soda, made into a paste with water. Rub the paste over the marble, and wash off with soap and water.

To Remove Grease Spots from Carpets. Scrape off as much grease as possible with the handle of a spoon; place a piece of clean folded blotting-paper over the spot and press it repeatedly with the point of a hot iron, using a fresh place in the blotting-paper each time until the spot is removed.

To Remove Ink-stains from Carpets. Soak up the ink as quickly as possible with blotting-paper; then pour milk on the stain, and rub with a clean cloth until the stain disappears.

Periodical Cleaning. It is the practice in most houses to give a thorough cleaning to every part in the spring and autumn. At such times white-washing, papering, and painting are done, carpets are well beaten, chimneys swept, blankets washed, pictures taken down and washed, cupboards cleaned, etc. If, however, the house is kept as clean as it ought to be, week by week, there will be little periodical cleaning to do.

QUESTIONS.

1. "A dirty house is an unhealthy house." Establish the truth of this saying; and state what should be done at regular intervals so as to keep a house clean. (*Scholarship*, 1895.)

2. How is a sitting-room best dusted? (*Scholarship*, 1896.)

3. How would you clean; (1) paint; (2) a boarded floor; (3) the front door steps? (*Scholarship*, 1897.)

4. In cleaning a sitting-room what order of work would you follow? Give careful directions for cleaning the grate, the door, and the carpet. (*Scholarship*, 1899.)

5. Describe, with reasons, the probable results of living in a house not properly cleaned. What household cleaning should be done (*a*) daily; (*b*) weekly; (*c*) at longer intervals?
(*2nd Year Certificate*, 1894.)

CHAPTER XVII.

WATER.

The Need for Water. We have seen in an earlier chapter that water is an essential part of our diet. It is, however, required not merely for drinking, but for household purposes, such as cooking, cleaning, and washing; and for public purposes such as cleansing the streets, flushing the sewers, supplying baths, etc.

Quantity of Water required. The amount of water used in different places varies very considerably. It is found, however, that a scanty supply of water leads to spread of disease resulting from want of cleanliness, and in most communities a liberal supply of water is provided. About 10 gallons per head per day is considered a sufficient amount for domestic purposes, including baths; another 10 gallons is needed to flush sewers and drains, and about the same quantity for trade purposes, making a total of 30 gallons per head per day. This must not be regarded as a high estimate, for in places where much water is used in manufacturing processes it would not be sufficient. In London the Public Water Companies supply 29½ gallons per head daily; in Edinburgh 40 gallons are supplied, and in Glasgow, 50 gallons.

Sources of Water. Rain-water. The source of all natural water is rain, though it is only occasionally that rain-water, collected direct, can be used for drinking purposes. In country-places where the air is pure, rain-water, collected in clean vessels, may be regarded as a safer supply than most of the water from shallow wells and ponds, though it is too soft to be pleasant to drink; but in towns the rain water becomes so impure in passing through the air and over dirty roofs that it cannot be regarded as a direct source of drinking-water. It is, however, very valuable for washing purposes where the water supplied by the town is hard.

The main sources of large supplies of water are springs, rivers, wells, and lakes.

Springs. When rain falls upon porous soil, such as gravel and limestone, it percolates through it until it is arrested by an impervious stratum such as clay. It then

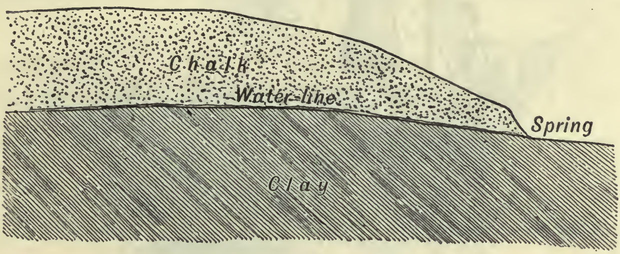


FIG. 64.—DIAGRAM SHOWING HOW A SPRING MAY BE FORMED.

runs along the top of this until the stratum comes to the surface, when the water issues as a spring. (See Fig. 64.)

In its passage through the soil rain absorbs carbonic acid gas which helps it to dissolve a considerable amount of mineral salts, more especially calcium salts, and so, spring waters are, as a rule, hard waters. They are also well aërated, cool, and generally free from serious impurities.

Rivers. The water in rivers is derived partly from springs and partly from water which flows off the surface of the land. Unless it can be obtained at the source, river water cannot be regarded as safe for drinking purposes, owing to the fact that most rivers are polluted by drainage from cultivated land or by sewage from the villages on their banks. River-water is generally softer than spring-water.

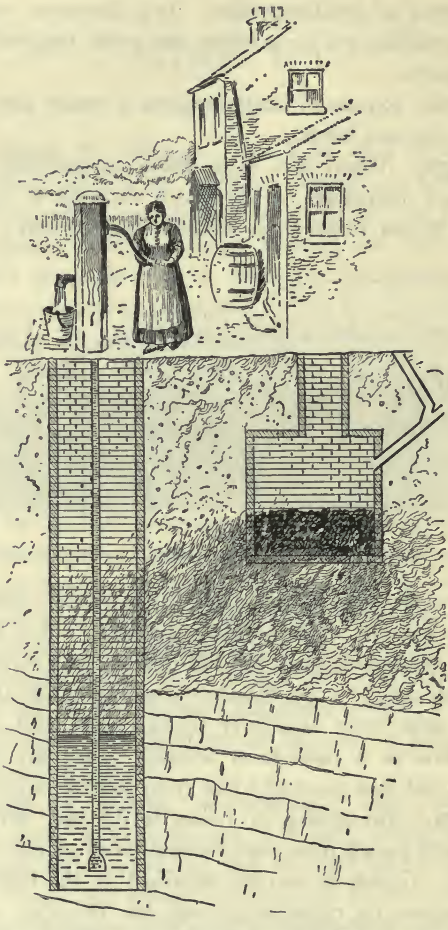


FIG. 65.—SHOWING HOW THE WATER IN A WELL MAY BE CONTAMINATED BY PROXIMITY TO A CESSPOOL.

Wells are of two kinds: shallow wells and deep wells. **Shallow or Surface Wells** are, as a rule, under 50 ft. deep.

They are made by digging down from the surface to catch the "ground-water" or sub-soil water, as it is also called. The water yielded by a shallow well may be good provided there is no danger of pollution from drainage from neighbouring cesspools or foul surface washings. (See Fig. 65.) Generally speaking, however, the water in a shallow well is unsafe for drinking purposes.

Deep Wells draw their water from the water-bearing stratum beneath an impervious stratum. (See Fig. 66.) A

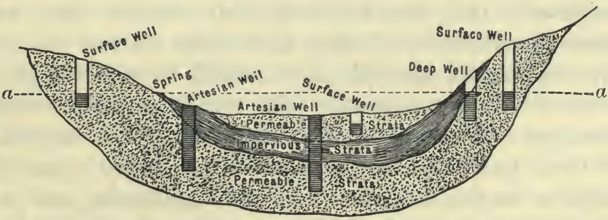


Fig. 66.—Sources of Water Supply.

shallow well is first dug and lined with brick set in cement, so as to exclude the ground water. A boring is then made until a water-bearing stratum is reached. The water in deep wells is, generally speaking, pure and hard, though the quality varies according to the nature of the soil from which it is drawn.

The Water of Lakes is usually very pure, especially when the lakes are fed by mountain streams.

Distribution of Water. There are two ways in which water may be distributed to the houses in a town. One is known as the **constant** system, the other the **intermittent** system.

In the **constant system** the supply pipes are always kept full of water, and the water is only turned off for repairs. In the **intermittent system**, as the name implies, the water is turned on at intervals for a short time during the day.

Of the two, the former is much to be preferred, for water is always at hand in case of fire, no cisterns are required, and the water coming direct from the main is purer and cooler than is found to be the case where storage is necessary. In the intermittent system it is necessary to have cisterns in which to store water for use during the intervals when it is turned off. Cisterns have many objections: they are generally placed in almost inaccessible positions, so that cleaning is a matter of difficulty and is often neglected; they are frequently left without lids, and objectionable matter of many kinds finds its way into the drinking water; they are often near the ventilating shaft of the soil-pipe or connected with the water closet, so that sewer-gas is absorbed by the water. A further drawback to the intermittent system is that the empty pipes are liable to suck in foul gases from the neighbouring soil, and thus pollute the water. Moreover, pipes that are sometimes empty and sometimes full rust and wear out more rapidly than pipes that are always full.

Cisterns. Where cisterns are used the following points should be carried out in their construction:

1. The cisterns should be made from galvanised iron or glazed stone-ware. **Lead** cisterns are objectionable, because soft water dissolves lead; many epidemics of lead poisoning have been traced to this cause. **Stone** cisterns are too heavy to be used anywhere but in the basement of houses. **Slate** cisterns become leaky after a short time. **Iron** rusts very quickly.

2. The cistern must be fixed in a place easily reached, so that it may be frequently cleaned out.

3. It must be provided with a well-fitting lid to keep out noxious gases and other impurities.

4. The cistern must in no way be connected with the water-closet, which must have a separate cistern.

5. The overflow pipe must discharge into the open air.

6. To facilitate the regular cleaning of the cistern it is better to have two small cisterns than one large cistern, so as to avoid the inconvenience due to emptying.

Characteristics of Pure Drinking Water. The water which is supplied to the houses of towns should be pure enough to drink. Such a water is clear and colourless, it is well aërated, fresh to the palate, should contain no suspended particles, and should deposit no sediment if allowed to stand, and in large quantities it is blue in colour.

Impurities of Water.—(1) **Mineral Impurities**. Of these, carbonate of lime is the most common; it does not, however, appear to exercise any injurious effect upon the system. Other mineral salts found in water are the sulphate, nitrate, and choride of calcium and the sulphate and choride of magnesium. The drinking of water containing these salts is liable to produce diarrhœa and dyspepsia. Water containing magnesium salts is thought to be responsible for goitre, the disease so prevalent in parts of Switzerland and in Derbyshire.

(2) **Organic Impurities**. It is the presence of decaying organic matter which is especially dangerous in water. Dysentery, enteric fever, diarrhœa, and cholera are caused by drinking water polluted by organic matter of animal origin, as, for instance, water contaminated by sewage or by the drainage of a graveyard. The water from marshes has been known to cause malarial fever and ague in persons drinking it. The eggs of parasitic worms, such as the tape-worm, the round-worm, the liver-fluke, and the thread-worm, are all found in water, and may enter the digestive tract along with the drinking-water.

Purification of Water. The subject of the purification of water must be considered under two heads:

(*a*) **purification on a large scale**, as practised by water companies, and (*b*) **domestic filtration.**

(*a*) Where the water supply of a town is a river, the water must be subjected to a process of purification before being distributed. This is generally effected by passing it through large filter-beds of sand and gravel. The water is poured upon the surface of the sand, and slowly filters downwards to the bed of gravel beneath, whence it passes into pipes and is conveyed to a pure-water reservoir. The bed of sand is from 2 to 3 feet thick, and the bed of gravel is 1 foot deep; both sand and gravel increase in coarseness towards the bottom of the beds. The action of this method of filtration is three-fold: It is **mechanical**, inasmuch as it arrests suspended matter; it is **chemical**, since the air contained in the interstices of the beds oxidises a large amount of the organic matter in solution; it is **vital** in its power of arresting bacteria. To be successful, filtration through beds of sand and gravel must be downward and intermittent; the beds of sand must be not less than 1 foot deep, and the water must pass through at the rate of not more than 4 inches per hour. Upward filtration does not answer, for the water, rising in one mass instead of in divided streams, displaces the air contained in the filtering material, and little or no oxidising action takes place. Intermittent filtration is necessary to allow all the beds time to become filled with air again during the periods of inaction.

(*b*) **Domestic Filtration.** Water may be purified in small quantities for domestic use by boiling or by filtration.

Boiling is very effectual in killing the dangerous germs which cause the water-borne diseases, and for this reason alone this method of purification should be resorted to when the water is suspected of impurity. Boiling also softens water by driving off the carbonic acid gas, thereby precipitating the lime salts held in solution. It is the deposit of lime salts which constitutes the crust or "fur" found in kettles and boilers. Water which has been boiled is flat and unpleasant to the taste; this may be remedied by adopting some method of aëration, as for example pouring it repeatedly from one vessel to another.

In **Filtration** on a small scale, **animal charcoal** is one of the materials most commonly used. If the charcoal is fresh and of good quality it has the power of oxidising organic matter and rendering it harmless. There are, however, many objections to its use; it adds to water nitrogen and phosphates, these being the foods on which micro-organisms flourish. It follows therefore that water cannot with safety be stored in a charcoal filter, because micro-organisms develop rapidly in it. The charcoal, too, quickly becomes dirty, and in that condition adds impurities to the water instead of filtering it.

Spongy Iron is considered one of the best filtering materials. It arrests suspended matters and oxidises organic impurities. **Silicated carbon** used in block form is of doubtful efficacy; the suspended impurities form a slimy deposit on the surface of the block, and the water is contaminated instead of being purified. **Sponge** is sometimes used in household filters. This is not a good plan, for the sponge speedily becomes foul and requires to be replaced by a new one; it also forms a breeding-place for various forms of microscopic life.

It is now generally recognised that the value of a filter lies in its power of holding back the micro-organisms which are the cause of disease.

Sand, which has little or no chemical action on water, is one of the best mediums for arresting bacteria, and its use for filtration has been invariably followed by a reduction in the number of cases of water-borne diseases.

The **Pasteur-Chamberland** filter is constructed with the sole idea of sterilising the water which passes through it. It consists of a stoneware case which contains a filter-tube or tubes of fine porcelain through which the water is forced by pressure. The filtered water is found to be quite free from bacteria. The drawback to this filter is that the rate of flow is very slow, but its value is shown in the fact that since it has been used in the French army the attacks of enteric fever have been reduced by 62 per cent.

It is necessary to remove the "candles" or tubes from time to time for the purpose of cleaning. This is easily done with a small brush and hot water.

QUESTIONS.

1. How are houses supplied with water? In choosing a house what points would you attend to in order to secure the purity and wholesomeness of the water. (*1st Year Certificate*, 1893.)

2. What are the characteristics of wholesome water? Name some of the impurities by which water is liable to be contaminated; and show how they may be prevented or removed. (*2nd Year Certificate*, 1894.)

3. What special forms of impurity affect town and country water-supply respectively? Discuss the good and evil of storage in cisterns. (*1st Year Certificate*, 1895.)

4. Describe the best form of filter with which you are acquainted. (*2nd Year Certificate*, 1895.)

CHAPTER XVIII.

THE FURNISHING OF THE HOME.

THE style in which a home is furnished varies according to the position and income of the occupier. Where expenditure need not be considered there is little difficulty in furnishing a home well and tastefully, but where money is limited in amount a great deal can be done by wise forethought and careful selection to secure economy in furnishing.

As in clothing, the lowest-priced articles are not necessarily the cheapest. Avoid purchasing showy furniture which will fall to pieces after 12 months' wear. Upholstered furniture, unless of good quality, rapidly loses its freshness; the springs give way, the wood warps, the stuffing makes its way through the cover, and the rooms present a shabby and dilapidated appearance.

Second-Hand Furniture. It is preferable to buy good second-hand furniture if it can be obtained; though second-hand beds, carpets, and upholstered goods are scarcely to be recommended owing to the danger of their carrying infection, or being infested with moth or vermin. Good chests of drawers, wooden chairs, tables, dressers, and iron bedsteads can often be met with and purchased at a low price.

Tasteful Furnishing. It is quite as economical to furnish with due regard to harmony of colour and style as to gather together a collection of things which have no relation to each other.

In furnishing a room, first select either the wall-paper or carpet, and take one of these as the basis of your colour scheme. If the wall paper be first chosen, select a carpet which will harmonise; then obtain hangings for windows and doors which will look well against the wall-paper and harmonise with the carpet. It will be found better, as a rule, to introduce several colours into a room, rather than to keep to one or two.

Upholstered furniture must be chosen with care, so that it may not cause discord in the room. Tablecloths look best if made of cloth of one colour, but such cloths are not economical owing to the way in which they show up spots and stains. With ordinary care, however, a plain table-cloth will last for several years.

In choosing furniture, it is well to make up one's mind beforehand as to what is wanted, and then wait until the desired article is met with. Never buy furniture in a hurry; articles which have to be lived with, perhaps all one's life, should be chosen with deliberation.

It is cheaper to buy muslin and make pretty frilled curtains than to buy ready-made curtains of Nottingham lace or inferior muslin.

Pictures and ornaments are gathered together by degrees, and often represent the taste of one's friends rather than one's own. It is sufficient here to give one general rule: Let everything intended for decoration be good of its kind and in harmony with the room. Good etchings and photogravures are better than poor oil-paintings and water-colours; a good print in a quiet frame is in better taste than a gaudy oleograph in a cheap gilt frame.

Flowers and plants are the best ornaments that can be introduced into a room; but the flowers must be fresh and tastefully arranged, and the plants must be healthy and well cared for.

Avoid overcrowding the rooms with furniture and ornaments; this is a common mistake in small rooms. It is better for a room to look under-furnished than over-furnished, and in the former case there is the additional advantage of extra air space. Avoid, too, the fashion of filling walls, shelves, and ledges with so-called ornaments, which only serve to collect dust and have no beauty in themselves. A bare wall is better than one filled with cheap paper fans and dust-laden brackets.

Cost of Furnishing a Cottage. The figures given below can only be regarded as approximately correct. In actual practice it will probably be found necessary to give more than is stated for some articles, while others may, on the other hand, be bought more cheaply. Only indispensable articles are included in the list.

The Kitchen.

Square of linoleum,	£0	9	6
Hearthrug,	0	3	11
Table (deal),	0	10	0
4 Wooden chairs,	0	10	0
Fender and fire-irons,	0	6	8
Window blind (muslin),	0	0	6
Coal-scuttle,	0	2	6
	£2	3	1

A dresser is a valuable addition to kitchen furniture, but is a costly article to buy. A small dresser may sometimes be obtained second hand for two or three pounds.

The Sitting-room must be looked upon somewhat as a luxury, and the furnishing be in accordance with the amount left over after buying necessary articles. It is wise to furnish a sitting-room by degrees.

Small couch,	£1	3	6
6 Chairs,	0	17	6
Easy chair,	0	17	9
Table,	0	17	6
Fender and fire-irons	0	9	0
Carpet (art square),	1	1	0
Hearth-rug,	0	5	0
Muslin curtains,	0	4	0
Small table,	0	2	0
Coal-scuttle,	0	2	6
	£5	19	9

The Bedrooms. When the bedroom accommodation is limited, it is a good plan to turn the sitting room into a bedroom. Such a practice is conducive to the comfort, health, and morals of the family.

Avoid overcrowding bedrooms with furniture. Every article in the room diminishes the amount of air-space, and a bedroom filled with heavy furniture is invariably close and unhealthy. Small bedrooms should be furnished sparely with small light pieces of furniture. Bedsteads should be of iron, with spring or chain mattresses, covered by hair or wool mattresses. Wooden bedsteads are more likely to harbour parasites and retain disease germs than are iron bedsteads. A bedstead should never be draped with curtains, for these collect and retain the dust, and prevent free circulation of air round the bed. Draughts may be prevented from reaching the bed by a light screen which can be easily and inexpensively made at home. Window curtains in bedrooms should always be made of washing material.

The following articles will be required for each bedroom:

Iron bedstead,	£0	15	9
Chain palliasse,	0	17	6
Wool mattress,	0	17	6
Bolster,	0	5	0
2 Feather pillows,	0	6	0
2 pairs blankets, 12s. 6d. and 10s.,	1	2	6
1 Counterpane,	0	4	6
Strips of carpet or rugs,	0	10	0
Dressing table of deal, draped,	0	5	6
Washstand,	0	7	6
Toilet set,	0	6	0
Dressing-glass,	0	4	6
2 Chairs,	0	5	0
Fender,	0	2	0
Window curtains (muslin),	0	3	0
	£6	12	3

China, Glass, etc. The stock of china and glass varies according to the amount set aside for that purpose. The following list gives only such articles as are necessary to commence housekeeping:

6 Tea cups and saucers,	£0	2	0
6 Small plates,	0	1	0
Cream jug and sugar basin,	0	0	6
3 Breakfast cups and saucers,	0	1	0
3 Jugs,	0	1	6
1 Teapot,	0	0	9
6 Large plates,	0	1	6
6 Smaller plates,	0	1	0
3 Dishes (varying sizes),	0	1	6
2 Vegetable dishes,	0	1	9
2 Salt-cellars,	0	0	4
3 Pudding-basins,	0	0	9
2 Basins (1 large),	0	0	10
3 Pie dishes,	0	0	9
1 Bread pan,	0	1	3
1 Pan for washing-up,	0	1	0
6 Tumblers,	0	1	0
2 Glass dishes,	0	1	0
	£0	19	5

Cooking and Household Articles.

3 Saucepans,	£0	4	0
1 Large pan for boiling,	0	4	0
2 Kettles (1 small),	0	3	6
1 Gridiron,	0	0	7
2 Baking-tins,	0	1	0
1 Frying-pan,	0	0	8
1 Iron spoon,	0	0	3
2 Wooden spoons,	0	0	3
1 Pastry board,	0	1	0
1 Rolling-pin,	0	0	3
2 Japanned trays,	0	2	0
Salt-box,	0	0	9
6 Knives and forks,	0	6	0
1 pair carvers,	0	3	0
4 Table-spoons,	0	1	10
6 Tea-spoons,	0	1	6

1 Pepper-pot, - - - - - - - -	£0	0	2
1 Flour-dredger, - - - - - - -	0	0	1
1 Grater, - - - - - - - - -	0	0	1
1 Coffee-pot, - - - - - - - -	0	0	9
2 Candlesticks, - - - - - - -	0	0	6
1 Coal-shovel, - - - - - - - -	0	1	0
2 Washing-tubs, - - - - - - -	0	5	0
1 Scrubbing brush, - - - - - - -	0	0	9
1 Linen brush, - - - - - - - -	0	0	6
3 Shoe brushes, - - - - - - -	0	2	0
Set of stove brushes, - - - - - -	0	2	0
1 Long brush, - - - - - - - -	0	2	0
1 Yard-broom, - - - - - - - -	0	2	0
1 Carpet-brush, - - - - - - -	0	2	0
1 Hearth-brush, - - - - - - -	0	0	8
1 Dust-pan, - - - - - - - -	0	0	6
2 Flat-irons, - - - - - - - -	0	2	0
2 House-pails, - - - - - - - -	0	3	0
1 Slop-pail, - - - - - - - -	0	1	6
	£2	17	1

Total Cost of Furnishing.

Kitchen, - - - - - - - - - -	£2	3	1
Sitting-room - - - - - - - -	5	19	9
1 Bedroom, - - - - - - - - -	6	12	3
China and glass, - - - - - - -	0	15	11
Household utensils, etc., - - - - -	2	17	1
	£18	8	1

Questions.

1. Give the names of six of the most important cooking utensils for a poor man's family, and explain their use. (*Scholarship*, 1889.)

2. How would the sum of £20 be most properly expended in furnishing a labourer's cottage containing three rooms?
(*Scholarship*, 1892.)

3. Enumerate the articles necessary for the proper cooking and saving of food in a labourer's cottage, with the cost of each.
(*Scholarship*, 1893.)

4. If you had to furnish for yourselves a bedroom and sitting-room, what sum would you need, and what would be the chief items of expenditure? (*2nd Year Certificate*, 1893.)

CHAPTER XIX.

RULES FOR PRESERVING HEALTH.

A Definition of Health. The human body may be fitly compared to a clock which goes well so long as its works are perfect; but let even the smallest obstruction find its way among the wheels, and the clock begins to go wrong, and if not promptly attended to, may break down altogether. The works of the clock correspond in some measure to the vital organs which enable us to go on living from day to day. As long as they are perfect and in good working order the body is in health; but any failure on their part, to perform their function means loss of health, or disease. Health may, therefore, be said to consist in the proper performance of their functions by perfect organs.

Value of Health. How largely health is conducive to happiness need scarcely be stated. The most fortunate of people are apt to take a gloomy view of life if their livers are sluggish and their digestions unsound. Loss of health is accompanied by pain and suffering, and, not infrequently, a consequent irritability of temper. Then, too, the additional expenses caused by illness cannot be overlooked; sometimes it is the bread-winner who is stricken down, and the family suffers from poverty just at the time when money is most needed. Worst of all, an unsound body is often accompanied by an unsound mind. The brain is never so clear in illness as in health; it soon becomes wearied and clouded unless supported by a perfect digestion and a good circulation.

Surely all this is enough to make everyone recognize the value of health; and having noted its importance to our general well-being, the question arises how may health be maintained, for it is better to seek to preserve health than to spend time and money in restoring it when lost.

The Laws of Health. Just as the people who make up a community are governed by laws formed for their protection, so the human body is governed by laws of health; and as a person who breaks the laws of the land is punished by fine or imprisonment, so are those who infringe the laws of health punished by the pain and suffering attendant on disease.

One would think that it would be sufficient to know the laws which govern health, to ensure their due observance; yet such is the folly of the human race that it is no uncommon thing to find persons who knowingly and systematically violate these laws.

The Influence of Heredity. Unfortunately the evil resulting from such wrong-doing is not confined to the wrong-doer, for though disease itself is not hereditary, the **tendency to disease** is undoubtedly transmitted from parent to child. Thus a man who has contracted phthisis by disregard of nature's laws is specially liable to have consumptive children, though these may escape the disease by taking special precautions. From this point of view alone it is obviously the duty of every man and woman to live as healthily as possible.

The Rules for Preserving Health. These may be briefly summed up as follows:

1. The provision of a sufficiency of wholesome food.
2. The adoption of healthy clothing.
3. The proper ventilation, warming, and lighting of dwellings, workshops, etc.

4. The formation of habits which conduce to promote health.

5. Attention to cleanliness of person and surroundings.

6. A sufficient amount of time devoted to exercise and rest.

The points comprised in rules 1, 2, and 3 have been fully dealt with in preceding chapters. It remains for us now to enquire how far health may be influenced by habits, cleanliness, exercise, and rest.

The Formation of Habit. When you do a thing for the first time, you are conscious of the action; the second time you are less conscious of it; and after several repetitions the action is performed quite unconsciously. It is in this way that habits are formed, and once formed they become part of ourselves, and it is with the greatest difficulty they are broken.

It is important, therefore, that habits should be formed which will lead to health, and not such as will hinder or destroy health. By good habits a weak constitution may be strengthened; by bad habits a naturally strong constitution may be utterly broken down.

Habits which influence Health. 1. With regard to Food. Early in life it should become a habit to masticate food very slowly and thoroughly. When such a habit is acquired, it becomes almost impossible to eat hurriedly, and as a result indigestion and its attendant evils are avoided. Persons who eat very quickly are apt to become dyspeptic.

The habit of eating pungent condiments, such as pepper, cayenne, and mustard, should be discouraged. These substances irritate the delicate lining of the stomach, and in time interfere with digestion. Children especially should take no condiment but common salt.

Habits of temperance in eating and drinking should be formed.

Overeating is productive of many evils, such as indigestion and corpulence. It is, however, more common for adults to suffer from this habit than for young people. The evil effects of intemperance in drink have been dealt with elsewhere. It is sufficient to say here that in youth, at least, a habit of total abstinence from alcoholic drinks should be formed.

2. **With regard to Air**. Persons who habitually breathe pure air soon feel the effects of an ill-ventilated room, and find it impossible to be comfortable in a foul atmosphere. The importance to health of forming such a habit is incalculable.

3. **Habits of Cleanliness.** Health and cleanliness are so interwoven as to be inseparable. Dirt is always accompanied by disease. Habits of cleanliness ought to be formed in early youth—it is rarely they are satisfactorily acquired late in life—whereas, if formed at the outset, they remain throughout one's life and form a valuable protection against disease.

4. An important habit is that of **Regular Attention to the Action of the Bowels**. The prompt removal of the waste matters which enter the large intestine is necessary to health. If these substances are retained in the body, they putrefy and give off foul gases, which are re-absorbed into the blood, and produce the muddy complexion so noticeable in persons who suffer from constipation. The excretory action of the large intestine is stimulated by eating fresh vegetables, fruit, and brown bread. But of even greater use than diet in this respect is the formation of a regular habit of attention to the action of the bowels at a fixed time daily. Children who are trained to do this early in life rarely have trouble in later life.

5. **Habits and Sleep.** Habits are as great an aid in securing sound sleep as in other matters relating to health.

It is wise to make a rule of retiring to rest at a certain hour daily. How far the system is governed by such a habit is shown by the desire for sleep at the regular hour on occasions when the rule is broken.

A useful habit for promoting health is that of sleeping with the window open at the top. When once a person is accustomed to this practice, it is difficult to sleep in a room with closed windows.

Learn to sleep with the mouth shut, so that breathing goes on in the proper way through the nostrils. Keep the head cool and the feet warm. It is a pernicious habit to sleep with the bed-clothes over one's head.

Make a rule of throwing back the bed-clothes and opening the windows wide before leaving the bedroom in the morning. This secures a well-ventilated bed.

Personal Cleanliness. To understand how health is affected by cleanliness of person it is necessary to know something of the structure of the skin.

The Skin forms a covering for the whole of the body. It may be divided into two parts, the upper layer being called the **epidermis** or scarf skin, and the lower the **dermis** or true skin.

The Epidermis (Greek **epi**, upon; **derma**, the skin) is made up of hard, flat, horny scales which are constantly being cast off from the surface and replaced by others from beneath. The thickness of the epidermis varies in different parts of the body. In the palms of the hands and soles of the feet it is much thicker than in other parts. On

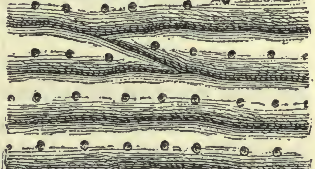


FIG. 67.—THE EPIDERMIS, SHOWING PORES (Highly magnified.)

examining the surface of the epidermis under a magnifying glass it is seen to contain innumerable minute openings called **pores** (see Fig. 67).

The epidermis contains neither nerves nor blood vessels. You may prove this by running a needle through it. So long as you do not penetrate the true skin beneath you will neither feel pain nor shed blood.

Colouring Matter. In the deeper portions of the epidermis are found cells which contain colouring matter and are called **pigment cells.** The colour of the skin is determined by the amount of pigment. A fair skin contains little colouring matter, a darker skin a greater amount, and a black skin, like that of the negro, has most of all.

The Function of the Epidermis is to protect the delicate dermis from injury.

The Dermis. The under portion of the skin, known as the dermis, differs very considerably in structure from the epidermis. It is made up of soft rounded cells, and is one mass of blood-vessels and nerves, so closely packed together that it is impossible to prick any part of it without blood coming to the surface and a sense of pain.

The accompanying diagram shows the different parts of the skin very clearly.

At the top is the hard epidermis. Underneath this the layer of pigment cells lies. Below the pigment cells we find the dermis, the upper portion of which is drawn into finger-like projections termed papillæ; these are nerve-endings. In the lower portion of the skin are fat cells which give roundness and plumpness to the body and serve also to keep the body warm, fat being a non-conductor.

The Glands of the Skin. There are two kinds of glands in the skin, (*a*) the Sudoriparous or sweat glands, and (*b*) the Sebaceous or oil glands.

The Sebaceous Glands are short; they are associated with the hairs of the skin (see Fig. 69), their function being to secrete an oily fluid which serves to lubricate the hair and the surrounding skin.

The Sudoriparous Glands secrete perspiration. If we follow a duct downwards from the pore on the surface of

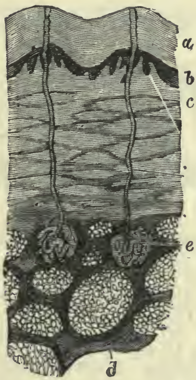


FIG. 68.—(*a*) EPIDERMIS; (*b*) PIGMENT CELLS; (*c*) PAPILLÆ; (*d*) FAT CELLS; (*e*) SWEAT GLANDS.

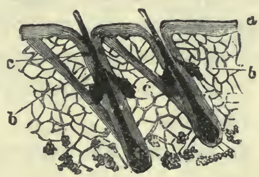


FIG. 69.—SEBACEOUS GLANDS AND HAIR-SHEATHS. (*b*) Sebaceous Glands.

the skin (see Fig. 70) we find that it passes through the epidermis, in twisted form, like a corkscrew; lower down in the dermis it is straight or only slightly curved, and on reaching the lower portion of the dermis it is coiled up into a little ball, which is surrounded by a dense network of blood-capillaries. It is the function of the sudoriparous glands to separate from the blood in these capillaries the fluid known as sweat or perspiration, passing it upwards through the duct until it reaches the surface of the skin. Sweat glands are found all over the body, being especially numerous in the palms of the hands.

Perspiration is a watery fluid containing dissolved in it various mineral salts, particularly common salt, and a small amount of carbonic acid gas. It is constantly evaporating from the surface of the skin, though the amount varies under certain conditions, more being produced, for instance, in hot weather and during active exercise.

Functions of the Skin.

1. **To serve as a protection to the more delicate parts beneath.**

2. **To serve as the organ of touch.** The skin contains numerous nerves and nerve-endings (papillæ) which render it very sensitive to impressions.

3. **To secrete perspiration from the blood and excrete it from the body.**

4. **To regulate the temperature of the body.** When the body becomes over-heated from such causes as exercise or the heat of the sun, the blood-vessels of the skin dilate, a larger supply of blood rushes to the surface of the body, the ducts of the sweat-glands open wider, perspiration flows out freely, and the body is cooled by evaporation of the moisture. On the other hand if the surface of the body is cold, the blood-vessels contract, the supply of blood to the skin is diminished, the ducts of the sweat-glands also contract, and the flow of perspiration is very small.

5. The fat-cells in the lower portions of the skin serve **to keep in the heat of the body.** The thick layer of fat or blubber which is found underneath the tough epidermis of the whale serves to protect its body from the effects of the icy waters of the Arctic Seas.

Necessity for Cleanliness of the Skin.

1. Cleanliness is necessary to keep open the pores of the skin. The dead scales of the epidermis tend to collect on

the surface of the skin, together with the perspiration and oil from the glands, and an inevitable amount of dirt, the whole forming an offensive accumulation which, if not removed daily, clogs up the pores and prevents the flow of perspiration. If the skin does not act properly as an excretory organ the blood becomes impure, and extra work is thrown upon the lungs and kidneys, the balance of health being thus destroyed.

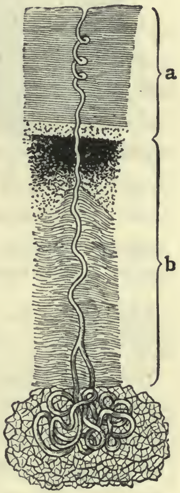


FIG. 70.—A SWEAT GLAND. (*a*) Epidermis, (*b*) Dermis.

2. If the sebaceous glands are allowed to become blocked, "**blackheads**" and pimples are produced.

3. **A dirty skin is colder than a clean one.** The retention of waste matters on the surface of the skin causes it to feel clammy and cold. This is explained by the presence of common salt in the perspiration, its hygroscopic properties inducing a sensation of chill.

4. **Dirt lessens the sensibility of the skin.** When the delicate papillæ are covered with a layer of dirt above the epidermis their sensitiveness is dulled.

5. **The danger of chills is increased by dirt.** The nerves of the skin govern the blood-vessels and regulate the supply of blood. If the sensibility of the nerves is diminished by dirt, the action of the skin in regulating the temperature of the body is interfered with, and there is greater liability to colds and chills.

6. **Skin-diseases are favoured by a dirty condition of the skin.** These may be either parasitic or non-parasitic in character. Parasites which are found on the surface of the body include :

(*a*) **The Itch insect** (Acarus scabiei, Fig. 71), which burrows into the skin, causing intense irritation and a pimply rash. The disease is very disgusting in character, and highly contagious. A speedy cure is effected by perfect cleanliness and the application of sulphur ointment.

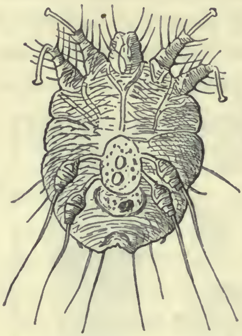


FIG. 71.—ITCH-MITE (ACARUS SCABIEI). Highly magnified.

(*b*) **The Louse** is found on the surface of the body or among the hair of the head. Whenever it occurs it gives rise to irritating itching. Body lice are kept away by cleanliness; head lice are got rid of by saturating the hair with an ointment of corrosive sublimate. Repeated attention is needed to free the hair from the nits.

(*c*) The **Pulex penetrans** or chigoe is a variety of flea met with in some parts of the tropics. The female insect burrows into the skin of the foot, causing pain, irritation, and swelling of the parts.

(*d*) **Fleas and Bugs** can be avoided by the practice of cleanliness.

Personal Cleanliness includes attention to the skin, hair, teeth, and nails.

Baths. To keep the skin in a clean and healthy condition the frequent application of soap and water is necessary. For persons in health a hot bath once a week and a cold or tepid bath daily should be the rule.

Classification of Baths. The physiological action of baths is mainly dependent upon their temperature. If water is much below the temperature of the body (98·4° Fahr.) it rapidly takes heat away from the body. No classification of baths can be regarded as arbitrary, because no two persons feel the effects of heat and cold equally, the following may, however, afford some guidance:

1. Cold baths from 32° F. to 60° F.
2. Tepid baths, between 60° F. and 85° F.
3. Warm baths 85° F. to 100° F.
4. Hot baths, from 100° F. upwards.

Cold Baths should be taken in the early morning. If not indulged in too long, or too cold, they are followed by a delightful feeling of exhilaration and warmth due to the reaction of the blood-vessels of the skin. Cold baths are valuable means of training the blood-vessels of the skin to contract and dilate alternately according to temperature, and for this reason habitual bathers rarely take cold. Cold baths should be discontinued if a sensation of chill results. They should not be taken by old persons or those whose circulation is weak.

Hot Baths are best taken at night to avoid chills. The heat of the water causes an expansion of the blood-vessels with a rush of blood to the surface, and a consequent decrease of temperature, hence the advisability of taking a hot bath immediately before getting into bed. The liability to chill may be reduced by sponging the body all over with cold water after the bath.

The Hair should be well brushed night and morning to free it from dust and scurf, and to produce a healthy condition of the scalp. It must be periodically washed, but not too frequently as washing makes the hair dry and brittle. The use of much soap or soda should be avoided.

The Teeth must be kept scrupulously clean, to keep them sound. Bad teeth cause bad digestion and consequent ill-health. The teeth should be brushed with a fairly soft brush after each meal, using either soap or a fine powder which will not scratch the enamel. Decayed teeth should be stopped as soon as they are noticed.

The Nails should be carefully trimmed and kept quite clean. It is possible for infectious diseases to be spread by dirty nails.

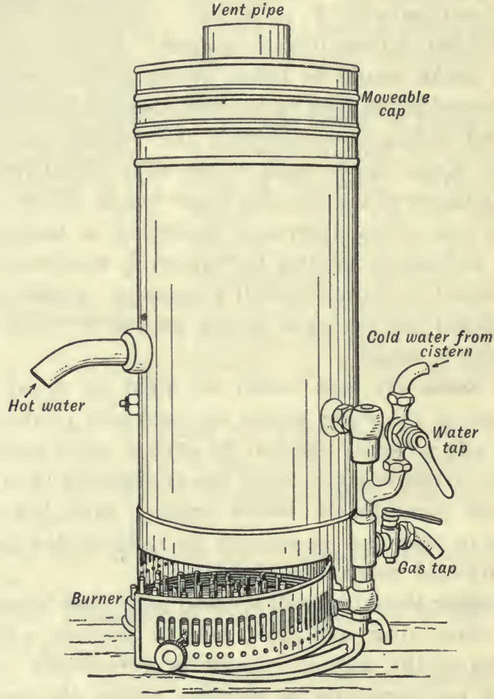


FIG. 72.—A GEYSER.

Baths. A well-arranged bath-room should be provided in every house with an open fireplace to help in securing ventilation. The bath should be large enough to admit a full-sized person. It should be supplied with hot and cold water, and both waste pipe and overflow pipe should end in the open air. To facilitate this, bath-rooms are best placed at the side of the house, with one external wall. It is usual to fix a leaden tray called a "safe" under the bath to prevent accidental spillings soaking through to the rooms beneath. The waste pipe from the safe should also discharge into the open air. There should be no communication whatever between the bath and the water-closet and soil pipe. Water-closets should not be fixed in bath-rooms, as is often the case; it is important that the air of a bath-room should be pure.

Baths are supplied with water either by means of a **circulating system,** in which the water is heated behind the kitchen fire, or by a **geyser.** (Fig. 72.) The latter should not be used without a vent pipe opening into the outer air and carrying off the poisonous products of combustion. When a geyser is used without a vent pipe, carbonic acid and carbonic oxide escape into the air of the room, causing violent headaches and even more alarming symptoms to appear.

The advantage of a geyser is the rapidity with which a hot bath may be obtained. Hot water is secured almost immediately, and a large bath may be filled in little more than ten minutes.

Exercise. Need for Exercise. It is a well-known fact that health cannot be maintained without abundant exercise in the open air, and the more one has of it, the healthier one becomes. That the desire for exercise is a natural instinct is shown by the extreme restlessness of growing children. It is a peculiarity of the body that the more it is exercised, within limits, the stronger it becomes. On the other hand, disuse of any part of the body is followed by deterioration; the rapidity with which the muscles of the legs waste away in cases where illness prevents walking is an instance of this.

Exercise does not only act upon the muscles of the body; it is necessary to the healthy action of the heart, lungs, arteries, brain, and nerves.

Effects of Exercise.

(*a*) **On the Muscles.** Under the influence of exercise the voluntary muscles become larger, harder, stronger, and more under the control of the will.

(*b*) **The Lungs.** The action of the lungs is increased by exercise; breathing becomes more rapid and the amount of air inspired and carbonic acid expired is augmented. This indicates that active exercise is best taken in the open air or in a freely-ventilated room.

(*c*) Upon **the circulatory system** the effect of exercise is to increase the force and rapidity of the action of the heart, thereby increasing the flow of the blood through the blood-vessels.

(*d*) The **Digestive Organs** are stimulated by exercise and the appetite increased, a special desire arising for meat, fat, and salt. The excretory action of the intestines is improved by exercise. The liver is especially benefited by active exercise in the open air.

(*e*) The action of **the Skin** is increased and perspiration given out freely during exercise. Evaporation goes on more rapidly as a consequence, and by this means the equable temperature of the body is maintained.

(*f*) The **Intellect** is strengthened by moderate exercise, inasmuch as the proper performance of their functions by other organs induces a healthy condition of the brain and nervous system generally.

Excessive Exercise is bad for many reasons. If the muscles are habitually overworked they suffer from muscular exhaustion; an instance of this is found in "writer's cramp"—loss of power in those muscles of the hand which are used in writing. Long continued or excessive exercise is apt to lead to palpitation, disease of the valves of the heart or other affections of a similar nature. Persons with weak hearts should never take violent exercise. On the lungs excessive exercise acts injuriously by affecting the circulation of the blood through the lungs and interfering with easy breathing.

Amount of Exercise. It is difficult to say what amount of exercise should be taken daily, for this differs with the age, sex, occupation, and constitution of the individual. In children, much of their energy is expended in building up the growing tissues; they should, therefore, not be expected to engage in laborious, muscular work. Women, as a rule, should not undertake such hard work as men. The delicate are less capable of exertion than the healthy. It must rest with each individual to ascertain what amount of exercise is necessary to the maintenance of health; it then becomes a duty to secure that amount.

Forms of Exercise. Of all the various forms of exercise **walking** is the best, because it brings into play most of the muscles of the body. Next in value in this respect is **swimming.** It must be remembered, however, that swimming must not be long continued, nor indulged in while fasting or immediately after a meal. Persons who invariably suffer from cold after being in the water should avoid this form of exercise.

Cycling is an excellent form of exercise for those whose time is limited, enabling as it does a large amount of exercise to be taken in a short time. It also strengthens muscles which are not specially used in walking. *Outdoor games,* such as football, cricket, golf, and tennis, are invaluable in providing motives for exercise. It is, doubtless, largely owing to the national games that English men and women are so well developed physically.

Singing and Reading aloud are useful in strengthening the lungs. Children with delicate lungs should take breathing exercises.

Gymnastics are of use in developing equally all parts of the body; also as a means of securing exercise for those whose time is limited, or as a short relaxation from mental work. It is with this idea that school children take drill in the intervals between lessons.

Rest. Not less necessary than exercise is rest, for during rest the tissues which have been wasted by exercise are repaired and built up. After exercise the body calls for rest, and, if this be denied, weakness and ill-health speedily follow.

Kinds of Rest. Rest may be either complete or partial.

Sleep is the only form of complete rest, and even then the heart, lungs, and other vital organs are at work.

Amount of Sleep. It is important to health that a sufficient amount of sleep be obtained. Women require more than men, the delicate more than the healthy, and children most of all. For an adult from 6 to 8 hours should suffice. Children require from 9 to 12 hours' sleep per day, and babies should sleep the greater part of the time. Children require more sleep than grown-up persons, because their tissues require not only to be repaired but to be built up, and as it is during sleep that this work goes on a sufficient amount of time must be allowed.

Hints on Sleep. It is always best to sleep on a bed raised on a bedstead. Sleeping on the floor is unhealthy, because it interferes with the free circulation of air under and around the sleeper; there is, too, danger of breathing in noxious exhalations from the ground. For healthy sleep the bedroom must be well-ventilated; fresh air must pass continuously into the room through window or ventilator; the chimney must be left open for the escape of foul air; the bed should be free from curtains which will shut in the expired air; at the same time the sleeper must not be exposed to a draught and must be warmly covered with bed-clothes. It is not wise to take food immediately before going to sleep; neither is hunger conducive to sleep; a light supper taken about 2 hours before retiring is a suitable arrangement for most persons. A hard biscuit eaten last thing at night has been proved in many cases to be a preventive of insomnia.

Sleeplessness is due to many causes. Cold feet will effectually prevent sleep; the remedy is to use hot-bottles and sleeping-socks. Mental excitement, consequent upon excessive use of the brain too late at night, is a common cause of insomnia among brain-workers. Exercise in the open-air is a valuable remedy in such cases. A stuffy condition of the atmosphere will drive away sleep in persons accustomed to a well-ventilated bedroom. Tea and coffee taken late at night excite wakefulness.

The Use of Drugs to induce sleep cannot be too strongly deprecated. Apart from the risk of taking an overdose, which may lead to death, sleeping draughts of any kind are dangerous to the health and disastrous in their effects on the mind and morals.

Partial Rest consists of a change of work. When mental study gives way to physical exercise, the brain is at rest though the muscles are working. Similarly, after not too arduous bodily exercise the brain can work while the muscles rest.

QUESTIONS.

1. To maintain a high standard of health, it is needful to regulate our lives carefully as regards air, food, work, cleanliness, and rest. Comment upon this statement, giving practical advice under each of those five heads. (*Scholarship*, 1895.)

2. A teacher living with her parents has two hours per day for recreation. How can she employ that time to the best advantage? (*Scholarship*, 1898.)

3. Name some of the most important conditions for maintaining the body in a healthy state. (*Scholarship*, 1899.)

4. Why is exercise necessary to health? State the effect on the body (1) of excessive exercise, (2) of deficient exercise. (*Scholarship*, 1900.)

CHAPTER XX.

THE MANAGEMENT OF A SICK ROOM.

THOUGH careful attention to the laws of health does much towards the prevention of disease, sickness in some form or other inevitably comes to us sooner or later. It is well, therefore, for every mother and sister to have some knowledge of the management of a sick room.

The successful ordering of the room in which the patient lies depends almost entirely upon the nurse. It will be recognised, therefore, how important it is in cases of severe illness to secure the services of a satisfactory nurse. Frequently the relatives of the patient prefer to undertake the work of nursing; but though this plan has the great advantage of economy, it is generally wiser, in serious cases, to engage a trained nurse. Relatives are apt to be indiscreet in granting the patient's wishes against the doctor's orders; nor have they, as a rule, the authority over the patient that a professional nurse is able to assume.

An ideal nurse—that is, one who possesses all the necessary qualifications—is not easy to find, though every nurse may and should endeavour to come as near the ideal as possible.

The Qualifications of a Good Nurse are as follows:

(1) She should understand domestic work, and not be afraid to practise it. It is the place of the nurse to keep the sick room neat and clean.

(2) She should be a skilful and painstaking cook. The food of invalids is of supreme importance. The nurse should know how to prepare it, how to serve it, and how to administer it.

(3) She should know sufficient of the laws of health to be able to regulate the temperature of the room, its lighting and its ventilation.

(4) She should know how to anticipate and attend to the wants of the patient, his personal washing, the changing of bed-linen, etc.

(5) She should be able to make poultices, apply dressings and bandages, and note the patient's temperature.

(6) Above all, she should obey the doctor implicitly, carrying out all his instructions with scrupulous care.

The Characteristics of a Good Nurse:

(1) The ideal nurse is essentially sympathetic. She feels with and for her patient, and expresses it in tender attention.

(2) She is full of tact, for tact and sympathy go hand in hand. The tactful nurse knows when to talk to her patient and when to be silent; when to amuse and when to soothe.

(3) She is firm without being harsh. She knows how to enforce the doctor's orders in the face of resistance from the patient without unduly exciting him. This is especially necessary in dealing with diet and medicine.

(4) She is cheerful without being noisy; she is attentive without being fussy; she is quiet without being dull.

The Health and Dress of the Nurse. A good nurse knows better than to neglect her own health, for unless she is quite well herself, how can she do her best for her patient? She should make it a rule to get one good walk in the fresh air every day, to secure a sufficient amount of **comfortable** sleep, to have a daily bath, and to eat well in cheerful surroundings. The nurse should never take her meals in the sick room, for, besides giving possible annoyance to the patient, she is less likely to gain benefit from the food herself. She should preferably be a total abstainer from intoxicating drinks.

FIG. 73.—A SICK NURSE.

The Dress of the Nurse should be neat, clean, and simple. A washing material is preferable to a woollen stuff; but whatever the fabric, it must be of a soft **silent** nature; rustling silks and crackling linings should be steadfastly shunned.

Squeaking boots are sometimes a source of great annoyance to the healthy; how much more so must they be to the irritable, nervous invalid! The nurse should in all cases wear quiet shoes.

The Patient. Under this head we shall speak of the duties of the nurse towards the patient. One of the chief of these is the attention she must give to the cleanliness of the patient. Twice every day, at morning and evening, she should wash his face and hands in warm water, and brush and arrange his hair. The body should be sponged according to the doctor's orders. This, as a rule, has a soothing effect which induces restful sleep. Body-linen should be changed frequently, for it absorbs the foul matters given off from the skin. Two sets of garments should be kept in use—one for day wear, the other for the night; and the nurse should remember to warm each garment before putting it on again.

The set of clothes not in wear should be freely exposed to fresh air in another room. A bed-jacket or warm shawl should be kept at hand to wrap round the shoulders of the patient when he sits up in bed.

FIG. 74.—SHOWING HOW TO CHANGE BED-LINEN IN A SICK-ROOM.

How to change Bed-linen. It is of great importance to keep the bed sweet and clean. Where the patient is too ill to leave his bed, it is a difficult matter sometimes to change the sheets.

The Under Sheet may be changed without much trouble in this way: Roll up the soiled sheet lengthways until the roll touches the patient. Roll up the clean sheet in the same way, and place the rolled half beside the soiled roll. Now lift the patient over both rolls, draw away the soiled sheet, and unroll the clean sheet to cover the bed (Fig. 74).

The Top Sheet should be rolled the narrow way of the sheet, and the roll put at the foot of the bed, under the soiled top sheet. Slip the hand beneath the bed-clothes, and gradually unroll the sheet into position, then carefully draw away the soiled sheet.

Medicine. The following points in connection with medicine should be carefully borne in mind by the nurse:

(1) It must be administered according to orders.

(2) It must be kept distinct from lotions and medicines of another nature.

(3) Poisons should be plainly marked, and kept in bottles of an unmistakable colour and shape.

(4) Medicine spoons and glasses should be kept quite clean.

(5) A patient should not, as a rule, be roused from sleep to take medicine.

How to take the temperature of the Patient. It is the duty of the nurse to watch the patient's progress, to note any change for better or worse, and to record accurate particulars of his condition and temperature at stated times.

The normal temperature of the body is 98·4 Fahr. If it rises or sinks even one degree, it indicates disease.

For the purpose of taking the temperature, a clinical thermometer is used in this way:

(1) Shake down the line of mercury until it is near the bulb, **but not inside it.**

(2) Hold the thermometer in your hand for a few minutes to warm it.

(3) Put the bulb under the tongue, close the mouth, and keep it there for three minutes; or put the thermometer under the arm-pit, taking care that the skin touches it all round, and leave it there five minutes. At the end of the time the temperature of the patient will be registered, and should be noted in writing.

It is a wise plan in critical cases for the nurse to keep a record, too, of the amount of food taken, the action of the bowels, the time spent in sleep, or any marked change in the patient's condition, to show to the doctor, so that he may know what is the state of the patient between his visits. Such information, if accurate, is helpful to the doctor in his treatment of the case.

FIG. 75.—A CLINICAL THERMOMETER.

The Sick Room. If it is important in health to have light, airy, and cheerful rooms, it is doubly so in sickness. Let the sick room be large, well ventilated, and well lighted. It must also be quiet for noise is not only distracting, but positively injurious in many cases of illness. Do all you can to make the sick room cheerful. Keep medicine bottles and glasses and similar signs of sickness out of sight; put pleasing pictures on the walls; arrange tasteful vases of flowers (not too strongly scented), and place them about the room where the patient can see them. All these things will tend to keep up the spirits of the sufferer and make confinement less irksome.

Ventilation of the Sick Room. Pure air is even more necessary to the sick than to the healthy. The window of the sick room should be kept open at the top night and day. Do not be afraid that the patient will catch cold. It is not easy to catch cold in bed if it be protected from draughts. The furniture of the sick room should be so arranged that a current of fresh air can pass from the window to the fire without coming near the bed; or the bed may be protected by a screen. If the room is too cold, do not shut the window, but make up a larger fire, and if necessary put hot bottles into the bed. Do not try to ventilate the room by opening the door instead of the window. The air which enters by that means is of doubtful purity, and the impure air of the sick room passes out to the rest of the house instead of escaping through the window.

It is of the utmost importance in securing purity of the atmosphere of a sick room, that nothing which can give off a foul odour or moisture be retained in the room. Utensils for receiving excreta should be provided with lids, and should in all cases be removed from the room immediately after use. A slop-pail should never be introduced into a sick room. Where there is a water-closet on the same floor it is best to take the utensils there at once, empty and wash them, and bring them back clean. Avoid drying damp towels or even allowing them to remain in the sick-room; nor should linen be aired in the room occupied by the patient. Where other arrangements are possible, it is best not to prepare food in the sick room.

Furniture. Remove from the sick room every article of furniture that is not strictly necessary; remember that furniture takes up air space which can ill be spared. Carpets and heavy curtains should be banished. Soft rugs which are easily taken away and shaken should take the place of a fixed carpet, and cretonne or muslin curtains are better than woollen ones.

The bed should be a narrow one which can easily be reached across; it should be so placed that the nurse can get all round it. It is often easier to raise the patient from the head of the bed than from the sides. A sick bed

FIG. 76.—A CHAIR USED AS BED-REST.

should never be draped; a simple iron or brass one is the best. A well-stuffed hair or wool mattress is better than a feather bed.

When the patient is too weak to sit up without help, a **bed-rest** is used. This may be improvised by placing a chair as shown in the illustration (Fig. 76).

Temperature. The warming of the sick room is an important point. It should never be allowed to get cold; from 60° to 65° Fahr. is the best temperature. Do not let the fire get too low before making it up; and when this is necessary, do it gently, without noise, putting the lumps on one by one with the fingers; a piece of paper may be used to avoid soiling the hands.

Poultices and Fomentations. **Poultices** are applied to relieve pain by means of moist heat, which softens the skin and reduces the danger of inflammation. Poultices should be changed before they become cold and dry. They may be covered over with oiled silk, mackintosh, cotton-wool, or flannel.

A Linseed Poultice. Scald out a basin, pour boiling water into it, and add enough linseed meal to form a thick paste, stirring all the time. Dip a knife into hot water, and with it spread the mixture on to cotton-wool or muslin. Apply as hot as can be borne.

A Bread Poultice is made from a mixture of bread crumbs and boiling water. The stiff mass resulting is spread upon muslin and applied hot.

A Mustard Poultice may be made from mustard only or from a mixture of mustard and linseed meal. The water must not be boiling or the pungency of the mustard will be reduced. The quantities of meal and mustard used are regulated by the doctor according to the strength desired. The mustard is mixed first with hot water, and the meal added afterwards. The poultice is spread thinly on brown paper and covered with muslin, the latter being placed next the skin.

Fomentations are made with folded flannel wrung out in boiling water. The flannel is placed between towelling, and boiling water is poured over. The wringing is effected by twisting the two ends of the towelling in opposite ways. Shake out the flannel and apply; cover with oiled silk or mackintosh.

A fomentation is lighter than a poultice, but does not keep hot so long.

Questions.

1. Write out (1) the chief qualifications of a sick nurse; and (2) the principal rules by which she should regulate her life and work in the sick room. (*Scholarship*, 1895.)

2. How, and when, is the clinical thermometer used in a sick room? (*Scholarship*, 1896.)

3. How can sheets best be changed on a sick bed without disturbing the patient? (*Scholarship*, 1897.)

4. How would you ventilate and warm a sick room? (*Scholarship*, 1900.)

5. How would you make a linseed poultice? (*Scholarship*, 1892.)

CHAPTER XXI.

THE PREPARATION OF FOOD FOR THE SICK.

Rules for Invalid Cookery. 1. The diet of a sick person is regulated by the medical adviser and not by the nurse. In serious cases grave injury to the patient may result from the neglect of this rule. In typhoid fever, for instance, death has been known to follow the giving of solid food too soon, against the doctor's orders.

The nurse will, however, be required to use her discretion. Should she, for example, observe that a particular food ordered appears to disagree with the patient, she will point this out to the doctor. A knowledge of the composition of food is of great value to a nurse in enabling her to interpret the doctor's orders in an intelligent manner.

2. Food for the sick should be served in small quantities in as dainty a fashion as possible. Everything used should be scrupulously clean, the tray-cloth of snowy linen, the china and glass brightly shining, and the cutlery free from stains.

3. Avoid leaving untasted food in the sick-room from

one meal to another; nothing is more likely to disgust the patient with food than this.

4. Do not consult the patient about his food. Prepare what you wish him to have and bring it as a surprise; in this way appetite is sometimes stimulated. It often requires much tact and perseverance on the part of the nurse, in illnesses where the appetite fails, to tempt the patient to take as much nourishment as he ought. A good nurse will leave no plan untried to gain her object.

5. Concerning the **choice of food** certain general rules may be laid down. Fish **must** be fresh. White fish is the most digestible, whiting especially. Shell-fish and oily fish should be avoided. Oysters are valuable in many cases. They should be eaten raw, lightly steamed, or stewed. Vegetables must never be given except with the doctor's permission. They must be quite fresh, clean, and well-cooked. Fruit must be ripe and sound. Over-ripe fruit is as dangerous as unripe. Condiments, sauces, and seasonings are seldom advisable adjuncts to invalid cookery. They are apt to cause irritation of the delicate membranes lining the digestive tract. Pastry, new bread, and cakes should, generally speaking, not be allowed. Eggs and milk must be perfectly fresh. The latter should not be given uncooked.

6. In preparing drinks for the sick-room make a point of serving the hot ones as hot as possible and the cold ones quite cold. Lukewarm drinks are seldom appetising. All liquid food should be kept covered.

Common Mistakes in Feeding the Sick. It is a matter of general opinion among persons who have not given special attention to the study of the composition of food, that among the most nourishing and suitable food for invalids, beef tea, meat extracts, jellies, and arrowroot should take a high place.

In point of fact there is very little actual nutritive value in either **beef tea** or the various **meat extracts.** Their value lies in their stimulating and recuperative properties. **Jelly** is useful in forming an easily digested bulk, and, in conjunction with other nitrogenous foods, has some slight nutritive value, but it can in no way be regarded as a strength-giving food. **Arrowroot,** though often acceptable to the patient, is purely a starchy food, and has only the nutritive properties of starch. **Milk and Eggs** are the articles of food most commonly relied upon for invalids. The mistake generally made in dealing with eggs is to give too many per day to the patient, forgetting that eggs are not altogether easy to digest. Milk should preferably be given hot, being more digestible hot than cold; in all cases milk used in a sick-room should be sterilised or boiled; or the patient may contract a second disease before recovering from the first.

Recipes for Invalid Cookery.

Milk Jelly is made by mixing milk with a little dissolved isinglass and then boiling the milk. When cold it is ready for use.

Milk and Beef Tea. The monotony of milk, varied only by beef tea, may be relieved by mixing a teaspoonful of beef jelly with a cupful of hot milk, thus securing a novel and nourishing food.

Milk with Egg and Beef Tea. This is a very nourishing food and useful where concentrated nourishment is necessary. It is suitable, too, for administration in the form of an enema.

Required: one fresh egg and the same quantity of milk and beef tea. Thicken the egg and milk over the fire as for a custard, pour it into a hot basin, and add the beef tea, previously heated, a little at a time; beat the mixture well and serve at once. Two to three pints of milk and one pint of beef tea form the **Fever Diet.**

Eggs used in the sick-room must invariably be perfectly fresh. Raw eggs are easily digested by most people, but they need careful preparation to render them appetising.

Egg, Milk, and Brandy. Put the yolk of a fresh egg into a glass, beat it well with a little sugar and a tablespoonful of brandy; add enough boiled milk to nearly fill the tumbler. Serve either hot or cold.

Egg Snow. Take a new-laid egg and divide the yolk from the white. Beat up the yolk with half a teaspoonful of white sugar; beat the white to a stiff froth and add it little by little to the yolk, mixing well and lightly. Serve at once in a tumbler.

Steamed Eggs are more digestible than eggs boiled in the ordinary way. A small fresh egg can be steamed in a potato steamer in 4 minutes; a larger one will want 5 to 7 minutes.

(For other methods of cooking eggs see page 66.)

Beef Tea. 1 pint water to 1 lb. lean beef. Remove all fat, skin, and gristle; cut the beef into small pieces about an inch square; put into a jar with the cold water, stir, cover with a lid, and let it stand for half an hour. At the end of this time place the jar in a pan of boiling water which reaches half-way up the outside of the jar. Let the water boil for an hour, then take out the jar, strain the beef tea into a basin or jug, skim off any fat floating on the surface, and let it cool. Warm up in small quantities as required.

The beef that is left may be put into the stock pot.

Mutton Broth, Chicken Broth, Veal Broth. Use 1 lb. of scrag end of neck of mutton or knuckle of veal or chicken, as the case may be, to a quart of water. Remove all fat, cut the meat into small pieces, and put into a pan with the cold water and $\frac{1}{4}$ teaspoonful of salt. Bring slowly to the boil, remove the scum which rises to the top, and then simmer for an hour. Add an ounce of rice, previously washed, bring to the boil, and let it simmer for a second hour. Pour off the broth and serve hot.

Calves' Foot in Milk is a cheap and nourishing dish. Required 1 calf's foot, 1 quart of milk, seasoning, etc.

Parboil the foot, cut it up and put it in a jar in the oven with the milk; stew it until it falls to pieces. Flavour with lemon-juice and season to taste. Strain while hot, and serve either hot or cold in small quantities.

Oysters are most digestible when raw, but in cases where cold dishes are forbidden, they may be made hot without interfering to any great extent with their digestibility.

Steamed Oysters. Beard the oysters and put them with a little of the strained liquor in a small basin; cover and place the basin in a potato steamer and steam in the ordinary way till the oysters are hot. Do not keep them over the fire a moment longer than is necessary. Serve on a hot plate with lemon-juice and seasoning.

Stewed Oysters. Cover the oysters with hot milk and the strained liquor mixed and set the vessel in a saucepan of hot water, which should simmer round it till the oysters are hot. Serve quickly.

Arrowroot. This is a favourite invalid food, because it is easily digested and palatable. It must be remembered, however, that there is very little nourishment in it unless milk is used instead of water.

To $\frac{1}{2}$ oz. of arrowroot use $\frac{1}{2}$ pint of cold water and 1 teaspoonful of sugar. Mix the arrowroot with the cold water, adding the latter a little at a time, and stirring all the while to keep it smooth. Put the mixture into a pan with the sugar, and stir till it boils and thickens; then let it boil for three minutes and serve.

Gruel. Mix a tablespoonful of fine oatmeal to a smooth paste with cold water, add a little salt, and then add gradually a pint of boiling water, stirring all the time. Put it into a sauce-pan, bring it to the boil, and let it simmer for about $\frac{3}{4}$ of an hour. Stir from time to time to keep it from sticking to the sides of the pan. Add $\frac{1}{2}$ teaspoonful of sugar or $\frac{1}{4}$ of an ounce of fresh butter, and serve hot. Milk may be used instead of water.

Savoury Pudding. Required: a teaspoonful of corn-flour, a teaspoonful of bread crumbs, half a pint of beef tea, the yolks of two eggs and the white of one, and a pinch of salt.

Beat the cornflour to a smooth paste with a little water, and add it to the beaten eggs; mix well with the cold beef tea and bread crumbs, let it stand a short time, and then steam in a basin for about half an hour. Serve hot or cold.

Rusk Pudding. Required: 3 finger-rusks, an egg, a gill of warm milk, a little jam or stewed fruit.

Crumble the rusks into a buttered basin; beat the egg and milk up together, pour over and leave until the rusks are well soaked. Steam for about 20 minutes and serve with jam or stewed fruit.

Vermicelli Pudding. Required: 1 pint of milk, an egg, an ounce of vermicelli, half an ounce of white sugar, a little butter.

Rinse the vermicelli in water and put it with the milk over a slow fire and stir till it boils; then simmer for half an hour, stirring frequently. Let it cool and then add the beaten egg and sugar. Pour the mixture into a buttered pie-dish and bake in a gentle oven for 20 minutes.

Drinks for Invalids. Toast-water. Toast thoroughly the top crust of a stale loaf, put it in a jug and pour boiling water over it. Flavour with lemon or orange juice and let it stand till cold; then strain and serve Toast-water should be made fresh daily.

Barley Water. Wash 2 ozs. of pearl barley in cold water. Boil it for 20 minutes in $1\frac{1}{2}$ pints of water; strain the liquid off and flavour with lemon-peel and sugar.

A Posset is an old-fashioned drink, commonly used in cases of cold in the head; it is made as follows: Boil a pint of milk, and when boiling point is reached stir in a tablespoonful of treacle. Boil till the curd forms freely, then separate the curd and serve the posset as hot as possible.

Linseed Tea is used for coughs. Allow 1 ounce of linseed to a pint of boiling water. Add half an ounce of best liquorice, cut up small, and leave in a covered jug in a warm place for half an hour. Strain and serve.

Lemonade. Required: 2 lemons, 1 pint of boiling water, 1 to 2 ozs. of lump sugar. Wipe the lemons clean, take the rind off thinly, and put in a jug with the sugar. Squeeze the juice in and pour the boiling water over. Stir with a wooden spoon; stuff the mouth of the jug with a clean cloth and leave the lemonade to get cold.

Lemon Tea. Make some weak tea and pour it quickly from the leaves. Add an equal quantity of lemonade and sweeten to taste.

Whey is valuable in cases of dyspepsia and other ailments. It is often given to infants who cannot digest whole milk.

Alum Whey is made by adding a drachm of powdered alum to a pint of hot milk. The whey must be strained thoroughly from the curd.

Lemon Whey. Boil a pint of milk with a teaspoonful of lemon juice, then strain through muslin. Rennet or vinegar may be used instead of lemon juice.

QUESTIONS.

1. In a sick-room what uses are made of barley, beef, bread, eggs, lemons, isinglass, milk, rice, linseed? (*Scholarship*, 1895.)
2. You are instructed to feed a convalescent on stimulating

but easily digested food. Draw up an appropriate dietary for two days. (*Scholarship*, 1898.)

3. Name some cooling drinks suitable for a sick person, and show how you would prepare one of them. (*2nd Year Certificate*, 1895.)

4. Name some errors commonly experienced in arranging the diet of a sick person. (*2nd Year Certificate*, 1896.)

CHAPTER XXII.

INFECTIOUS DISEASES.

It is now generally known that certain diseases are caused by the presence within the body of definite poisons, which have entered from without, and which are capable of multiplying and of being given off from the body. Owing to the fact that the poisons can be communicated from one person to another, diseases so caused are termed **infectious**, the poisons being described as the agents of infection. The researches of science have proved that the infective agents are in all cases minute forms of life, known variously as **germs, microbes, bacteria**, or **micro-organisms**, each one consisting of a single cell, with an external covering of cellulose and internal living matter called protoplasm.

Micro-organisms differ very considerably in shape, being round, oval, rod-shaped, spiral, wavy, or thread-like. Each disease is characterised by its own special germ, the microbe of diphtheria, or instance, being quite distinct from that of enteric fever.

The Spread of Infection. It is impossible to enumerate all the ways in which the poison germs are conveyed from place to place and from person to person; but one of the most important factors is undoubtedly the **air.** The disease germs rise into the air and remain suspended, being blown about hither and thither, and subsiding as dust when the air is still. The poison of the disease is thus conveyed from one side of the street to the other, and in such channels as sewers is capable of being carried long distances. It is not known exactly to what extent infection can be carried by the air; scarlet fever and typhus fever can only be conveyed for short distances; whooping-cough and measles can infect at longer ranges, and the poison of small-pox is shown by experience to be capable of carrying the disease to a very considerable distance from its centre.

Articles of food, especially water and milk, are common means of spreading the infection of enteric fever, cholera, diphtheria, and tuberculosis, the germs in such cases being taken into the digestive tracts. Clothing, books, toys, etc., are fruitful causes of the spread of infection. Such articles, put away in cupboards and drawers, without being previously thoroughly disinfected have been known to retain the infection for years.

Rats, domestic pets, and even house-flies are known to convey infection from one place to another.

Carelessness and want of cleanliness in persons attending the sick are culpable causes of the spread of infection.

Prevention of Infectious Disease. It is clear that anything which will prevent the spread of the germs will prevent the disease, so in the case of an infectious disease our greatest attention should be given to this important point.

Notification. It should be borne in mind that every case of infectious disease must be notified to the Medical Officer of Health as soon as it occurs, by the medical attendant or person in charge, and any failure to do this is punishable by fine. By this means proper supervision of the case by the sanitary authority is secured, and the danger of infection lessened.

The diseases scheduled under the Infectious Diseases Notification Act of 1889 are: small-pox, diphtheria, membranous croup, cholera, enteric fever, typhus, erysipelas, relapsing fever, puerperal fever, and continued fever. Measles, whooping cough, or any other infectious disease may be added by the sanitary authorities, with the sanction of the Local Government Board.

Notification is valuable as affording a means of locating an outbreak of infectious disease, and of securing its proper treatment. It is plain, however, that notification alone will never suffice to stamp out infectious diseases, for many cases do not declare their true nature until after infection has been given off, while others are so mild as to escape notice altogether. This is more especially the case with diphtheria, where the sore throat is attributed to a cold. For this reason it is necessary in dealing with infectious diseases to practise both isolation and disinfection.

Isolation to be of any value must be complete; in other words, the patient and his nurse must be entirely separated from the rest of the household. This is easily managed in private houses of even moderate size, where a room on the top floor may be turned into the sick-room, but in business houses, workshops, schools, or the overcrowded dwellings of the poor isolation is practically impossible. In such cases the sick person should be removed to the fever hospital, not only that he may receive more skilled attention, but in the interests of the community.

Where isolation is practised at home, certain precautions are necessary to ensure success.

The door of the room should be kept closed or the space covered with a sheet kept saturated with a 5 per cent. solution of carbolic acid in water.

All carpets and hangings, and any unnecessary articles of furniture, should be taken from the room, so as to furnish more space and fewer hiding-places for the germs of the disease.

The ventilation of the room should be secured by keeping a small fire burning in the grate, and, as far as possible, windows open. The more fresh air there is in the room and in the house, the less chance there is of the disease spreading.

Soiled linen and all dishes and other utensils used in the sick-room must be disinfected before leaving it. Rags should be used in place of handkerchiefs, and burned as soon as done with.

Articles brought to the room should be given to the nurse at the door, and on no account should any person enter the room save the nurse and the doctor.

The nurse's dress should be of washing material; heavy woollen fabrics should not be worn.

Excretal matter should be received in bed-pans containing some disinfectant, and, after being well mixed with the disinfectant, should be left for 15 minutes for the disinfecting action to take place, and then be either burnt, buried, or thrown down the water-closet. In the latter event the closet should be well flushed after the discharge.

The duration of isolation varies with the disease. In all cases it should be practised as soon as the nature of the disease declares itself, and should be continued till the medical attendant gives permission to the patient to mix with others.

Disinfection must run hand in hand with isolation. By disinfection is meant the destruction of the germ or agent of infection. It is, unfortunately, a common error to regard as disinfectants substances which have no power as such, but are merely capable of arresting the growth of microbes, or of destroying foul odours.

To practise disinfection efficiently it is necessary to be able to distinguish between deodorants, antiseptics, and disinfectants.

A Deodorant is a substance which removes a foul smell, frequently by veiling it. It has no power over germs and is worse than useless as a disinfectant, because it gives people a false sense of security. Eau de Cologne, sanitas, camphor, and charcoal are good examples of deodorants.

An Antiseptic is capable of delaying putrefaction and will arrest the growth of microbes. Condy's fluid, vinegar, and common salt are well-known antiseptics.

Disinfectants are of a more powerful nature; they vary considerably in nature and application. Possibly the best disinfectant is **fire**, and where it is practicable the best plan is to burn infected articles.

Next to this, **steaming** at a high temperature is the best way of disinfecting bedding and clothing. Superheated steam must be used and applied under pressure in specially constructed apparatus. Under these conditions the disinfection of bedding, clothing, etc., can be satisfactorily accomplished.

Exposure to hot air or **baking**, though sometimes practised for disinfecting purposes, can scarcely be regarded as a sound method; for unless the air be raised to a temperature which damages the materials, the heat is not great enough to kill the germs of disease.

In cases where steaming is not practicable, bedding and clothing should be boiled or allowed to soak in a disinfecting liquid for 24 hours. The following are instances of disinfectants for clothing, bedding, crockery, etc.:

(*a*) Chloride of lime mixed in the proportion of 2 ozs. to 1 gallon water.

(*b*) Bichloride of mercury, $\frac{1}{2}$ oz.; hydrochloric acid, 1 oz.; aniline blue, 5 grs.; water, 3 galls.

(*c*) Carbolic acid, 5 parts to 100 of water.

For drains, 1 lb. sulphate of iron to 1 gallon of water forms an excellent disinfectant. It must on no account be used for clothing, owing to its staining properties.

For air, one of the best disinfectants is **sulphurous acid,** produced by burning sulphur in the infected room. At least 3 lbs. of sulphur must be allowed for every 1000 cubic feet of air space, and it is preferable to use a larger amount.

To disinfect a Room. When the patient has been pronounced quite recovered, and able to leave the sick-room, the room itself must be disinfected in the following manner:

(1) Enter the room, and throw the windows wide open.

(2) Collect bedding and clothing, and send them to be baked or steamed in a disinfecting chamber.

(3) Shut the windows, and paste brown paper over the crevices, fireplace, or any other opening, but throw open all cupboards.

(4) Put a pail containing a little water in the middle of the floor, and place an iron vessel, such as an old saucepan, over the pail by resting it on a pair of tongs or a large flower-pot turned upside down in the pail.

(5) Into the sauce-pan put broken pieces of roll-sulphur, and set them alight by dropping a live coal into the pan.

(6) Leave the room quickly, shut the door, and paste paper over the crevices and keyhole outside.

(7) Allow the sulphur to burn for a few hours, then enter the room, open wide the windows and doors, and allow air to circulate freely.

(8) Strip off the wall-paper and burn it.

(9) Lime-wash the ceiling and walls, and wash the furniture and woodwork with soap and water containing carbolic acid or chloride of lime.

(10) If possible, leave the room unoccupied for a few days.

Other Gaseous Disinfectants. (*a*) *Chlorine*, given off from chloride of lime moistened by a little dilute sulphuric acid and put in a shallow dish. (*b*) *Nitrous Acid*, evolved from copper, nitric acid, and water. To disinfect 1000 cubic feet of air space allow 1 oz. copper shavings, 3 ozs. nitric acid, 3 ozs. water. Put the copper into a jar and pour the acid and water over.

Illegal Actions. In this connection it is well to remember:

(1) That any person suffering from an infectious disease who enters a public vehicle without first notifying the driver;

(2) Or who mixes with healthy people in a public place, or who allows an infected person in his charge to do so;

(3) Or any person who lets an infected house or room before it has been disinfected;

(4) Or any driver who neglects to have a vehicle immediately disinfected after use in connection with an infectious disease—commits an illegal act, and is liable to prosecution and fine, not exceeding £5.

Incubation and Infection. The infectious diseases most prevalent in England are measles, erysipelas, mumps, whooping-cough, scarlet fever, chicken-pox, diphtheria, enteric fever, small-pox, and tuberculosis. Less common in this country are cholera and typhus. In each disease there is an interval between the reception of the poison and the first outward signs. The germs need time to develop in the body before they begin to make their presence felt. The period of **incubation**, as this interval is called, varies according to the disease.

In some diseases, small-pox for instance, it is almost invariably of the same length; in others the period varies, as shown in the table below. It is essential to the successful treatment of infectious diseases to know the period of incubation in each disease, inasmuch as it enables one to decide that when a person has been exposed to infection, after the lapse of a certain number of days, it is safe for him to mix with others.

The following table shows the period of incubation and the duration of infection in the various diseases:

Disease.	Period of Incubation.	Duration of Infection.
Measles, . . .	8 to 20 days,	4 weeks.
German Measles, .	6 ,, 14 ,,	3 ,,
Mumps, . . .	14 ,, 22 ,,	3 ,,
Whooping Cough, .	4 ,, 14 ,,	8 weeks or until the cough has ceased.
Scarlet Fever, . .	1 ,, 6 ,,	6 to 8 weeks.
Chicken-pox, . .	10 ,, 14 ,,	3 weeks.
Diphtheria, . .	1 ,, 8 ,,	6 ,,
Enteric Fever, . .	8 ,, 14 ,,	6 ,,
Erysipelas, . . .	1 ,, 5 ,,	1 week.
Small-pox, . .	12 days,	6 weeks.
Tuberculosis, . .	Not known,	Throughout the disease.
Cholera, . . .	1 to 5 days,	3 weeks.
Typhus Fever, . .	6 ,, 14 ,,	4 ,,

Measles begins with all the signs of a bad cold in the head—the eyes water, and there is frequent sneezing, with some degree of fever. About the end of the third day a red rash appears on the chest, face, hands, and other parts, rapidly spreading over the whole body. The important thing to remember in the treatment of measles is that the patient must be kept warm and free from all fear of chills.

Mumps comes on with feverishness, pain near the ear, and swelling of the parotid salivary glands, which causes lumps at the side of the neck and in front of the ear.

Whooping-cough is distinguished by the crowing noise the child makes in drawing in his breath after an attack of coughing, and the sickness which accompanies it.

All three of these diseases are very infectious in the early stages, even before the characteristic symptoms have made their appearance. Especial care should therefore be taken to isolate ailing children whose appearance is at all suspicious.

Scarlet Fever. The symptoms of this disease are feverishness, with vomiting and sore throat. The skin is hot and dry, and within twenty-four hours a red rash appears on the chest and spreads to all parts. Scarlet fever is infectious even before the rash appears, and the infection continues throughout the disease until the skin has finished peeling. Owing to the fact that the fine, bran-like scales of the skin attach themselves particularly to clothing, books, toys, etc., infection lingers about such articles for months, and even years. In this disease it is wise, therefore, **to burn** all infected articles.

Scarlatina is a name often used for mild cases of scarlet fever. You must remember, however, that it is the same disease, and in every way as infectious.

Chicken pox is usually a mild disease, and comes on without any previous sickness, except perhaps a little feverishness. The rash comes out in pimples, turning rapidly to clear vesicles, and continues to appear for four or five days.

Diphtheria is heralded by sore throat and a general feeling of weakness. After a day or two white patches appear in the neighbourhood of the tonsils, and, in severe cases, join to form one continuous membrane. The infection of diphtheria lies in the breath and the discharge from the mouth and nostrils.

Typhoid Fever, also called **Enteric Fever,** attacks the stomach and bowels, and the infection lies in the intestinal discharges. It is essential, in cases of this disease, that all such excretory matter be thoroughly disinfected before being cast into the drain, and that the closet and drains be flushed frequently, as well as disinfected.

The poison of typhoid fever, as a rule, enters the body with drinking-water or milk. In all outbreaks of typhoid, drinking-water should be boiled and milk should invariably be thus treated, if infection would be avoided.

Consumption. The nature and prevention of consumption, or tuberculosis of the lungs, has attracted much attention of late. It is now generally believed to be an infectious disease, the germs being given off with the expectorated matter. To prevent consumption, it is necessary to have well-ventilated rooms and plenty of sunlight, and to keep up the general health. Here, again, milk is guilty of spreading the disease, and we find another reason for boiling it before use.

Small-pox, the most terrible of infectious diseases, is infectious throughout its course. It is one of the most repulsive of diseases; and where it does not kill, it marks its victim for life by a pitted skin, a ruined complexion, and frequently the complete loss of sight.

Happily, we in these days are able to prevent it by means of **vaccination**, a mild form of cow-pox communicated by lymph taken in the first instance from an infected calf.

That persons who have been successfully vaccinated are, as a rule, not susceptible to the small-pox poison, has been conclusively proved in thousands of cases, and to vaccination alone is due the rarity of small-pox at the present time.

Some people oppose vaccination on various grounds, into which it is not necessary to enter; but no one who has studied the question can doubt its efficacy in preventing small-pox.

Erysipelas is an inflammation of the skin which spreads and is accompanied by fever. It is especially favoured by ill-ventilation, over-crowding, want of cleanliness, and defective sanitary arrangements.

Questions.

1. What means should be taken by teachers and parents in a case of scarlet fever (when the schools have not been closed) to prevent the spread of the disease? How would you purify the schools afterwards? (*Scholarship*, 1889).

2. What precautions would be advisable when nursing a case of scarlet fever? (*Scholarship*, 1899).

3. What do you mean by the term "disinfect"? Name some disinfecting agents and describe how they are used. (*Scholarship*, 1900)

CHAPTER XXIII.

AILMENTS AND ACCIDENTS.

Coughs and Colds. In all cases coughs are produced by chills, which may be contracted in various ways. For instance, if a person after sitting in a hot room and perspiring freely goes out into colder air without putting on additional clothing, his body becomes chilled externally; the blood rushes inwards to the internal organs, which, being overcharged with blood, become congested and the symptoms of cold follow in their course.

Sitting in a Draught is another common cause of cold; and **wet feet** and **wet clothes** are equally fruitful in this respect. Little harm is done by wet clothes if they are changed as soon as exercise ceases; it is **sitting** in damp clothes that does the harm, for, as the moisture in them evaporates, it robs the body of heat, and during rest, as you know, insufficient warmth is produced to make good such loss.

Sleeping in a Damp Bed will rarely fail to produce chills, which frequently have terrible results. In such instances the warmth of the body is used up in drying the damp linen by drawing out its moisture in the form of vapour, and the sleeper awakes to find himself chilled to the bone. The wearing of underlinen which has been insufficiently aired produces a chill in the same way.

Symptoms of Cold. A cold manifests itself in various ways. What is known as "**cold in the head**" is accompanied by sneezing, running at the eyes and nose, a parched condition of the mouth and throat, a stuffiness in the nose, and headache; and if the cold is severe, the sufferer will have fits of shivering.

Cold in the Chest is more serious. Sometimes it follows a cold in the head, the inflammation spreading downwards into the air passages of the lungs; but not infrequently the lungs are attacked in the first instance.

The symptoms of such a cold are a tightness in the chest, and possibly some difficulty in breathing. There is, too, an accumulation of phlegm, which can only be dislodged by coughing. In severe colds of this kind the patient is often feverish.

Treatment of Colds. In the early stages a cold may be cured by taking 4 or 5 drops of spirits of camphor on a lump of sugar at short intervals, or oil of eucalyptus may be inhaled. In bad cases the sufferer should keep in a warm room and wear extra clothing. It is useful, too, to induce perspiration just before going to bed by taking hot drinks or hot gruel and putting the feet into hot mustard and water.

To Cure a Cough. An ordinary cough which is merely the result of cold may be cured by drinking hot linseed tea and keeping in a warm room.

Coughs arising from some disease of the lungs can only be treated by the doctor.

It is important not to neglect a cough, but by the doctor's aid to find out at an early stage whence it arises. In far too many instances has that dread disease consumption gained a firm hold because the victim attached no importance to a troublesome cough until too late.

A Sore Throat is a frequent result of a chill. It is, as a rule, accompanied by hoarseness and a feverish condition of the body.

The sufferer should be kept in a warm room, and gargle with vinegar and water. Aconite is useful if the patient is feverish.

Headaches are of various kinds, and arise from various causes. What is known as a **sick headache** or bilious headache comes from a disordered condition of the liver and bowels. Indigestion of any kind is usually accompanied by headache.

Nervous Headaches are brought on by worry, noise, fatigue, and undue excitement, and the dull ache is varied by sharp, shooting pains.

Neuralgic Headaches are the result of cold and a reduced state of health. Headaches, too, are often caused by confinement in an impure atmosphere.

To Cure a Headache. The cure differs with the cause. A bilious headache may be relieved by aperient medicines, which will open the bowels and probably remove the cause of the derangement. Nervous headaches are often cured by complete rest and quiet in a darkened room, with perhaps the addition of a nerve tonic. If nervous headaches are constant, the sufferer should avoid excitement and fatigue.

Neuralgic headaches can only be removed by avoiding all exposure to cold, and by improving the general health. Quinine is a useful tonic in such cases.

Headaches brought on by breathing impure air are quickly cured by a brisk walk in the open air.

Close application to study is a frequent cause of headache. The time devoted to study should be judiciously broken by intervals for bodily exercise, during which the strain on the mind is removed.

Chilblains are the result of defective circulation, and consequent cold hands and feet. To prevent them the extremities should be kept warm by suitable clothing and plenty of exercise. The application of tincture of iodine will relieve unbroken chilblains. Broken chilblains are more difficult to deal with; they should be poulticed with bread at night and dressed with spermaceti ointment in the morning.

Chapped Hands may be easily prevented by keeping the hands warm and the skin supple. The latter may be secured by carefully drying the hands after washing and rubbing in vaseline, glycerine, and rose water, or any oily substance at night.

Stomachache is sometimes the result of cold and sometimes of overeating. The application of a hot bran bag or hot flannels will give relief, and sometimes an aperient will be necessary.

Burns and Scalds. In the treatment of accidents of this character nothing is so valuable as **presence of mind**, a term which signifies self-control and a power to act for the best in unforeseen circumstances. And when presence of mind is backed up by knowledge, precious indeed is its possession. In burns and scalds it is necessary to act with promptitude, for every moment's delay adds to the gravity of the accident.

Remember that flames mount upwards, so that in the case of a dress or pinafore catching fire the flames will speedily envelop the whole person. The first thing to do in a case of this kind is to put the burning child on the ground so that the flames rise away from the body, then speedily wrap it round with any woollen article which comes first to hand, say a rug, table-cloth, or cloak.

Fire Drill. It is a good plan for teachers to allow their classes to practise a kind of fire drill. On the word of command let one of the scholars rush from her place crying "Fire." Two others immediately put her down on the ground, while one or two more run for cloaks and jackets to smother the flames, taking care, however, not to smother the girl at the same time by covering up her face.

If school children could be made familiar with some such drill as this they would be ready to act in case of accident, and there would be less loss of life from fire among small children.

Treatment of Burns and Scalds. In a scald there are no flames to be put out, but it is just as important to treat it with promptitude. A burn or scald which covers a large surface is more dangerous than a small but deep one, for the nerves which are found so plentifully in the skin become affected to such a degree that the sufferer is in danger of dying from shock. To prevent collapse of this kind it is necessary to administer almost immediately a stimulant such as brandy.

The actual dressing of the injured parts requires great care and delicacy. The clothing must be removed gently, and where it has stuck to the skin it must not be torn away, but cut round. The best application is boracic acid ointment—a mixture of boracic acid and vaseline—spread on lint or soft linen, which should be laid carefully over the injured parts and covered with a layer of cotton wool, the whole being kept in place by bandages. This should be changed every day; the pain occasioned by changing will be relieved if the burn is bathed in warm water and borax (1 teaspoonful of borax to a pint of water).

If large blisters form, they should be snipped at one end with a sharp pair of scissors and the fluid pressed out; small blisters are best let alone.

In severe cases it is, of course, necessary to call in medical aid.

Flannelette a Source of Danger. It does not seem to be generally recognised that flannelette is a cotton material, and exceptionally inflammable. To prove that this is so, put a small piece in the fire and watch how readily it blazes. Now that flannelette is such a popular material for clothing, especial care should be taken with regard to fire.

Cuts and Wounds. Cuts are of various kinds. There is a **clean** or **incised** cut, such as that made with a sharp knife; there is the **punctured wound**, made by a sharp pointed instrument; and there is the **torn** or **lacerated wound**.

In each case the first thing is to see that the wound is free from dirt or other foreign matter. Sponging with warm water will increase the flow of blood and thus help to cleanse the wound. When the wound is clean, stop the bleeding as speedily as may be by the application of cold water, which causes the blood-vessels to contract. The edges of an incised cut may be kept together by the application of transverse slips of sticking-plaster. Cuts of a more complex character should be covered with lint soaked in iodine lotion, covered with oiled skin to keep the dressing moist, and then bandaged.

Bleeding. If the bleeding is from some great blood-vessel, the loss of blood must be stopped immediately, or death may speedily follow. Bleeding of this kind is stopped by pressure on the cut vessel, and to know how to apply it successfully one must be able to decide whether the blood issues from a vein or an artery.

Arterial Bleeding may be distinguished by the bright red colour of the blood, and the jerks or spurts in which it issues from the wound.

Venous Bleeding, on the other hand, is slow and continuous, and the colour of the blood is dark purple.

FIG. 77.—IMPROVISED TOURNIQUET.

When an artery has been cut, pressure must be applied on the side of the wound **nearest the heart**, thus cutting off the supply. If the bleeding be venous, pressure must be exerted on the side **away from the heart**, for blood in the veins moves to the heart. It is often found that by pressing one thumb upon the other the bleeding may be stopped; but if this fails, a handkerchief tightly twisted round by the help of a stick or lead pencil, as shown in the illustration, will generally prove successful (Fig. 77).

Bleeding from the Nose may be stopped in various ways; holding up the arm is sometimes effectual, and bathing the forehead and nose in cold water answers well.

Bruises. A bruise is, as a rule, caused by a fall or blow. It makes its first appearance in a red swelling, which afterwards becomes much discoloured, owing to the rupture of the small blood-vessels, which lie near the surface of the skin, and the consequent escape of blood.

The treatment consists in the immediate application of cold water; and afterwards **arnica** may be applied, but only **if the skin is unbroken.**

A Sprained Wrist or Ankle should be bathed with hot water, bandaged carefully, and kept at rest until the swelling has gone down.

Bites and Stings. Fortunately for us bites and stings in England are rarely dangerous to life. In the case of a bite from an animal, bathe the part well in warm water to encourage bleeding, the object of this being to wash out from the wound any venom or foreign matter which might prove harmful. If there is any suspicion of the animal being mad, go to a doctor at once and have the wound burned with caustic. Stings are of less moment. The irritation they cause may be allayed by the application of ammonia. If a bee or wasp has left its sting in the flesh, it must be pulled out.

Accidents from falls or being run over require to be treated according to the nature of the injury. Except in very slight accidents it is always advisable to call in medical aid, that the extent of the injuries may be known at once. There are, however, certain steps to be taken while the doctor is being procured. If there is bleeding, it should be treated as described above; broken bones should be laid in position and secured by splints and bandages. In the absence of proper apparatus, walking sticks, umbrellas, or flat pieces of wood will serve instead of splints, and handkerchiefs take the place of bandages. A stretcher may be improvised from a door or shutter.

If a bone is dislocated it should be left to the doctor. Unskilled treatment of dislocations is most dangerous.

Fits are of various kinds. They may be fainting fits, epileptic fits, apoplectic fits, or hysterical fits.

Fainting Fits are characterised by the extreme pallor of the face and partial or complete loss of consciousness. They may be caused by sudden shock or severe pain, which so weakens the action of the heart that the blood leaves the head. The treatment is, naturally, to restore the blood to the head, and to this end the patient should be placed on his back, preferably with his head lower than the rest of his body; or he may be put into a chair and his head thrust down to the level of his knees. The clothing should be loosened, fresh air be allowed to freely circulate around the patient, and a teaspoonful of brandy or sal volatile administered.

Epileptic Fits are accompanied by unconsciousness and convulsions, during which the sufferer is apt to hurt himself. The treatment is to loosen all tight clothing, put the patient on the floor on a mattress, and watch that he does not come to harm. A cork, or the handle of a spoon wrapped in a handkerchief should be put between the teeth to prevent the tongue being bitten. Avoid administering stimulants. The chief danger from epileptic fits lies in the fact that the sufferer often falls into the fire, or, if the fit occurs in bed, suffocates himself among the pillows. Persons subject to epilepsy should be carefully guarded.

Convulsions in infants are not unlike epileptic fits. They are caused by irritation of the digestive tract, due to improper feeding or imperfect digestion and by teething. The child should be put immediately into a hot bath, kept there for a few minutes, and then rolled in a hot blanket. A dose of castor oil will serve to remove the cause of the disturbance. Medical aid should in all cases be summoned.

Apoplectic Fits are marked by unconsciousness, a purple condition of the face, heavy breathing and paralysed limbs. A doctor should be sent for at once; in the meantime, the head of the patient may be slightly raised and ice applied. On no account give stimulants.

Hysterical Fits are caused by lack of control over the emotions. The patient sobs, shrieks, and laughs wildly and may throw herself about. The treatment is to affect sternness and to apply cold water to the face. There is, as a rule, no danger to be apprehended.

Unconsciousness may, in addition to the above causes, be due to injuries to the brain, poisoning from drugs, drunkenness, etc. Mistakes are sometimes made in ascribing to drunkenness the unconsciousness due to more serious causes.

Suffocation indicates an obstruction to free respiration. The treatment is (*a*) to remove the obstruction, (*b*) to induce natural respiration by having recurrence to artificial respiration for a time.

Suffocation may be caused by **hanging.** In this case the first thing to do is to cut the patient down and loosen the rope; then, if necessary, resort to artificial respiration as described below.

Or it may be produced by **the presence of a solid body in the throat,** such as a cherry-stone, a piece of meat, or a small bone. It is urgent in such cases to remove the obstruction without loss of time. Try to reach the object with the finger, and, failing this, send for the doctor at once, and try to excite vomiting.

Suffocation is also due to **poisonous gases** such as an escape of coal-gas into a bedroom, or an accumulation of carbonic acid at the bottom of a disused well or mine. The treatment is to take the patient at once into the open air, loosen any tight clothing, and perform artificial respiration until breathing is restored.

Drowning is perhaps the most common cause of suffocation. As in all other cases it is important that no time be lost in restoring consciousness and respiration.

The treatment is as follows:

1. Cleanse the mouth from mud, weeds, etc.

2. Draw the tongue forward, and if possible keep it forward so as to keep open the air passage to the lungs.

3. Put the patient on his back with a firm cushion under his shoulders to give support.

4. Practise **Artificial Respiration.** There are several methods of doing this, but **Silvester's Method** is most commonly used.

In this method inspiration is effected by grasping the patient's arms behind the elbows and raising them slowly

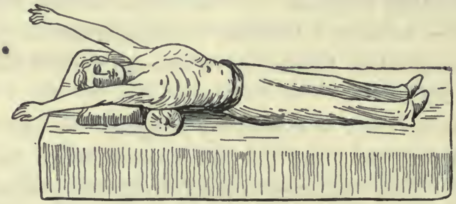


FIG. 78.

but forcibly above his head (see Fig. 78). The chest is thereby expanded and air is drawn into the lungs. Expiration is produced by bringing the arms down and pressing them firmly against the sides of the chest (see

FIG. 79.

Fig. 79) so as to force the air out of the lungs. It is important that these movements be performed steadily at regular intervals at the rate of 15 per minute. They should be persisted in until natural breathing results, or at least for 30 minutes.

5. While artificial respiration is taking place other persons may assist by rubbing the legs, putting hot bottles

to the feet, and wrapping the legs in hot blankets so as to assist the circulation. Smelling salts applied to the nostrils may help to induce natural breathing.

6. When consciousness is restored the patient should be put into a warm bath and then to bed; and when he is able to swallow, a cup of hot strong coffee may be given. If breathing is still difficult, mustard plasters may be put to the back of the chest.

Poisons. As in drowning, cases of poisoning frequently call for prompt action and practical knowledge. To deal adequately with a case of poisoning it is necessary to know something of the nature of the different poisons likely to be met with.

Poisons are variously classified by different writers. One of the best is as follows:

1. Corrosive Poisons.
2. Irritant Poisons.
3. Poisons acting on the general system.

1. **Corrosive Poisons.** These include corrosive sublimate, oxalic acid, chloride of zinc, sulphuric acid (oil of vitriol), hydrochloric acid (spirits of salt), caustic soda, and caustic potash. Any of these poisons destroys the mucous lining of the mouth, gullet, and stomach, causing intense burning and pain.

Treatment. On no account administer an emetic in a case of corrosive poisoning; such a practice increases the harm done to the walls of the stomach. In cases of acid poisoning give an antidote in the form of an alkali, such as chalk, magnesia, or even a piece of plaster from the wall or ceiling, powdered and mixed with milk, and followed by olive oil.

In poisoning from carbolic acid give raw eggs in milk, followed by olive oil and stimulants; the latter are necessary to prevent collapse.

Where a poison of an alkaline nature has been taken weak vinegar and water or lemon-juice should be given freely at first, and olive oil and milk afterwards.

2. **Irritant Poisons** include arsenic, salts of copper, salts of lead, and other metallic salts. They are less dangerous than the corrosive poisons. The symptoms they produce are vomiting, pain in the abdomen, diarrhoea and subsequent inflammation.

Treatment. It is urgent to get the poison out of the system as quickly as possible, and to this end an emetic is given.

Emetics. The best emetic is about half a teaspoonful of sulphate of zinc in warm water. Failing this an emetic quickly prepared consists of a dessert-spoonful of mustard mixed in a cupful of warm water; or salt and warm water may be used. Vomiting may be induced by tickling the back of the throat with a feather or with the finger.

In poisoning from **salts of lead** the emetic should be followed up with doses of Epsom salts until the bowels act. When **copper** is the poison, castor oil should be administered after the emetic.

Phosphorus poisoning from sucking the ends of matches or taking rat poison causes pain in the throat and stomach and vomiting. After an emetic has been given, administer large doses of magnesia or chalk in water, or small quantities of turpentine. Do not give oil or fat.

3. **Poisons acting on the General System.** (*a*) **Narcotics** or sleep-producing poisons act on the brain, causing headache, drowsiness, stupor, and insensibility. The commonest examples of this class are **opium, alcohol,** and **chloral hydrate.**

Treatment. In the case of opium or morphia poisoning give an emetic at once; then rouse the patient by repeated cold douches to head and neck. Keep him walking about and let him drink strong coffee, the object being to prevent sleep. If all other efforts prove useless administer a shock from a galvanic battery, and if breathing ceases perform artificial respiration.

For **chloral** poisoning administer an emetic and then give stimulants freely. If necessary resort to artificial respiration.

(*b*) **Belladonna**, commonly known as deadly nightshade, is a poison which produces sleep, and also gives rise to delirium and disordered vision. Owing to the attractive appearance of its berries, belladonna poisoning often occurs in children. The treatment is similar to that for other narcotics.

(*c*) **Hemlock** is a vegetable narcotic which produces paralysis.

(*d*) **Prussic Acid** kills by shock to the nervous system. Its action is rapid, so time must not be spent in preparing an emetic. Dash cold water over the head immediately, rub the hands and feet, and if necessary try artificial respiration.

Numerous cases of accidental poisoning occur every year through carelessness on the part of responsible persons. It should be a rule in every house to keep poisonous substances in blue-ribbed bottles of peculiar shape, so that they may be distinguished from ordinary medicine bottles even in the dark. Every bottle should be clearly labelled "Poison," and if the label be destroyed it should be immediately replaced.

Children should be made familiar with the appearance of poisonous plants. This can be done in the nursery and in the schoolroom, partly by the aid of coloured pictures, but best of all by object lessons, with the plants themselves for illustration.

Questions.

1. If a child in your school was severely scalded, what would you do, and why would you do it? (*Scholarship*, 1892.)

2. Supposing the clothes of a girl in your school took fire, describe accurately what you would do and what you would not do. If you had to carry her home, how would you improvise a stretcher? (*Scholarship*, 1891.)

3. What would you do in the following cases of accident in school: (*a*) a cut finger, (*b*) an epileptic fit, (*c*) nose bleeding, and (*d*) scalding? (*Scholarship*, 1894.)

CHAPTER XXIV.

HOUSEHOLD EXPENDITURE AND INVESTMENT OF SAVINGS.

Management of Money. The comfort of the home depends very largely upon the skill displayed by the housekeeper in managing the money at her disposal. Where the income is large it is easy to secure a life free from the trouble of "making ends meet"; but where the weekly wages barely suffice for the needs of the family skilful management is indeed necessary. It is, therefore, with the expenditure in the homes of working people that this chapter will deal.

Some Guiding Rules. The golden rule of housekeeping is **to keep the expenses well within the income.** Though this is difficult where the income is small and the needs of the household great, yet if the housekeeper is to have a quiet mind and freedom from worry she must find some way of compassing it. To this end she must **keep a strict account of all money spent or paid away**; she must also **pay ready money** for everything, or at the most have weekly accounts.

The credit system of purchasing has been the ruin of many a working man's home. When goods can be obtained by ordering without payment at the time, there is the temptation of buying articles that one can do without. Few women are strong enough to resist this temptation altogether. The system of **paying by instalments**, though much in vogue among the working classes, is not to be recommended. Articles so purchased are invariably much dearer than ready-money goods, while the small sum of money to be paid to gain possession of the article leads purchasers almost unwittingly into extravagances they cannot afford.

The Division of the Income. It may be of use in the management of money to know what proportion of the income should be allotted to the various needs. A plan which has been found to work satisfactorily is to divide the income into twentieths ; take 4 for rent, taxes, etc., 10 for food, fuel, and light, 4 for clothing, and 2 for savings. Such a division makes no provision for books, education, or amusements. It will probably be found that money can occasionally be spared for these purposes from the food or clothing allowance. In actual practice the housekeeper will, no doubt, find it necessary to modify the above division according to her individual needs.

Small Savings. The urgency of saving from even the smallest income cannot be too strongly insisted upon. Sickness, death, accidents, loss of employment, or troubles in some other form, come into every house at some time or other, calling for a reserve fund of money to meet the contingency. And even apart from this, the satisfaction of knowing that there is a sum of money ready to hand when wanted more than makes up for self-denial expended in saving. Children should be trained to habits of thrift from their earliest years. Habits thus formed while young are likely to cling through life.

Tables of Expenditure. Complicated printed household account-books may be bought from any stationer, but it is more economical as well as more useful to obtain a cloth-covered note-book, with simple rulings for money, in which each purchase may be entered as it is made. An example of a page from such an account-book is given in the following "model" expenditure of **an artisan earning 30s. per week and having a wife and two children:**

Rent, Taxes, etc.,	£0	5	6
Fuel,	0	2	6
Light,	0	0	6
Meat,	0	4	0
Bones and Suet,	0	0	6
Bread,	0	2	0
Flour,	0	0	8
Tea,	0	0	9
Sugar,	0	0	8
Cheese,	0	0	6
Butter	0	1	0
Peas, Rice, Sago, etc.,	0	0	4
Lard,	0	0	4
Currants, Lemon-peel, etc.,	0	0	4
Vegetables,	0	0	6
Salt, Pepper, Mustard, etc.,	0	0	1
Milk,	0	1	9
Cleaning Materials, Repairs, etc.,	0	0	6
Clothing,	0	4	0
Savings,	0	3	0
Books and Amusements,	0	0	7
Total,	£1	10	0

In the country the conditions of living differ considerably from those in the town. Wages are much lower, but rent and food are less costly, clothing keeps clean and lasts longer, and wood can frequently be obtained for nothing.

Model expenditure of a farm labourer with wife and two children. Wages 12s. 6d. per week.

Rent,	£0	1	6
Coal and Lighting,	0	0	8
Meat,	0	1	6
Flour,	0	2	6
Suet,	0	0	4
Tea,	0	0	5
Sugar,	0	0	6
Cheese,	0	0	6
Butter,	0	0	6
Peas, Rice, etc.,	0	0	4
Milk,	0	0	6
Salt, Pepper, etc.,	0	0	1
Cleaning Materials,	0	0	2
Clothing,	0	2	0
Savings,	0	1	0
Total,	£0	12	6

Vegetables are almost invariably grown in the cottage garden; a pig or a few fowls are often kept at small expense; on farms where butter is made skim-milk can sometimes be bought at a low price.

Expenditure of a Teacher. The arduous work of teaching entails so much physical strain that, in apportioning her income, a school-mistress must bear in mind the necessity of providing for a possible breakdown; at the same time she must remember that prevention is better than cure, and to this end secure comfortable apartments, good food, and enjoyable holidays, which will do much to keep her in health.

It will, as a rule, be found best for the average school-mistress to board with a family, sharing the family meals, even if she has her own sitting-room. In this way a greater variety of diet can be obtained and the food be made more appetising.

Expenditure of a Teacher earning £70 per annum.

Board and Residence at 14s. per week,	£36	8	0
Washing,	3	0	0
Clothing,	10	0	0
Books, Papers, etc.,	2	0	0
Classes, Lectures, etc.,	1	0	0
Savings,	10	0	0
Holidays,	5	0	0
Charities,	1	10	0
Amusements,	1	2	0
Total,	£70	0	0

General Remarks on Thrift. The thrifty housewife will not only make up her mind to save a certain sum weekly, but will carry the principle of thrift into every department of house-keeping.

In dealing with **Food** she will purchase good, wholesome articles, for there is no economy in buying food which makes the family ill, but she will at the same time recognise that some foods are much dearer than others. Practical knowledge of this kind is only gained by experience, but after a very short time she will be able to distinguish by the help of her weekly accounts cheap foods from expensive foods. Skilful cooking is a great aid to economy. A clever cook will make dainty dishes from scraps which an ignorant or wasteful cook would throw away.

In purchasing **Clothing**, the truly thrifty method is to buy good clothes which will stand hard wear, and then to take care of them. Children should be taught to change their best clothes when they come into the house; little children should wear over-alls; and the habit of keeping clothes as free as possible from spots should be formed early. With a little trouble and some skill old clothes of good material can be cleaned and altered to great advantage.

With regard to **Furniture** the same rule holds good, viz.: buy only good articles and take care of them. Keep the furniture well polished, and do not allow children to knock it about or to jump on upholstered chairs and couches. If children are taught from the first to respect furniture they will acquire a valuable habit appreciated by all who have to do with them.

The thrifty housewife will wage war against moths, and by cleanliness, ventilation, and vigilance see that her blankets, heavy curtains, rugs, and carpets do not become moth-eaten. Various substances which aid in keeping moths away may be bought of any chemist and laid among the folds of materials stored away.

Thrift with respect to **Fuel** and **Light** must not be practised at the expense of health. It is no economy to sit in cold and ill-lighted rooms and contract chills and damaged eye-sight. It is, however, an unnecessary extravagance as well as a danger to leave a large fire burning in the grate when the sitting-room is vacated for the night. In districts where coal is dear, coke may be used to advantage to mix with the coal. A coke fire is hot, bright, and clear, but unless the ventilation of the room is good, the air is apt to become too dry and to cause headaches, owing to the carbonic oxide given off by imperfect combustion of the coke. In country places, where wood can often be had for the trouble of collecting, little coal need be used.

Thrift in **Lighting** may be practised by care in turning gas jets low in unoccupied rooms, and by putting out lamps and candles as soon as they are done with.

Investment of Money. If it is necessary to save money, it is equally necessary that the savings be deposited in a safe place. Money makes money, hence it is not difficult to find persons who are willing to pay a small sum annually for the loan of a larger sum, at the same time guaranteeing the safe keeping of the deposit. Money thus paid for a loan is known as **interest**, the loan itself being described as the **principal.**

Though all financiers wish their own particular schemes to be considered safe investments, and offer interest at varying rates to investors, it must be understood that as a rule a moderate rate of interest is alone compatible with safety. Modes of investment offering a high rate of interest require strict investigation before faith can be put in them.

The Teachers' Provident Society. For teachers an easy means of investing small savings and providing for sickness and old age is furnished by the Teachers' Provident Society, which was founded in 1878 by the National Union of Teachers. Members may join for any one of the benefits offered, such as sick pay, pension, life assurance, or endowment, or they may join for all. By a payment of 2s. 1d. per month, a member joining at the age of 21 would receive £1 per week during sickness. At the end of six months, if sickness continues, the payment is reduced to 10s. per week; and at the end of a year to 5s. per week. The society is entirely managed by teachers, and management expenses are kept very low.

The Post Office Savings Bank. For the small savings of working people the safest and most convenient place of deposit is undoubtedly the Post Office Savings Bank. The bank is under Government control, business being transacted, as the name implies, through the medium of the Post Office. Interest is paid on every complete pound at the rate of 2½ per cent. per annum. As little as a shilling can be paid in at one time, and sums to the extent of £50 may be deposited in one year. When the balance amounts to over £200, the excess, unless the depositor arranges differently, will be invested in Government stock at interest varying from $2\frac{1}{2}$ to 3 per cent., according to the stock purchased.

Advantages of the Post Office Savings Bank.

1. *Its Absolute Safety.* The Government itself is responsible for the safe return of deposits and interest.

2. *Its Convenience.* Deposits may be made and money withdrawn at any Post Office in the British Isles. Correspondence is carried on between the depositor and the bank free of cost. Bank books and withdrawal forms are also provided free.

Withdrawals may be made at any time, the only delay being the time taken in sending the form to London and getting the reply by return of post. In urgent cases withdrawals can be effected by telegraph.

3. *Its Secrecy.* The officials connected with the Savings Bank are not allowed to divulge its business.

4. *Its Simplicity.* The business of the bank is conducted throughout on very simple lines. The most ignorant person can follow the simple instructions for making deposits and withdrawals; and in the case of the death of the depositor without a will the money is paid over at once to the administrator upon production of the letters of administration or to the nearest legal relatives.

5. The Post Office Savings Bank offers inducements to **thrift in children** by providing stamp forms capable of holding 12 penny stamps. When the first filled-in form is presented a bank book containing a deposit of a shilling is given in exchange. Subsequent deposits may be made in the same way.

Government Stocks, Consols, etc. These consist of money lent to the Government by private individuals on the understanding that interest will be paid annually. Money so lent constitutes part of the National Debt. The capital itself can only be recovered by selling the stock to other buyers in the ordinary money market.

As stated above, Government stock may be bought through the medium of the Post Office Savings Bank, the rules being as follows: Not less than one shilling may be devoted to the purchase of stock at one time, nor more than £100 in one year. The total amount of stock held must not exceed £500. If not less than £10 nor more than £25 stock be bought at one time 9d. only will be charged for commission. For amounts over £25 and not exceeding £50, 1s. 3d. is charged; for over £50 and not exceeding £75, the charge is 1s. 9d.; and over £75 and up to £100, 2s. 3d. Interest is paid at $2\frac{1}{2}$ per cent., $2\frac{3}{4}$ per cent., or 3 per cent., according to the stock purchased.

Life Annuities may also be purchased of the Government through the Post Office. They are of two kinds: (1) Immediate, (2) Deferred.

An **Immediate Life Annuity** is obtained by paying a lump sum down, the amount paid being determined by the age and sex of the purchaser and the amount of the annuity purchased. The following figures give a few examples of the terms on which annuities of this kind are offered to the public:

Age of the Person at time of Purchase upon whose Life the Annuity is to depend.	Males. Price of an Immediate Annuity of £1.	Females. Price of an Immediate Annuity of £1.
	£ s. d.	£ s. d.
If 50 and under 51, - -	14 19 11	16 11 9
,, 52 ,, ,, 53, - -	14 7 1	15 17 4
,, 54 ,, ,, 55, - -	13 13 8	15 2 4
,, 56 ,, ,, 57, - -	12 19 8	14 6 11
,, 58 ,, ,, 59, - -	12 4 11	13 11 1
,, 60 ,, ,, 61, - -	11 9 8	12 15 1
,, 62 ,, ,, 63, - -	10 14 11	11 19 0
,, 64 ,, ,, 65, - -	10 0 6	11 2 11
,, 66 ,, ,, 67, - -	9 6 4	10 6 4

The above figures give the cost of an immediate annuity of £1. The cost of a larger annuity is in exact proportion.

Thus for an annuity of £40 multiply the given figures by 40; for example, a woman aged 60 requiring an immediate annuity of £40 must pay down £12 15s. 1d. × 40 = £510 3s. 4d.

Deferred Life Annuities are purchased either by a lump sum down or by a number of payments, the annuity to commence at a particular age arranged between the Government and the annuitant. In the case of annual payments the premium varies according to the number of years which must elapse before the annuity commences. As with immediate annuities, women must pay on a higher scale than men, owing to their longer expectation of life. Thus a man over 35 years of age and under 36 may, by annual payment of £1 6s. 6d., secure a life annuity of £1 to commence when he reaches the age of 46; whereas a woman of the same age and under the same conditions must pay £1 9s. 5d. The above figures refer to payments which will be returned upon application or in the case of death before the annuity commences. If an annuity be purchased on a non-returnable basis, the purchase money is on a lower scale. For instance, instead of the annual premium of £1 6s. 6d. quoted above for a man of 35, the sum demanded is £1 3s. 11d., and for a woman of 35, £1 7s. 6d. instead of £1 9s. 5d.

Advantages and Disadvantages. It is obvious that where a man has no one depending upon him it is advantageous to purchase an annuity on the non-returnable scale; and there is little doubt that for persons of small means with no one to whom they wish to bequeath money, a Government annuity, especially if purchased by a lump sum, is the safest method of providing for old age.

The disadvantage attending annuities purchased by annual or monthly premiums is that if by sickness, loss of employment, or other cause the premium is not paid when due, the money already paid in is lost.

Life Insurance is a very popular form of thrift. By means of a number of annual payments, known as the premium, a specified sum is handed over to the next of kin at the death of the insurer. For example, one well-known insurance company offers the following terms:

FOR AN ASSURANCE OF £100 AT DEATH, WITH PROFITS.

Age next Birthday.	Annual Premium.		
	During Life.	20 Payments.	10 Payments
	£ s. d.	£ s. d.	£ s. d.
30, - -	2 1 6	2 19 11	4 17 1
40, - -	2 14 9	3 11 11	5 15 0
50, - -	4 1 7	4 16 3	7 6 1

Care must be taken to insure in a well-established and thoroughly reliable society, or the whole of the savings may be lost. The Government offers good terms and perfect security to those insuring through the Post Office.

The Practice of Insuring Young Children is one of disrepute. Unscrupulous persons have not hesitated to insure the lives of the children entrusted to their care and have then by neglect, or more rapid measures, tried to secure the death of the children to obtain the insurance money.

And even where there is no criminal intention on the part of the insurer, premiums paid on infant lives are only recoverable if the child dies young. If he lives beyond a certain age, the insurance is lost to the insurer and no repayment is made.

The Value of Insurance lies in the fact that, when the insured dies, those dependent upon him are assured of a definite sum of money. In the event of an early death the insurance is much larger than the money paid in.

Arrangements can be made in most societies for the insurance or part of it to be drawn by the person insured at the age of 60 or later if he be alive at that time.

Benefit Societies, or Friendly Societies as they are also called, are maintained on a co-operative principle. A number of working men join together and agree to pay subscriptions at regular periods for certain benefits, such as payments in case of sickness or death.

If established on a sound basis such societies work admirably in helping the working man to keep his home together in times of trouble. Care must be taken in joining a Friendly Society to see that it is sound financially.

A Good Benefit Society should be (*a*) registered under the Friendly Societies Act of 1875. (*b*) It should be able to give proof of the soundness of its financial arrangements. (*c*) The payments should be based upon a sliding scale, so that young members do not pay for older ones, nor healthy persons for the weakly. (*d*) It should not be connected with a Trades' Union, which has the power of expelling members who disagree with its policy from the society.

Co-operative Societies are generally composed of working people who combine for mutual benefit. The most common form of co-operative society is one which provides for its members provisions, clothing, and household goods. The society is managed by a committee, competent buyers and storekeepers being engaged for the wholesale and retail work. All business, whether buying or selling, is done with ready money, the advantages thus gained adding largely to the profits. At the end of a certain time, usually half a year, a balance sheet is presented to the members and the profits are divided among them in proportion to their purchases. Members are at liberty to allow their dividends to accumulate until they have a sum large enough to be used in purchasing shares. Only members may become shareholders. Membership is obtained by payment of a small annual sum.

When a co-operative society is well managed and the goods sold of good quality and fair price, membership constitutes a very profitable form of thrift, and one greatly to be encouraged among the working classes.

Building Societies. The most popular form of building society is known as the **Permanent Benefit Building Society.** Such a society is composed of members who pay subscriptions with the idea of raising funds wherewith to purchase or build houses or other property by the aid of sums of money lent by the society.

Such loans are only granted to members whose subscriptions are fully paid up; and the property purchased by means of the loan is mortgaged to the society as security until both loan and interest have been repaid.

In some building societies houses are built by the society on its own land and sold to the members on easy terms. Where competition is keen the houses are balloted.

Advantages and Disadvantages. A firmly established and well-conducted building society is one of the best means of saving money, but so numerous and extensive have been the frauds practised upon the public by careless or dishonest management of such societies that careful investigation should in every case be made before joining.

Money may be invested in building societies by persons who do not wish to become property holders. The rate of interest is usually good, but there is sometimes a considerable delay in withdrawing money.

Terminating Building Societies are managed much on the same lines as Permanent Societies. Subscriptions are paid by the members, and when there is a sufficient sum an **appropriation** takes place; in other words, the money is lent to one of the members for a term of years, without interest, to be repaid by easy instalments. The member to receive the privilege is decided by ballot. The member selected may, if he wishes, sell his loan to any other member.

When every member has received a loan and all repayments have been made, the society comes to an end.

Shares may be purchased in companies such as water, gas, tramcar, insurance, etc. Local and well-established companies may usually be regarded as safe; but new companies should be joined with caution. A high rate of interest should, as a rule, be regarded as of doubtful security.

Other Inducements to Thrift. Penny Banks. The arrangements of the Post Office for securing the saving of pence have already been described. In the majority of **elementary schools** penny banks have been established in connection with the Post Office Savings Bank. The simplest plan is that in which the teacher is supplied with a number of stamps and stamp forms, and sells the stamps to the children. At certain intervals a Post Office official calls at the school, receives the money from the teacher, and gives bank-books in exchange for filled-in slips.

Such a plan saves the teacher the trouble entailed by other methods which necessitate the keeping of children's books, cash book, and ledger. Penny Banks are also established in many parts of the country, and adults as well as children are allowed to make deposits.

Medical Clubs and Provident Dispensaries are found in most places where there is a large population of working-men. Members subscribe about 1d. per week, and in return are entitled to medical attendance and medicine in times of sickness, and in some cases to an allowance at death. This is a form of thrift which should be encouraged among working people. If there is no provision made for sickness there is the temptation when it comes to neglect to call in the doctor until much harm has been done by the delay.

Clothing Clubs are formed in connection with various benefit and charitable societies. Money is paid in periodically and tickets are given in return stating the amount of the subscription plus bonus. Certain tradespeople undertake to supply goods in return for the tickets, the money being paid to the shopkeeper by the club. As a rule clubs of this kind work admirably in inducing thrift.

Questions.

1. Explain the principle of annuities, immediate and deferred, giving an illustration of each method of investment. Which would be the better plan for the teacher of an elementary school, and why? (*Scholarship*, 1888.)

2. Explain what is meant by Consols, Deferred Annuities, Provident Dispensaries, and Life Insurance, and give any particulars you know respecting one of them. (*Scholarship*, 1890.)

3. Say what is meant by a "Benefit Society"; what sort of rules it enforces; and what are the advantages and risks connected with them. (*Scholarship*, 1890.)

4. Explain how thrift may be exercised in regard to food, fires, clothing, drinks, furniture, health, and recreation. (*Scholarship*, 1895.)

5. Write notes on a lesson on "Co-operative Stores."

6. In what way may a school penny-bank be best founded and conducted? (*Scholarship*, 1896.)

7. If you received a legacy of £200, in what various ways could you advantageously invest it? (*Scholarship*, 1898.)

8. Explain what is meant by the terms "interest," "deposit," "investment," "annuity." (*Scholarship*, 1900.)

9. Point out some of the best modes of investing savings, and show what kind of investment ought to be avoided.

(*2nd Year Certificate*, 1892.)

10. How, and to what extent, may small investments be effected in Consols through the agency of the Post Office?

(*2nd Year Certificate*, 1896.)

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