ELEMENTS of the THEORY and PRACTICE of COOKERY

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WILLIAMS AND FISHER

THE MACMILLAN COMPANY

Domestic Science Book Received [illegible] hand.

Emily Jones

Emily Jones [illegible]

leavening agent

air, carbon dioxide, steam

[illegible] 29 [illegible]

[illegible]

soda + sour milk

baking powder

molasses + soda

yeast

[illegible] in [illegible] + [illegible]

cream puffs

Allene Hayes

Meridian, Miss

ELEMENTS OF THE THEORY AND PRACTICE OF COOKERY

Moderate 185
hot 215 - 250

PLATE I.

BREAKFAST TABLE SET FOR FOUR PERSONS.

THE INVALID'S TRAY.

ELEMENTS

OF THE

THEORY AND PRACTICE OF

COOKERY

A TEXT-BOOK OF HOUSEHOLD SCIENCE FOR USE IN SCHOOLS

BY

MARY E. WILLIAMS

SUPERVISOR OF COOKERY IN THE PUBLIC SCHOOLS OF THE BOROUGHS OF MANHATTAN AND THE BRONX
NEW YORK CITY

AND

KATHARINE ROLSTON FISHER

FORMERLY TEACHER OF COOKERY IN THESE SCHOOLS

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PREFACE

THIS text-book has been prepared at the earnest request of the teachers of cookery in the public schools of New York City, and in response to the many letters that have come to the supervisor from all parts of the country asking for information about the instruction given in this branch of household science.

American text-books for beginners in cookery are few. We believe that "The Elements of the Theory and Practice of Cookery" is the first book of this order to combine the features of a working guide for the kitchen laboratory with those of a hand-book for study and reference.

We have reason to feel, therefore, that in offering it for the use of young students we are supplying a want. This book aims to supplement the instruction of the teacher, and to aid in unifying the work of classes and schools. It is planned to save time and labor for teacher and pupils, and, incidentally, to insure correctness in language and content by furnishing recipes and other matter that have ordinarily to be copied or written from dictation.

All who are working to improve the home, whether along the line of home economics, household science, temperance, or in other ways, recognize that the hope of this improvement depends in great measure upon the better preparation of home-makers for their duties. The modern school of domestic science holds that an essential part of this preparation is instruction in the principles of science which underlie the proper performance of household labor, and in training that will enable the student to apply these principles. The day is past for the study of any science as an accomplishment. The schoolboy has long known that chemistry would be useful to him should he become a manufacturer, an engineer, or a physician. The schoolgirl is now being led to see as clearly its use to her in the business of housekeeping.

Keeping in view this idea of the function of the school-kitchen, we have closely interwoven theory and practice in this text-book, as they should be interwoven in actual experience. The presentation of these two aspects of the subject in their naturally close relation is the surest means of proving to those who doubt the wisdom of teaching cookery, except as an art, that even the theoretical side of domestic science is of practical value. It should operate also to dispel the prejudice of those other persons — if any such there still be — who hesitate to approve the introduction of cookery into public schools for fear of countenancing the teaching of a trade.

We send forth our book in the hope that it may help, at least a little, to draw into closer union teachers and students of household science, home-makers, and all who are interested in the welfare of American homes.

We desire to thank for the contribution of valuable suggestions, information, material, or all of these, Professor Robert W. Hall, of the New York University, Dr. H. W. Wiley and Dr. A. C. True, of the United States Department of Agriculture, Mr. Jonathan D. Hyatt, Principal of Public School 85, New York City, and, particularly, the teachers of cookery in the New York public schools.

NOTES TO TEACHERS

The plan of this text-book does not assume the employment of any one particular method of teaching cookery. The book can be used equally well whether the pupils work individually or in groups, whether all at one time or in turn.

Recipes making quantities suitable for a small family are given, as being the most practicable from all points of view. The individual recipe is not adapted to home use, nor is it so easy to multiply it as it is to divide the ordinary recipe to make the latter meet the requirements of individual practice.

The subject-matter in this book can be covered in three terms (one and a half school years) by classes of girls in the sixth and seventh or seventh and eighth years of school, one two-hour lesson being given each week.

The chapter topics are taken up in the order that experience has proven to be for most classes the most natural and convenient one. The progression has been carefully worked out, as a glance at the table of contents will show; and, while the numerous cross-references make it possible to depart occasionally from this order, it is believed that to obtain the best results it should be adhered to in the main. Certain portions of the text are printed solid, *e.g.* Chapter I, Section 2, Paragraphs 25–31, and Sections 3 and 4 of Chapter VI, to indicate that they may, at the discretion of the teacher, be left until later in the course, without interfering with the continuity of the work.

On the other hand, the sections of a chapter are not necessarily to be taken up in the order in which they stand. In many cases, subject-matter from different sections of the same chapter may properly be presented in one lesson. For example, Sections 2 and 3 of Chapter II would naturally be taken up together.

The subject of cleaning is treated in considerable detail (Chapter I, Section 4), both because of its importance as a part of a course in household science, and in order to facilitate the keeping of the school kitchen and its equipment in proper condition. Each pupil should be thoroughly familiar with this section, so that when called on to serve as housekeeper she should know how to perform her duties, and where to turn in the text-book to refresh her memory with regard to them.

With the exception of this section on Cleanliness and Cleaning, no part of the book is intended to be studied at home before being taken up in class. Sections 5 and 6 of Chapter I, both sections of Chapter V, and Section 4 of Chapter VI are designed to be used chiefly for reference.

Directions for performing experiments and for making tests and "studies" are explicit, in order that each pupil may carry them out individually, — at school, if conditions permit, if not, then at home. It is assumed that experiments and tests referred to in the text, but for which directions are not given (*e.g.* the decomposition of water by sodium, p. 30, and testing for proteid with nitric acid, p. 87), will be performed by the teacher before the class.

A microscope is a desirable part of the equipment of a school kitchen, but if one is not available, drawings or charts showing the appearance of common foods and foodstuffs under the microscope may answer instead of an exhibition of the specimen itself under the microscope.

In taking up a new topic, this book, as a rule, gives opportunity for some practice work before presenting any theory. Principles are taught in connection with their application, and the classification of foods and general statements about them are deferred until some practical acquaintance has been gained with typical foods and their chief constituents. It will be observed that the recipes in the section on Diet for the Sick (Section 2 of Chapter XI) are so classified and arranged that this section forms a review of the different classes of foods in the same order in which they are taken up in the preceding chapters.

Although beverages are grouped by themselves, they are treated independently of each other and of other topics, in order that they may be taken up separately whenever convenient. A lesson on tea may be given in connection with the study of water, tea-making thus forming the first practice work of the course. Instruction in the preparation of cocoa and chocolate can be given to better advantage after milk has been studied.

Opportunity is offered, especially by means of the experiments, "studies," and suggestions for reading and home work, for correlation with history, drawing, and the natural sciences. It is desirable that every teacher of household science should make the most of these opportunities, and should secure the coöperation of principal and grade-teachers in correlating, not these branches only, but English and mathematics as well, with the work of the school kitchen.

LIST OF PUBLICATIONS REFERRED TO IN SUGGESTIONS TO PUPILS CONCERNING SUPPLEMENTARY READING

Boston School-kitchen Text-book. Mrs. Mary J. Lincoln. Little, Brown and Co. Boston.

Boys and Girls in Biology. Sarah Hackett Stevenson. D. Appleton and Co. New York.

Bulfinch's Mythology. Revised by Rev. E. E. Hale. Lee and Shepard. Boston.

Century Cook-book, The. Mary Ronald. The Century Co. New York.

Chemistry in Daily Life. Dr. Lassar-Cohn. Lippincott and Co. Philadelphia.

Chocolate Plant, The. Walter Baker and Co. Dorchester, Mass.

Coal and the Coal-mines. Homer D. Green. Houghton, Mifflin and Co. Boston.

Domestic Science in Grammar Grades. A reader. L. L. W. Wilson. The Macmillan Co. New York.

Dora's Housekeeping. E. S. Kirkland. A. C. McClurg and Co. Chicago.

Drinking-water and Ice Supplies. T. Mitchell Prudden, M.D. G. P. Putnam's Sons. New York.

Dust and its Dangers. T. Mitchell Prudden, M.D. G. P. Putnam's Sons. New York.

Early Chapters in Science. Mrs. W. Audry. John Murray. London.

Fairyland of Science. Arabella Buckley. D. Appleton and Co. New York.

Food Products of the World. Dr. Mary E. Green. The Hotel World. Chicago.

Foods and Beverages (Information Reader No. 1). E. A. Beal, M.D. Boston School Supply Co.

Hiawatha. Henry W. Longfellow.

Home Economics. Maria Parloa. The Century Co. New York.

Story of the Bacteria, The. T. Mitchell Prudden, M.D. G. P. Putnam's Sons. New York.

Woman's Share in Primitive Culture. O. T. Mason. D. Appleton and Co. New York.

American Kitchen Magazine. Home Science Publishing Co. Boston.

Chautauquan. Chautauqua Assembly. Cleveland, O.

Harper's Weekly. Harper and Bros. New York.

Nation, The. Evening Post Publishing Co. New York.

Penny Magazine, The. London.

Scribner's Magazine. Charles Scribner's Sons. New York.

Farmers' Bulletins. Nos. 42, 57, and 112. Sent free on application to the U.S. Department of Agriculture, Washington, D.C.

OTHER BOOKS SUITABLE FOR READING IN CONNECTION WITH "THE THEORY AND PRACTICE OF COOKERY."

What to Eat and How to Serve It. Mrs. C. T. Herrick. Harper and Bros. New York. 1891.

Cookery for Beginners. Mrs. M. V. Terhune (Marion Harland). D. Lothrop and Co. Boston. 1884.

Text-book of Domestic Economy. F. T. Paul. Longmans, Green and Co. New York. 1894. (Good chapters on fuel, draining, and water supply.)

History of a Mouthful of Bread. Jean Macé. Harper and Bros. New York.

Servants of the Stomach. Jean Macé. Harper and Bros. New York.

COOKERY BOOKS

Art of Cookery, The. Mrs. E. P. Ewing. Flood and Vincent. Meadville, Pa. 1896.

Boston Cook-book. Mrs. Mary J. Lincoln. 1899.

Boston Cooking-school Cook-book, The. Fannie M. Farmer. 1896.

Hand-book of Invalid Cookery. Mary A. Boland. The Century Co. New York. 1893.

Philadelphia Cook-book, The. Mrs. S. T. Rorer. 1886.

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THE MOTTO OF THE NEW YORK CITY PUBLIC SCHOOL KITCHENS

Good cookery means the knowledge of all fruits, herbs, balms, and spices, and of all that is healing and sweet in fields and groves, and savory in meats. It means carefulness, inventiveness, watchfulness, willingness, and readiness of appliance. It means the economy of your great-grandmothers and the science of modern chemists. It means much tasting and no wasting. It means English thoroughness, French art, and Arabian hospitality. It means, in fine, that you are to be perfectly and always ladies (loaf-givers). — Ruskin.

INTRODUCTION

HOMES AND HOME-MAKING

The mission of the ideal woman is to make the whole world homelike. — FRANCES WILLARD.

TO THE GIRLS WHO WILL USE THIS BOOK:—

The business of home-making. — Have you ever thought what an important business home-making is? The prosperity of a nation is founded in the welfare of families, and the welfare of a family depends upon its having a healthful, happy home.

Origin of the home. — The home, as we know it, has grown out of the need of a shelter for family life. Parent birds build nests, not for themselves, — they could perch comfortably under cover of leafy twigs, — but in order to have places in which to rear their young. Thus, long ago, before men had learned to build houses and cities, mothers, seeking shelter for their babies, crept into caves. These were the first homes of human beings.

Women the home-makers. — The home-makers have always been women, the care of the home and the management of household industries having been at all times in their hands. In very early times men spent their lives in hunting and fighting; the animals killed they brought home for the women to cook. In order to do this more conveniently, the women made clay dishes and baked them by the fire or in the sun. Because the women stayed at home all day, they were interested to improve their way of living. Dwellings more comfortable than caves began to be constructed — tents of animals' skins, and huts made of boughs, such as some savages live in to-day. Finally, when people had become civilized, they built for themselves large and fine houses, varying in style to suit different climates and the customs of different countries.

Of the various kinds of labor still carried on at home by the members of the household, the most important are cooking, cleaning, and laundry work, commonly classed, together with a few other occupations, as *housework*.

Household industries and household science. — **Science** *is systematic knowledge.* **Household Science** *is systematic knowledge of things pertaining to the home.* It treats of the house and its industries in their relation to the welfare of the household. **Cookery**, *one branch of Household Science, treats of the preparation of food for eating.* A rational study of any subject includes both practice and theory. **Practice** teaches how to do a thing; **theory** explains why it should be done.

Home and school ought to work for the good of the nation. — In its mission of training children to be good citizens, the school needs help from the home. For without right home conditions, including a sufficient supply of suitable and well-cooked food, boys and girls cannot have the strong bodies and clear minds needed for doing school work while they are children, and for their life-work as men and women. Think, then, how important to the nation it is that home-makers should have a knowledge of Household Science!

Training for home-making. — All knowledge comes by study and practice; a girl spends two years, at least, in fitting herself to teach; a boy, even longer in learning a business or trade. Is special preparation less necessary for home-making, which involves many kinds of work, some of them difficult, and which usually includes the noblest of all occupations, the care and training of children? And do you not think, since almost every woman is at some time engaged either in making a home or in helping some other woman to make one, that every girl should learn all she can about housekeeping and home-making?

In studying Household Science, and particularly in studying Cookery, you will not only learn many interesting things that you would be unlikely to discover for yourself in doing housework at home, but you will find pleasure in the work itself. Because certain household duties may seem hard or unpleasant is no reason for considering housework unworthy of attention. Some people make hard work of housekeeping by doing it in an unthinking way; when, by putting their minds upon it, they might discover how to make it easier and pleasanter. Only by treating housekeeping as an honorable employment, worthy of our best thought and skill, can we bring about conditions of health, comfort, and happiness in our homes.

You may enjoy reading *Dora's Housekeeping*, a good story of how a girl kept house while her mother was away; and "Notable Housekeepers" (one of these being Louisa M. Alcott), an article in the *American Kitchen Magazine*, February, 1898, Vol. VIII, p. 186.

CHAPTER I

PREPARATORY LESSONS

Section 1. Air in its Relation to Life and to Fire

Sunlight, pure air, and pure water are our common birthright, which we often bargain away for so-called comforts.

— ELLEN H. RICHARDS and S. MARIA ELLIOTT.

1. *Three things are essential to life,* — **air, water, and food.** Of these, air is the first essential, since we can live without eating or drinking longer than without breathing. How is breathing related to health and life? We can best answer this question by showing how air is affected by being breathed.

AIR IN ITS RELATION TO LIFE

2. Testing air for carbon dioxide. — Experiments. A. Into a clean bottle, pour a little clear lime-water; cork the bottle, and shake it so that the lime-water may come in contact with the air in the bottle. Do you see any change in the appearance of the lime-water? Now hold a glass tube so that it dips below the surface of the lime-water, and blow through it for a minute or two. Is the lime-water changed in appearance? Do you think that air exhaled from the lungs is just like air in the room?

B. Insert a splinter in a cork, light the splinter, and fit the cork into the neck of a bottle. What happens? Pour a little clear lime-water into the bottle and shake. Note the effect on the lime-water.

Air from the lungs and air in which a splinter has been burned both turn lime-water cloudy. It is known that this cloudiness is produced only by **carbon dioxide**, an invisible gas. How does this gas get into the air?

3. Composition of air; formation of carbon dioxide by burning. — Air is a mixture of two invisible gases, **oxygen** and **nitrogen.**[1] Wood contains **carbon.**

4. When the splinter is lighted, a part of this carbon unites with the oxygen of the air to form carbon dioxide, and continues uniting with it as long as any oxygen is left in the bottle. When all this has been used, the fire goes out, because the oxygen has been replaced by carbon dioxide, in which nothing will burn. Part of the carbon remains unburned as **charcoal.**

5. Formation of carbon dioxide in the body; oxygen necessary to life. — The presence of carbon dioxide in air that has been breathed is similarly caused by a slow kind of burning constantly going on in the body. That the body contains carbon may be shown by burning a piece of meat, which has almost exactly the same composition as human flesh. It becomes black like the burned splinter. The oxygen of the air taken into the lungs unites with this carbon, produces heat to keep the body warm, and forms carbon dioxide. The walls of the little cells in the lungs are so thin that oxygen passes through them into tiny blood-vessels called *cap-*

[1] Argon, a gas discovered in 1894, is also found in air, but in such small quantities that it may be disregarded here.

illaries, and at the same time carbon dioxide, brought by the blood from all over the body, passes out into the air. The blood flows on to other parts of the body, giving up oxygen on its way, thus literally keeping up the "fires of life"; for without oxygen life would go out as surely as does the burning splinter. Carbon dioxide, on the contrary, is useless, — a substance to be carried off by the blood, and quickly gotten rid of through the lungs.

6. Plants *breathe through their leaves*, taking in carbon dioxide and giving off oxygen when in the sunlight. At other times they give off carbon dioxide.

AIR IN ITS RELATION TO FIRE

7. Food being cooked chiefly by means of heat, cookery includes a study of **fire**. Let us learn what we can of the relation of air to fire.

A Study of Combustion

8. Experiments with a candle. — A. Set a two-inch piece of candle on the table and light it. How does it burn? Notice the appearance of the flame. (Fig. 1, *a*.)

B. Set over the candle a lamp-chimney supported on two pencils or blocks of wood. (Fig. 1, *b*.) Notice how the flame has changed. Hold your hand for a moment about two inches above the chimney, and notice the heat felt. Hold a bit of tissue paper just above the chimney. Is it drawn upward or downward? Hold it near the space at the base of the chimney. Is it drawn outward or inward?

C. Remove the supports, letting the chimney rest upon the table. (Fig. 1, *c*.) Test for heat with your hand, then hold the bit of paper as before. Do you feel any heat? Does the paper move? What happens to the candle? Can you, by recalling the experiment with the splinter and the bottle, explain this?

D. Relight the candle, replace the chimney upon the supports, and cover the top with a piece of thick cardboard. (Fig. 1, *d.*) What happens? Explain. Removing the cardboard, quickly thrust a lighted splinter inside of the chimney. What gas do you think may be present?

E. Through a tiny hole in the cardboard pass a fine wire bent into a small loop at one end. Arrange candle and chimney as in

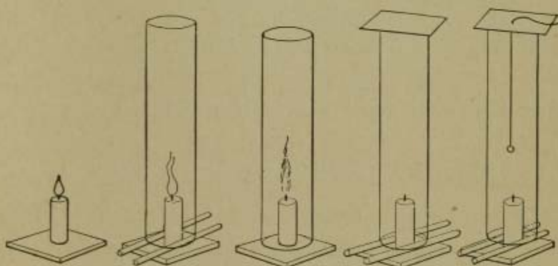


FIG. 1.

Exp. **D.** Dip the wire loop into clear lime-water, which should form a film across the loop. Cover the chimney with the cardboard, letting the wire hang inside. (Fig. 1, *e.*) About two minutes after the candle goes out examine the film. What gas has been formed? Is the candle as large as it was before it was lighted? What has become of the part that has disappeared?

9. Explanation of the burning of a candle. — When a candle is lighted, the wax, by the heat of the burning match, is first melted, and then, being soaked up by the wick, is changed to gas. The oxygen of the air, always eager for something to unite with, seizes upon this gas;

in other words, *the gas burns.* Whenever oxygen unites with another substance so rapidly that light and heat are given off, we have burning, or **combustion**. The light and heat we call **fire**. **Flame** *is burning gas.*

10. Drafts. — In still air a candle-flame streams straight upward, because of the constant upward draft caused by the heating of air near the flame. As this air rises, air from below flows toward the candle to take its place. This in turn becomes hot and rises, thus starting a draft that continues as long as the candle burns. And, while the burning of the candle keeps up the draft, this draft supplies the candle with oxygen to keep it burning. When we place a lamp-chimney over the candle, leaving a space at the bottom, we make the draft stronger by shutting off side-drafts. The flame flickers, and the candle burns faster. But if either the opening at the top of the chimney, or the space between chimney and table be closed, all draft is stopped, and as soon as the oxygen then inside the chimney is used up, the candle goes out. To keep up combustion, then, we must have a draft. *For a draft through an enclosed space two openings are necessary*, one to let air in, the other to let it out.

11. Products of combustion. — The candle, after burning for a time, is shorter than when first lighted, because it has, little by little, united with oxygen to form new gases which stream off unseen. One of these gases is carbon dioxide, as is shown by the clouding of the lime-water on the loop of wire. Besides this, water is formed from oxygen and a substance in wax called **hydrogen** (*water-maker*). Substances formed as a result of combustion are called **products of combustion.** Some of the carbon is not burned at once, but floats in tiny particles in the flame. If some cold object, such as a saucer, be held in the flame, this carbon is deposited on it as **soot.** Ordinarily, unburned carbon goes off as **smoke.** We may state the process of combustion somewhat like an example in arithmetic: **candle + air = carbon dioxide and water.**

12. Nothing destroyed in combustion. — By letting H stand for hydrogen, O for oxygen, and C for carbon, and, taking into account that oxygen unites with just half its bulk of carbon and with twice its bulk of hydrogen, we have $C + 2O = CO_2$, and $2H + O = H_2O$.

The water, smoke, carbon dioxide, and other gases produced would, if weighed, exactly equal the weight of the burned candle plus that of the oxygen used in burning it. Nothing has been destroyed.

13. Burning in oxygen. — In pure oxygen, combustion is more rapid and energetic than in air, iron and other substances that will not burn in air burning readily in oxygen. Could we use iron stoves if our atmosphere were pure oxygen? In oxygen or in air, however, combustion is essentially the same; whether in fireplace, stove, or lamp; whether a single match burns, or a whole building. Wherever combustion takes place, something unites with oxygen, giving off heat (and usually light), and forming products of combustion.

The story of Prometheus, who is fabled to have stolen fire from heaven, is told on p. 19 of *Bulfinch's Mythology.* You may also like to read in *Early Chapters in Science* about combustion, on p. 328, and carbon dioxide, on p. 332; and in either *The Fairyland of Science*, pp. 50–72, or in the *Domestic Science Reader*, pp. 123–131, about "The Aerial Ocean in which We Live."

Section 2. The Kitchen Fire — Fuels

A clean fire, a clean hearth. — CHARLES LAMB.

14. In order to manage a kitchen fire successfully, we must understand the construction and purpose of every part of the range. Much fuel is wasted, food spoiled, and time lost because women do not take the trouble to do this.

THE COAL RANGE

15. The range and its parts. — A range or a cooking-stove is an iron box. It should stand upon a brick hearth, or a sheet of zinc, and the wall near it should be of brick or tiling, or else protected by zinc.

A range has the following parts: —

1. Fire-bcx, to contain fuel.
2. Grate, which forms the floor of the fire-box.
3. Dampers
   - *a.* Creative, *b.* Check — to regulate draft.
   - *c.* Oven, *d.* Chimney — to direct current of hot air.
4. Ash-pan, to receive ashes, cinders, and clinkers (incombustible waste material and solid products of combustion).
5. Stove-pipe, to carry off smoke (unburnt carbon) and gaseous products of combustion.
6. Oven, for food.

Some ranges have other parts, — an oven for warming dishes, a water-front, more dampers, etc., — but the parts named above are all that are essential.

Distinction between a stove and a range. — A stove is movable, and usually has one oven with two doors. A range may either be built into the wall (*set*), or stand out in the room (*portable*).

16. The range in detail. — When the fire is out take off all the lids and as much of the top of the stove as is removable. Look first at the fire-box.

The **fire-box** is a rectangular space open at the top, lined on the sides with a fireproof material (*fire-bricks*), and having a movable grate for a floor.

Underneath the fire-box is the **ash-pan.** It should be emptied once a day, and the space around it brushed out.

The **stove-pipe** connects the range with the chimney.

The **oven** in a stove or a portable range is back of the fire-box. In a set range there are generally two ovens, one on each side of the fire-box. An oven should contain a rack. Between the oven and the top, sides, and bottom of the range there is a space for the passage of air from the fire-box. This space must be cleaned occasionally to keep it from becoming choked with soot and ashes.

The **dampers** are slides or doors fitted to openings in the range. Below the fire-box is the front damper. In the stove-pipe is the chimney damper. At the back of the oven is the oven damper, usually moved by a rod extending to the front of the range.

17. Management of the dampers. — By opening the **front, chimney,** and **oven dampers** a *direct draft* is produced, the air passing from below the grate, up through the fuel in the fire-box, and out into the chimney. This arrangement of dampers is used to start the fire, or to increase the heat of a fire already burning. (Fig. 2, *A*.) If the front damper be opened, and the chimney damper closed, when a fire is starting, the smoke will come into the room. Why? The chimney damper should be so arranged that the opening in the stove-pipe is never wholly closed.

By closing the oven damper, the air heated in the fire-box is made to flow around the oven before entering the chimney. By this means the oven is heated, and the force of the draft at the same time lessened by its having to make its way around corners. (Fig. 2, *B*.) *Observe carefully the mechanism of the chimney dampers. In some ranges they are opened by pulling the handles out; in others by pushing them in. The range in your home may differ in this respect from the one at school.*

18. The **check damper** is in front of the fire-box. Opening it sends a stream of cold air across the top of the fire. Air admitted *below* the fire-box feeds the fire by parting with its oxygen as it passes through the fuel. Air admitted *above* the fire-box merely flows over the burning fuel and goes up the chimney before it has time to part with its oxygen. Its effect is to check the fire by cooling it.

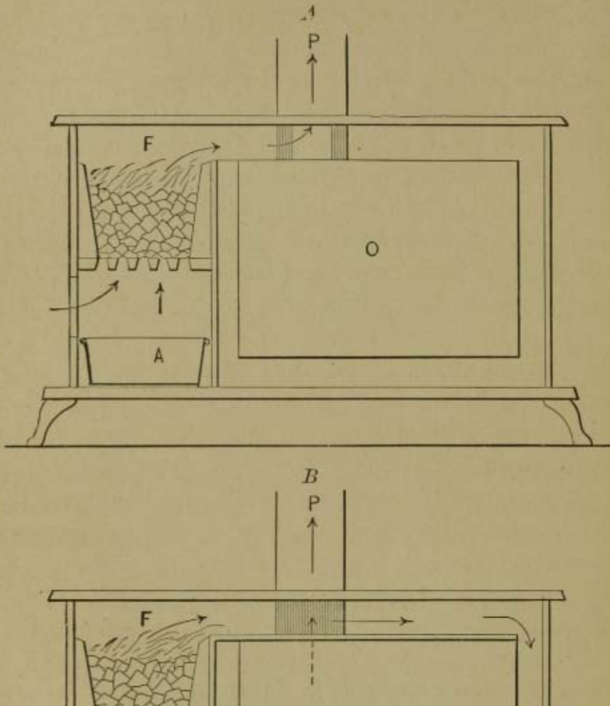


FIG. 2.

Diagrams of range: *A*, with oven damper open; *B*, with oven damper closed; F = fire-box; A = ash-pan; O = oven; P = stove-pipe. Arrows show direction of air-currents.

How to make a Fire

19. Cleaning the fire-box. — 1. Close all the dampers except the oven dampers.

2. Brush the ashes from the edge of the fire-box into the fire-box, and put the lid on.

3. Turn the grate over, so as to dump the ashes into the ash-pan. (If there is an ash-sifter in the range, the ashes will fall upon this, and must afterward be sifted through it into the pan.)

20. Laying the fire. — 4. Lay the fire: —

a. Fill the fire-box one-third full of shavings, or wisps of paper twisted in the middle so as to expose a large surface to the air.

b. On these lay small sticks of soft wood crosswise, or one bundle of such kindling as is sold by grocers in New York City.

c. Put two shovelfuls of coal on top of the wood.

The fuel should be arranged loosely in order that the air may have free passage through it. (See Fig. 2.)

5. Cover the top of the range. Open all the dampers except the oven dampers.

21. Starting the fire. — 6. Light the fire by applying a lighted match between the bars of the grate to the paper or shavings inside. (If the stove is to be blackened, do it now.)

7. When the wood is all ablaze, add coal until the fire-box is level full. (As the wood burns away the

coal will settle. The fire-box should never be kept more than three-fourths full.)

22. What to do when the fire is well started. — 8. When the blue flame disappears, close the oven dampers, and half close the lower damper. When the coal is burning well, close the lower damper entirely, and half close the chimney damper.

How to manage a Fire

23. For a steady hot fire, rake out the ashes with a poker from beneath the grate; or, if the grate is a revolving one, give it one turn. Fill the fire-box three-fourths full of coal. Open the lower front and chimney dampers. See that oven and check dampers are closed. When the coal in the lower part of the fire-box is glowing red, the top layer still black, and the flames yellow, close the dampers. When the top layer begins to glow, add more coal, so that there will always be black coals on top.

To heat the oven. — Open the oven and chimney dampers, keeping all others closed.

To check the fire *slightly*, open the slide in the check damper. To check it *decidedly*, open the check damper itself. All other dampers must be closed.

To keep a fire over night. — Fill the fire-box with coal; close oven, lower front, and chimney dampers. and open the check damper.

24. Kindling-point. — Why is it, with active oxygen always in the air, ready to devour, that chairs, tables, houses, do not take fire and burn? Simply because a substance must be heated to a certain degree before it will begin to unite with oxygen. Except for this, everything combustible would have burned up long ago. The temperature to which a substance must be raised before it will burn is its **kindling-point**. This point differs for different substances. See how we take advantage of this fact in starting a fire. We first light a match, the phosphorus[1] on which kindles from the friction of striking, setting on fire the sulphur mixed with it. This, which has a somewhat higher kindling-point than phosphorus, in turn ignites the wood of the match, the kindling-point of which is higher still. Coal will not take fire from a match, because its kindling-point is so high that the match burns out before the coal becomes hot enough to burn; but paper may be lighted from a match, wood from burning paper, and coal from burning wood.

To start a fire three things are required: *oxygen, fuel, and some means of raising the fuel to its kindling-point.*

THE GAS RANGE

25. Some of the advantages of a gas stove or range over one burning coal are, (1) it saves time and labor, (2) it does not heat the kitchen uncomfortably in summer, and (3) it is, *if managed with care*, more economical, because no fuel need be burned when the stove is not in use.

26. Connections. — The range should be connected with the largest main pipe accessible (not less than one-half inch

[1] Phosphorus burns, though slowly, at the ordinary temperature. It must, therefore, be kept under water.

bore inside measure). If within six inches of the wall, the connecting-pipe should be protected by zinc or tiling.

27. **The range and its parts.** — A range of ordinary size has: —

1. Four top burners, for saucepans, kettles, etc.
2. One or two sets of oven burners, for heating the ovens.
3. A baking oven, for bread, cake, and large roasts.
4. A broiling oven (below the burners) with rack and pan, for steaks, chops, etc., for small roasts, for toast, and for dishes to be browned.
5. Gas-cocks, one or more to each top burner, two to the oven burners, to regulate the supply of gas.
6. An oven lighter, or "pilot light," at the right-hand side of the oven, for lighting the oven burners.
7. A stove-pipe, connected with the chimney, for carrying away gases produced by combustion.

The broiling oven is heated directly from the oven burners, the baking oven by currents of heated air passing around it, as in a coal range. Some ranges have a small top burner, called a **simmering burner**; all ranges should have a movable sheet of iron under the top burners. The connecting pipe is sometimes fitted with a gas-cock.

Air is admitted to the burner through holes in the supply pipes. This makes the gas burn with a blue and very hot flame.

How to Manage a Gas Range

28. Learn which pipes supply each burner; learn the position of each gas-cock, when open and when closed.

When the range is not in use keep all gas-cocks closed, *i.e.* turned toward the right. *It is not sufficient to turn off the gas by closing the cock in the connecting pipe only;* if this is done, leaving other cocks open, the gas, when next turned on, will escape unlighted. If it escapes into the oven, a dangerous explosion is likely to take place, on lighting the oven burners.

How to light the gas range. — *To light a top burner*, first open the cock in connecting pipe by turning it to the left; then open the cock in the pipe supplying the burner, let the gas flow for two or three seconds, and apply lighted match or taper. **If the burner is a double one,** and you wish to light both parts, light one first; then turn the cock admitting gas to the other, and it will light from the first. **To light the oven burners,** first see that all stop-cocks regulating the supply of gas to the oven burners are closed, and that both oven doors are open. Now open the pilot light cock, and light the pilot light from the outside, through the hole made for this purpose; this done, open first one oven cock and then the other. Each set of burners will light with a slight explosive sound; when you see that both are burning blue and clear, turn off the pilot light.

If the gas burns yellow with a roaring noise, it has "struck back," and is burning in the air-chamber. Turn it off at once, let it flow a few seconds, and relight it.[1]

29. How to use the gas range. — For broiling, toasting etc., have oven burners lighted and doors closed at least five minutes before using the oven. Place the rack and pan close under the burners. **For roasting in the broiling oven,** observe the same rules and turn the roast frequently. **For baking,** light the oven burners and close the door ten to fifteen minutes before putting in the food.

30. To avoid wasting gas. — 1. As soon as the contents of a kettle or saucepan boil, turn the gas down, and keep it as low as possible without checking the boiling. For simmering, turn still lower or use the simmering

[1] In some ranges the supply of air may be regulated by turning a cap, which enlarges or decreases the size of the air-holes in the supply pipe.

burner. When so little heat is required that the gas is in danger of going out, turn it up a little and moderate the heat by putting an asbestos board over it. 2. When the oven is sufficiently hot, close one oven cock, or partly close both. 3. Always turn off the gas the instant you are done using it, even if it is to be relighted ; *matches are cheaper than gas.*

31. Care of the gas range. — Keep air-holes clear. Draw out iron sheet under top-burners and clean it once a day. For further care see § 95.

FUELS

32. Anything that unites readily with oxygen may be used as **fuel.** Fuels common in American households are coal, wood, coal-oil (kerosene), and, in some places, gas.

33. The story of coal. — Coal, by composition and structure, is shown to be of plant origin. Leaves, ferns, bark, whole tree trunks even, have been found turned to coal in mines. The slow process of decay that effected this change took place long before men lived on the earth, at a time when the land was covered with thick forests different from any growing now. Many trees then resembled gigantic ferns. Evidently these forests were flooded from time to time, the trees being overthrown and buried beneath sand washed in by the water. The flood subsiding, a new forest arose, to be in turn similarly buried. Pressure, combined with heat greater than now prevails anywhere on earth, slowly carbonized these layers of plant-substance into seams of coal. This period is known as the Carboniferous Age.

34. Coal works for us. — The heat of burning coal may be utilized to cook food, melt iron, make steam to drive engines, and do hundreds of other kinds of work. A person able to work is said to have energy. Whence comes the energy of coal? From its carbon; and to find out where that came from we must go back to the Carboniferous Age.

35. The heat of fires comes from the sun. — The carbon taken in by plants becomes, we know, part of the plants; but only with the aid of sunlight can they breathe in carbon dioxide from which to obtain carbon. (§ 6.) The sun, then, is the source of the energy in coal; we may say that *the sun lights our fires.* Stephenson, the inventor of the locomotive, when asked what drove his engine, answered, "Bottled-up sunshine." He spoke the exact truth; the sun's energy is stored up in coal-mines until, with pick and blasting powder, man sets it free.

36. Hard and soft coal; buying coal. — **Hard**, or **anthracite**, coal is the result of almost perfect carbonization of wood; in **soft**, or **bituminous**, coal the process has not gone so far.[1] The latter is crumbly and dull, and burns with much smoke. Which yields the more heat, *i.e.* has the more energy, hard or soft coal? Hard

[1] Wood contains about 50 per cent of carbon, bituminous coal about 77 per cent, anthracite about 90 per cent. All coal contains sulphur.

coal is best for household use. A good quality is jet black and glossy, breaks into roughly cube-shaped pieces, is free from slate, and yields little clinker. For a stove with a small fire-box, use "chestnut" coal; for most ranges a mixture of "stove" and "chestnut" is desirable. Too small coal will fall between the bars of the grate before being burned. It is prudent to buy a year's supply of coal in summer, when it is cheapest; coal bought by the pound or basket costs about three times as much as if bought by the ton.

37. How to save coal and gain heat. — Coal burns at first with a blue flame, but when thoroughly afire, with a clear, red glow. When white-hot, almost all its heat-giving power has been exhausted. A good coal fire consists of a mass of red coals covered by a layer of black ones heating and ready to kindle when the red ones die out. More heat is gotten from the same quantity of coal by adding it to the fire a little at a time than by putting it on all at once.

38. By the first method the coal gets sufficient air to be burned to carbon dioxide (CO_2); by the second, much of it is burned to carbon monoxide (CO), thus taking up only half as much oxygen as it is capable of uniting with, and of course, producing less heat.

39. Kerosene, or "coal-oil," prepared from the mineral oil petroleum, is the cheapest household fuel, and is safe when of good quality and when burned in stoves intended for it. *Never use kerosene to kindle a wood or coal fire.* When heated, it gives off vapor that in contact with fire is likely to explode.

40. Natural gas, used for heating and lighting, flows from the ground. Both it and coal-oil are believed to be of vegetable origin. What is the source of their energy? **Artificial gas** is made from coal.

In *The Fairyland of Science*, you will find an interesting chapter, illustrated, on "The History of a Piece of Coal." *Coal and the Coal-mines* tells all about coal, and has pictures of Pennsylvania mines, plant forms found in coal, etc.

Another good book (not quite so simple as this) is *Chemistry in Daily Life*. For information about primitive ways of obtaining fire, and about Matches and Phosphorus, see pp. 17–22; Petroleum, pp. 28, 29; Gas and Gas-stoves, pp. 33–36.

Chapter VII of *Home Economics* tells some things not mentioned in this text-book, about fuels and fires. *Domestic Science in Grammar Grades* tells about "The Evolution of Fire," on p. 29, and about "Ancient Forests and Modern Fuel," on p. 32.

Section 3. Water

Men really know not what good water's worth. —BYRON.

41. Water in nature. — Water occurs more commonly and in larger quantities than any other liquid. It exists not only in the ocean and in other bodies of water, but in plants, the bodies of men and animals, and even in rocks and other things that seem quite dry. Air contains water; some fruits consist of little but water and flavoring, with just enough solid matter to give them form; our own bodies are about three-fifths water.

Water is called "the universal carrier." It carries soil from place to place, piling in valleys what it washes away from hills; it bears seeds from one shore to plant them on another. It is the water in sap that enables it to flow through plants, carrying material to build them up; it is the water in blood that enables it to do the same for the animal body. **Without water there is no life**; a seed kept dry never sprouts; an unwatered plant dies.

Water as a Solvent

42. Much of the material carried by water is dissolved in it.

Experiments in solubility. — A. Put a level teaspoonful of salt into a glass of cold water. When the salt has disappeared taste the water. Put another teaspoonful into hot water. In which does the salt disappear more quickly? Try the same experiment with powdered chalk.

Salt is **soluble** in water; chalk is **insoluble** in water. Hot water dissolves salt more quickly than cold water does; that is, it is a better **solvent** for it.

B. Find out which dissolves faster, a whole lump of sugar, or a lump broken into bits; coarse or fine salt.

Water dissolves more substances than any other liquid. To this property it owes much of its carrying power. The more finely divided a substance is the more rapidly it dissolves. Why?

C. Boil some of the salt solution till the water is all gone; taste the residue, and tell what it is.[1]

[1] Sugar cannot be recovered from solution by boiling in the open air; it burns before it becomes solid. It may be recovered by crystallization, which we shall learn about in Chapter IX.

43. Pure water; impurities, organic and inorganic. — Clean water is colorless, odorless, and nearly tasteless. Its slight taste comes from various substances dissolved in it. One of these is air. If a glass of water stands until the air in it appears in bubbles on the glass, it is found to taste "flat." Absolutely pure water has no taste. Such water is not found in nature. That most nearly pure is the rain-water that falls during the latter part of a shower. The first rain to fall carries down with it dust and other impurities from the air. As water flows over or soaks through the ground, it dissolves a good deal of **inorganic** or mineral matter, with some that is **organic**, that is of plant or animal origin.

44. Living things, plants or animals, differ from lifeless things, in being able to feed, grow, and reproduce themselves. Organs were once supposed to be necessary for these acts; and, in consequence, things once part of an animal or a plant, as well as things actually alive, were termed *organic*. Though we now know that some tiny living things have no organs, we still use the words *organic* and *inorganic* to distinguish these two kinds of matter. **Examples of inorganic matter**: water, sand, carbon dioxide. **Examples of organic matter**: wood, perspiration, leaf-mould, manure.

45. Soft water best for cleaning and cooking. — Neither dirt nor soap dissolves readily in hard water. The latter forms with it a curdy substance. For cleaning and laundry purposes hard water should be softened by the addition of washing soda or ammonia. A moderate degree of hardness does not injure water for drinking purposes. As a rule soft water is desirable for cooking, especially when the object is to draw out flavor or nourishment from food, as in making soup or tea.

46. Drinking water should be pure. — Much organic matter in drinking water makes it unwholesome, and

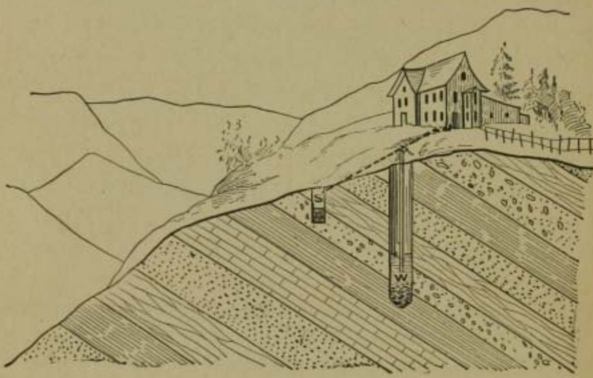


FIG. 3.

S = cesspool into which drain empties.
W = well into which contents of cesspool run through layers of sand and gravel.

may make it dangerous. Most objectionable of organic impurities is sewage, which is likely to contain disease germs. Wells are often dug for convenience near houses. Figure 3 shows how such a well may be polluted by house and stable waste. Fortunately, polluted water tends to become purer by filtering through the ground, and by running over its surface where air can reach it.

Spring water and water from artesian wells is usually pure. City water, if not from pure sources, should be filtered through sand beds. **Filters** of charcoal or porcelain for household use must be kept clean, or they soon become filled with impurities, making the water passed through them fouler instead of purer. **Small filters** ***screwed on to faucets are of little or no value.*** Drinking water about the purity of which there is any doubt should be boiled to kill germs (*bacteria*). (§§ 57–59.) Water may dissolve lead from the pipes it runs through. To avoid the risk of lead poisoning, let the water run for a few minutes — long enough for what has stood in the pipes over night to run off — before drawing any for use.

A Study of the Effect of Heat on Water

47. Experiment. — Put some water in a saucepan or other vessel. Take its temperature with a thermometer. Set it on the stove or over a Bunsen burner, and hold the thermometer so that its bulb is below the surface of the water, but not touching the bottom of the vessel. (Fig. 4.) Watch the sides and bottom of the saucepan.

Are the bubbles large or small at first? After a little while? What comes off from the surface of the water? Note the temperature of the water. Note it again when the bubbles begin to break at the surface. Does the mercury rise after this? Increase the heat. Can you make the water any hotter?

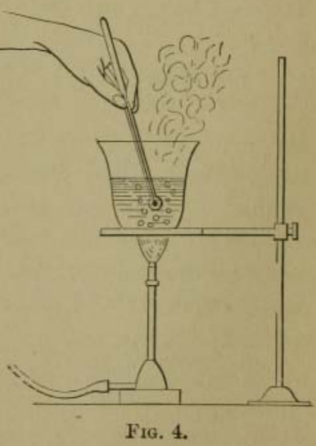


Fig. 4.

48. The changing of water into steam; simmering-point of water 185° F.; boiling-point 212° F. — When water is heated the air dissolved in it expands, forming tiny bubbles. These rise, but the cold water near the surface chilling them, they contract, and sink again. When all the water has become warm they rise and escape. By this time the heat is beginning to change the water into **steam,** an invisible gas. The steam bubbles are larger than the air bubbles. As they near the surface of the water, they are cooled, and **condensed,** *i.e.* turned back to water. This bubbling below the surface is called **simmering.**[1] The temperature of the water is now about 185° F. The water growing hotter, some of the bubbles reach the surface and break there, giving off clouds of steam. Now, for the first time, the water boils. Its temperature is 212° F. By increasing the heat the water may be made to boil faster, but it will not grow hotter. All the heat is now being used in turning water into steam. If boiled long enough all the water turns to steam and disappears in the air. If steam be cooled, by coming against a cover, for instance, it gives up its heat and becomes water again.

The word **vapor** is applied to gases that, under ordinary circumstances, are liquid. Steam, therefore, is **water-vapor.**

[1] In cooking, it is sometimes important to keep water simmering; at other times necessary to have it boiling. Learn to distinguish between these. When steam comes in jets from the spout of a teakettle, the water boils.

49. The weight of air pressing on the surface of water prevents the steam from escaping until it gains force enough to overcome this pressure. At the sea level water boils at exactly 212°, but on a high mountain at a temperature several degrees lower. If the steam be confined, water may be raised to several degrees above 212°; for the air under the lid soon takes up all the vapor it can hold, making it impossible for any more water to be changed into steam. The heat that would otherwise be used in making steam is now saved and makes the water hotter.

50. Real steam is invisible, the mist we call steam being steam partially condensed. The slow forming of water-vapor that takes place at ordinary temperatures, in the drying of clothes, the disappearance of water after a rain, and the like, is called **evaporation.**

51. Effect of cold on water. — At 32° F. water freezes, becoming ice. At 32° ice melts, forming water. By heating it, ice may be in a few minutes changed to water, and from water to steam. Do you know of anything else that is changed from solid to liquid, and from liquid to gas, by heat?

52. Solids, liquids, and gases. — The particles of which **a solid** is composed hold firmly together, those of **a liquid** hold loosely; those of a **gas** tend always to go farther apart. Heat separates particles of matter; on cooling, they draw together again.[1] Hence we say, "Heat expands, cold contracts." Hot air rises, because by expanding it becomes thinner and lighter.

[1] EXCEPTION. — Water expands just before it freezes; hence the bursting of pipes.

53. Composition of water. — Water is composed of hydrogen and oxygen. In what experiment was water formed? Where did the hydrogen come from? The oxygen? Water may be decomposed by sodium, a soft white metal. A bit of this thrown upon water unites with its oxygen so rapidly as to catch fire. The hydrogen, ignited by this, burns also, as is shown by the appearance of the blue hydrogen flame.

Some Facts about Water to be Remembered

54. 1. A solid dissolved in water will, in most cases, be found at the bottom of the vessel after the water has evaporated or boiled away.

2. Boiling expels air from water, making it taste "flat." Boiled water should be poured back and forth several times from one pitcher to another, or shaken in a large bottle, to restore its flavor.

3. Hard water may be made soft by boiling.

4. Impure water may be made safe for use by boiling.

5. Since, by ordinary means, water cannot be made hotter after it begins to boil, *fuel is wasted in keeping up more fire than is required just to keep the water at the boiling-point.*

6. By covering the vessel some of the steam is condensed, thereby saving heat.

55. Water in relation to health; drinking freely of pure water makes for health. — The water we drink or take in as part of our food aids digestion, conveys nourishment to all parts of the body, removes waste, and in other ways keeps the body in order. Large quantities of cold water should not be drunk when one is overheated; nor should water or any other liquid be used to wash down solid food.

Suggestions for reading and home work in connection with this section. — Read in *Early Chapters in Science* about thermometers, pp. 241–244; and about the density of ice, pp. 250, 251. Try distilling water and crystallizing alum according to directions on pp. 231 and 236. See what Dr. Prudden writes in his little book, *Drinking-water and Ice Supplies*, about "The Earth's Stock of Water," pp. 12–15; "Kinds of Water," pp. 31–37; "Some Ways of Getting Water," pp. 78–89; and "Solid Water" pp. 115–125. This last chapter tells how ice is cut and stored.

Section 4. Cleanliness and Cleaning

All may of Thee partake.
  Nothing can be so mean
But with this tincture, *For Thy sake*,
  It will be bright and clean.

A servant by this clause
  Makes drudgery divine;
Who sweeps a room as by Thy laws,
  Makes that and the action fine.

— George Herbert.

56. Pure air and pure water we have seen to be simply clean air and clean water. The importance of cleanliness is better understood than ever before, now that scientists have shown the close relation between dirt and disease. The dirt that shows most plainly may not be the most objectionable. A dusty chair is of much less consequence than an unclean dish-cloth.

57. Two kinds of dust: living and lifeless; bacteria. — The dirt in houses consists for the most part of dust, both alone and mixed with grease (fatty matter), moisture, and sticky substances. **Dust** *is earth or other matter in particles so fine that it can be raised and carried by the wind.* Dust is everywhere present. We see how quickly it gathers on the floor and the furniture; a sunbeam shows us that the air is full of it. This **visible dust** was for a long time the only kind known about. It has been discovered, however, that mixed with visible dust is another kind, so fine that it can be seen only

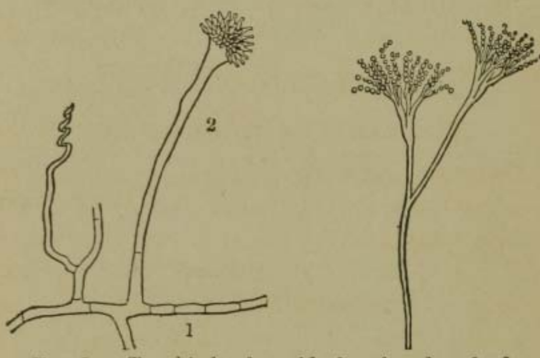


FIG. 5. — Two kinds of mould often found on **food.**

with a microscope. This **invisible dust** is composed of tiny plants and their seeds, or *spores.* When these spores fall upon suitable material they grow. When enough plants are growing together they can be seen with the naked eye.

58. Experiments. — A. Expose a piece of bread or cheese, or some cooked fruit, to the air for a few days, covering it to keep it moist. What appears on the surface?

B. Examine this growth with a magnifying-glass or microscope.

Microscopic plants are of three kinds, **moulds, yeasts,** and **bacteria** (singular *bacterium*, rarely used). They will be studied in other chapters.

59. Bacteria the most objectionable kind of dust. — Visible dust may do harm by irritating the throat and lungs; but certain kinds of bacteria, if they enter the body, may produce such diseases as consumption, diphtheria, and typhoid fever. Other kinds cause food to spoil. Bacteria thrive best in dark, damp places, where other dirt is present. Anything that kills bacteria or hinders their growth is called a **disinfectant.**

Natural Aids to Cleanness

60. Light, air, and water. — Light promotes cleanness by revealing the visible dirt and destroying the invisible. Direct sunlight is a better disinfectant than mere daylight. A draft of air removes dust, smoke, and watery or greasy vapors, which combine with air to coat surfaces with an unclean film. It is impossible to live in a cleanly manner without a liberal use of water. Water is useful for cleaning on account of its power as a solvent (§ 42).

Friction is required to remove soil closely attached to a surface or ingrained in the material.

Artificial Aids to Cleanness (Plate II).

61. Implements and materials for cleaning. — The implements for cleaning include brooms, brushes, cloths, pails, etc. Cleansing materials are of two sorts, those that act mechanically by friction, and those that act chemically upon dirt removed with difficulty or not at all by water; for example, grease and stains. Care must be taken to use implements and materials that will remove the soil without injuring the surface beneath it.

Cleaning powders. — For additional friction mineral powders are employed. White sand is used for scouring iron and wood; bath brick for steel knives; tripoli or rottenstone for copper, brass, or tin; whiting for silver, aluminum, and brass.

62. Bath brick is made from earth containing lime. **Tripoli** is impure decayed limestone. **Rottenstone** is a fine kind of tripoli. **Whiting** is powdered English chalk made very fine by sifting it through muslin, or by floating it on water so that the heavier particles may sink.

63. Alkalies; the removal of grease. — Most important of chemical cleaning materials are certain alkalies, those most commonly used being **soda** (also called sal-soda and washing-soda) and **ammonia.** The former is much the stronger. **Potash**, or lye, an alkali similar to soda, was much used before soda became cheap enough to drive it out of the market.[1] By means of these, grease can be removed, since any alkali unites with grease to form a compound soluble in water.

64. How soap cleans. — **Soap** is a preparation of alkali in a convenient form. It is a compound of soda or potash with acids found in fat. Potash makes soft soap;

[1] A compound sold in round cans labelled "potash" is simply commercial caustic soda.

PLATE II.

Materials used in Cleaning.

Implements and Materials used in Cleaning.

soda, or potash to which salt has been added, hard soap. Water decomposes the soap, and the alkali thus set free attacks any grease it touches. Any dust mixed with this grease can then be washed away. Soap and water is effective for almost all cleaning purposes.

65. Sal-soda; care in using it. — If a stronger form of alkali is needed, sal-soda is the best for general use. Being cheap, it forms the basis of most washing-powders and compounds. As these are often sold for many times their value, it is more economical to buy the soda itself. On account of its powerful action upon the skin it must be used with care. *Do not add soda directly to the washing-water, but dissolve one pound of it in one quart of water*, in a saucepan over the fire. When it is cool put it in a bottle labelled "Sal-soda Solution," and pour in a little when needed.

66. Ammonia is used chiefly in laundry-work. It may be used instead of sal-soda for general cleaning. (For the use of alkalies with hard water, see § 45.)

Kerosene. — Kerosene is useful for cleaning polished woods which would be injured by alkalies. Kerosene and alkalies are both excellent disinfectants.

Cleaning Metals

67. Experiments. — **A.** Let a piece of iron lie wet in the air for several hours. Pour a little water into an old worn tin dish; allow a few drops of water to fall on a steel knife-blade; and let dish and knife lie for some time. What do you observe? Has the *tin* rusted? How can we keep steel from rusting?

B. Lay one silver spoon next to a rubber band. Wrap another in white flannel. Lay a bright brass button in a dry place. Wrap another in damp cloth. Examine all these after a day or two. Would you approve of keeping silver wrapped in white flannel? What effect has dampness on brass?

68. Tarnish and rust.[1] — **Rust** is a compound formed in the presence of moisture, by the union of the oxygen of the air with iron (§ 103). **Tarnish** is a discoloration of polished metals caused by the action of oxygen, sulphur, or some other element upon the metal. The sulphur used in making rubber and in bleaching cloth, and the sulphurous gases from burning coal or gas, form with silver a grayish black compound insoluble in water.

69. C. Try to remove the tarnish from silver with whiting, with alcohol; from brass with rottenstone, with rottenstone and water, with rottenstone and oil, with vinegar or lemon-juice. Compare the effectiveness of the various materials.

70. Removal of tarnish. — Labor is saved by using an acid or other substance that will act chemically on the tarnish, dissolving it.[2] A mineral powder completes the work and adds polish. Oil, water, or acid, — lemon-juice or vinegar, — mixed with the powder, forms a paste easy to apply. The cleaning preparations in the market are the substances described above, or combinations of them, sometimes with the addition of coloring-matter.

[1] Tarnish and rust, although, strictly speaking, not dirt, are removed by similar means, and are therefore conveniently treated of here.

[2] It is not always safe to use a chemical, although it may be easier. For instance, any chemical that brightens zinc eats into it.

71. Putz pomade is a mixture of whiting, oil, and acid. **Sapolio** is a compound of fine clay, alkali, and fat. Most **silver-powders** are simply whiting. **Stove-blacking** is made of graphite mixed with molasses or other sticky substance.

Care of Floor and Woodwork

72. Care of kitchen floor. — The best kitchen floor is of hard wood, oiled or varnished. If anything is spilled upon it, wipe or brush it up at once. Cover grease-spots on wood or stone with flour, starch, or powdered chalk, which will absorb the grease. Cold water poured upon grease as soon as it is spilled will harden it; the greater part may then be scraped off. Sweep the kitchen floor thoroughly once a day. With care it will not need washing or scrubbing oftener than once a week.

73. How to sweep. — *Before beginning to sweep, see that no food is left uncovered in the room.* Sweep from the edges of the room toward the centre. Sweep with short strokes, keeping the broom close to the floor. Turn it edgewise to clean cracks. When the dust has been gathered at one spot, take it up with a short broom and a dust-pan, and, if possible, burn it at once. Never sweep dust from one room into another. *Always sweep a floor before washing or scrubbing it.*

74. How to scrub a floor. — Soft-wood floors must be scrubbed. Provide two pails of cold or lukewarm water, a stiff scrubbing-brush, a large, soft, but not linty cloth, and soft soap and sand, or sand-soap. Dip the brush in water, then in soap, and lastly in sand.

Look for grease-spots and take them out first. After the floor has become wet you cannot see where they are. Scrub with the grain of the wood, doing a few square feet at a time. Dip the cloth in clean water, and wash the part that has been scrubbed. *Use no more water than you need.* Wet the cloth again, wring it as dry as you can, and wipe the floor. Proceed in this way until the whole floor has been cleaned.

75. Care of hard-wood floor. — On a hard-wood floor use little water or none at all. Wipe it with a cloth moistened with a very little kerosene, — a teaspoonful or two to begin with, and as much more when that has evaporated. Rub hard with another cloth until the wood is perfectly dry. Window-sills and all hard-wood finish may be cleaned in the same way.

76. Care of oil-cloth. — Wash oil-cloth with warm water and milk, — *one cupful of skim-milk to one gallon of water*, — and wipe dry with a clean cloth.

77. Cleaning paint. — To clean paint, provide whiting, two basins or pails of water, and three clean, soft cloths, — woollen is best. Take a little whiting on a damp cloth, and rub it on the surface to be cleaned. Do not let drops of water trickle down the paint. Wash off with a second cloth and clean water. Wipe dry with a third cloth. Clean a little at a time, leaving the cleaned part dry before going on.

78. Dusting. — After sweeping a room dust the woodwork, furniture, and movable articles with a soft cotton

PLATE III.

THE SINK AND ITS FITTINGS.

cloth. Spread the cloth out and gather the dust into it, folding it in as you work. Shake it frequently out of the window. In the kitchen where there are no delicate articles to be injured by moisture, use a damp cloth. To have it just damp enough, wet a part of it, wring this out, fold the damp part and the dry together, and squeeze them. When the room has been dusted, wash the cloth and hang it to dry.

The Sink and its Fittings (Plate III)

79. Construction of the sink; the trap. — Soapstone and enamelled iron are the best materials for a sink. Wood is least desirable, because hardest to keep clean. The space below the sink should be left open. The sink should slope down toward the waste-pipe. The waste-pipe should have a bend in it that will allow water to stand in it deep enough to prevent gases from passing up from the drain into the kitchen. This bend is called a **trap**. The water it contains is called a **water-seal.** (T, Fig. 6 *A*.)

After pouring soiled water down the waste-pipe, follow it with clean water, so that foul water shall not stand in the trap. If a sink is left unused for several days or longer, the water-seal may evaporate so that gases from the drain rise into the room. On this account a house that has been vacant should be well aired before being occupied.

80. Sink-fixtures and conveniences. — There should be a **strainer**, *screwed down* over the top of the waste-pipe.

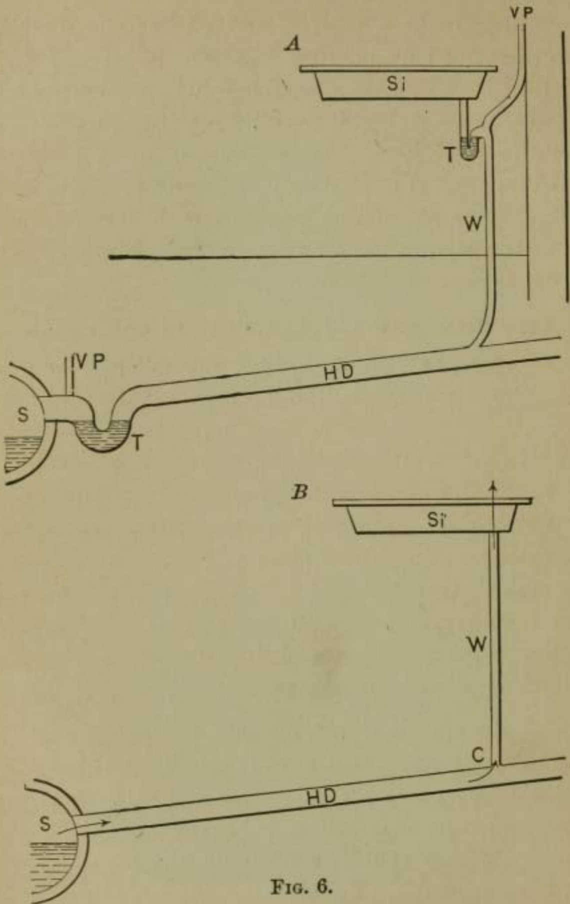


FIG. 6.

A, Sink properly trapped and connected with sewer; *B*, Sink improperly connected with sewer.

Si = sink. W = waste-pipe. VP = vent-pipe.
T = trap. S = sewer. HD = house-drain.
C = connection of waste-pipe with drain.

Arrows show direction of current of sewer-gas.

It is well to have a finer strainer also, through which to pour waste-water. This, by catching crumbs which might pass through the set strainer, helps to keep the sink clean. A grooved **draining-board**, sloped toward the sink, and a **shelf** above the sink for cleaning materials, are convenient. There should be **hooks** for hand-basin, dipper, soap-saver, sink-scraper, and scrubbing-brush. The **garbage-pail** should be of metal, or indurated fibre. Its cover should fit tightly.

81. Care of the sink. — Neglect of the sink causes bad odors, attracts water-bugs and roaches, and not infrequently produces disease. *Keep it at all times free from scraps.* When the dishes have been washed, or when the sink is to be left unused for several hours, wash it, using scrubbing-brush and sapolio. Wipe the woodwork and tiling. Wash strainer, soap-dish, and other sink utensils. Wash the cloth. Scrub the draining-board, and rinse the sink. If it is of iron, and is to be left for several hours, wipe it dry. If rusty, use kerosene, or grease it with mutton-fat or lard, sprinkle with lime, and leave over night.

82. Care of faucets. — Clean **brass faucets** with flannel dipped in vinegar or lemon-juice, and rub thoroughly with rottenstone and oil, then polish with a dry cloth. Or apply putz pomade or some similar preparation, rub off with another cloth, and polish with a third one. If the faucets are greasy, wash them with soap-suds or sal-soda solution before using anything else. Metal cleaned with acid tarnishes quickly unless all trace of the acid is removed by rubbing with powder. (§ 105.) **Nickel faucets and trimmings** need only to be washed with hot soap-suds and wiped dry.

83. Care of waste-pipe and trap. — Waste-pipe and trap must be kept as free as possible from deposits of grease. After pouring down very greasy water pour down boiling water, that the grease may not cool and settle on the sides of the waste-pipe. Once a week pour down a strong hot solution of sal-soda (*one-half cupful of soda to two quarts of water*). If the pipe becomes clogged use a stronger solution.

84. Care of garbage-pail.[1] — Scrub the garbage-pail with sal-soda and rinse with boiling water once a day. Dry it in the sunshine, if possible.

Care of Dishes

85. Dish-washing need not be an unpleasant task if these four rules are observed: 1. Use hot soapy water. 2. Change the water frequently. 3. Have the dishes free from crumbs and scraps before beginning to wash them. 4. Wash kettles and other cooking utensils first.

86. Directions for dish-washing. Preparation. — 1. Collect all dishes to be washed. 2. Scrape them, putting scraps in an earthenware or enamelled dish; wipe frying-pans and other greasy dishes with pieces of soft paper. This paper may be used for kindling. 3. Fill

[1] It is better to avoid using a garbage-pail. Garbage may be burned in a bright fire if all the drafts are left open.

greasy pots and pans with hot water to which a teaspoonful of sal-soda has been added, and let them stand. Soak dishes that have contained batter, dough, eggs, or any starchy material in cold water; dishes that have been used to cook sugar, in hot water. 4. Put all dishes of a kind together; plates in piles, knives, forks, and spoons laid with handles one way, etc. Place nearest to you the dishes to be washed first. 5. Have a clean dry place clear for clean dishes. 6. Make ready two pans, — one half full of hot soapy water, and the other half full of clear hot water.

87. Washing. — 7. Wash the dishes in the following order: *a*. Large kettles and cooking utensils. *b*. Smaller articles of kitchenware. *c*. (With clean water and dish-cloth) glassware. *d*. Silver. *e*. Cups and saucers. *f*. Plates. *g*. Platters, vegetable dishes, etc.

88. General instructions. — 8. Wash all dishes, *including kettles*, inside and out, in soapy water; rinse in clear water, drain, and wipe dry. 9. Use sapolio to remove food that sticks or is burnt on. 10. Use a wire dish-cloth on **ironware**, a scrubbing-brush, if necessary, on **enamelled ware, tinware**, and **wire strainers**. Clean seams in tinware and enamelled ware with a wooden skewer.

89. Special instructions. — 11. Do not put **knife-handles** in water. Water discolors and cracks ivory and bone handles, and may loosen wooden ones. After washing knives, scour them with bath brick. 12. **Do not** wash **bread-board** or **rolling-pin** at an iron sink. The **iron** will leave marks on them. Wash them at the **table.** 13. Be careful not to wet the cogs of a **Dover egg-beater.** Wash the lower part, and wipe off the handle with a damp cloth. Water washes the oil from the cogs, thus making the beater hard to turn. 14. Dry the seams of a **double-boiler** carefully. 15. Do not waste time polishing **tins.** It is sufficient to have them clean and dry.

16. Dip **glasses** into hot water, so that they will be wet inside and outside at the same time. Unequal expansion of the glass, caused by one part being heated suddenly, is what breaks them. 17. **Silver and glass** are brightest if wiped directly from clean, hot suds, without being rinsed. A damp towel makes dull spoons and glasses. 18. Scald, *i.e.* rinse with boiling water all **vessels that have contained milk.** 19. Wash **teapot** and **coffee-pot** in clean hot water without soap, and wipe dry. Clean the spout carefully. Let them stand for a while with covers off. 20. Wash dish-pan and rinsing-pan, and wipe dry with a towel, *not with the dish-cloth.*

For care of towels and sink, see §§ 81 and 92.

90. To scour steel knives. — Scrape off a little bath brick with the *back* of the knife or with an *old knife.* Dip a cork in water or oil, and then in the brick-dust. Hold the knife firmly, with the blade resting flat upon a level surface, and rub both sides of the blade with the cork. (Fig. 7.) Wash the knife. Scour steel forks in the same way. *Never scour silver-plated knives or forks.*

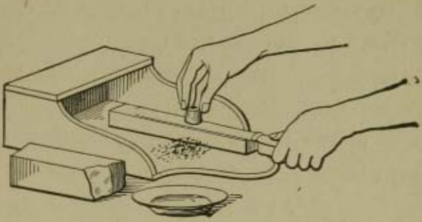


FIG. 7.

91. To clean silverware. — Moisten a soft cloth with water, dip it in *fine* whiting, and apply to the silver. When the whiting has dried, rub it off with another soft cloth, and polish with chamois-skin. To cleanse chasing or ornamental work, use an old tooth-brush. Rub egg-stained spoons and other badly tarnished articles with salt before washing them. Wash in ammonia and water.

Tarnish is not soluble, but with the chlorine in the salt it forms a new compound soluble in ammonia. (§ 102 and § 104.)

CARE OF KITCHEN TOWELS AND CLOTHS

92. Dish-cloths, dish-towels, and sink-cloths should be hemmed. Lint and threads from unhemmed cloths are likely to obstruct the sink drain. *Use each cloth only for the purpose for which it is intended.*

93. The dish-cloth. — No detail of housekeeping is more important than keeping the dish-cloth clean. A damp, sticky, greasy dish-cloth breeds disease. The disease germs on the cloth are transferred to the dishes, and from them to the people who eat from them. In this way a whole family has sometimes been made sick. Wash the dish-cloth with hot water and soap after using it. Rinse it, shake it out, and hang it to dry, — in the sun, if possible. Boil it once a week, or whenever washing fails to make it white. *Never use it for anything except washing dishes.*

94. Other cloths. — Wash **dish-towels** once a day in warm water, using soap. Rinse them in warm or cold water, and hang them to dry with the ends pulled evenly together. **Strainer-cloths** that are not greasy may be washed in cold water. Wash greasy ones in hot water with soap or sal-soda. **To remove fruit stains** from a cloth, lay it over a bowl and pour boiling water upon the stain. All **cleaning-cloths** should be washed, rinsed, and *dried* after being used.

Care of Stove and Zinc

95. If anything is spilled on the **stove** or **range**, wipe it off at once with soft paper. Use sapolio to remove anything not taken off by the paper. To keep it black and clean, wipe it daily with a few drops of kerosene on a cloth. Polishing is unnecessary; but if you prefer to polish it, apply stove-blacking just after the fire has been started, and polish with a brush or coarse cloth.

Zinc discolors easily. Even a drop of water allowed to stand on it will make a spot. It may be cleaned with a little kerosene rubbed on with a flannel, or with electro-silicon on a damp cloth. Polish with dry flannel.

Care of Refrigerator

96. The waste-pipe of the refrigerator or ice-box should empty into a pan, or into the open end of a properly trapped drain-pipe; it should never be continuous with the drain-pipe, such an arrangement making easy the passage of sewer gas into the refrigerator.

Daily care. — Keep the inside of the food chamber dry. See that no food remains in the refrigerator long enough to spoil. Empty the pan, if there is one, every day.

Weekly cleaning. — *Clean the refrigerator thoroughly at least once a week.* Take out both food and ice. Wash shelves and racks with hot soapsuds or with sal-soda solution, and rinse with clear hot water. Dry them in the open air or by the fire. Wash the food chamber and the air chamber in the same way. Clean grooves and corners with a skewer, and run a wire with a cloth twisted around it down the waste-pipe. Rinse the pipe with hot sal-soda solution. Wipe the refrigerator dry; and if possible, let it remain open for an hour.

Care of Articles used in Cleaning

97. Rinse scrubbing-brushes and dry them in the sun, *bristles down.* Hang up brooms, when not in use, by strings tied into the handles. Do not waste soap by leaving it in water. Keep knife-cleaning materials in one box, silver-polishing materials in another, etc. See that all things used in cleaning are kept clean.

Treatment for Insects

98. To have a kitchen free from cockroaches and water-bugs, keep every part of it clean and dry, and leave no uncovered food, soiled dishes, garbage, or crumbs about. To destroy the pests, dissolve one pound of alum in three pints of hot water, and pour the solution while hot into cracks and crevices. Also sprinkle borax in all places where the insects have been seen.

Personal Cleanliness

99. Observe the following rules in the school kitchen and at home : —

1. When cooking, or doing other housework, wear a washable gown short enough to clear the floor by at least two inches.

2. When in the kitchen, pin or tie your hair back so that no hairs may fall into the food. When sweeping, cover it with a cap or kerchief to protect it from dust.

3. Wear no rings or bracelets in the kitchen.

4. Before touching or preparing any food, wash your hands thoroughly with soap and water ; scrub the nails with a nail brush, and clean them with a wooden tooth-pick or a regular nail cleaner.

5. Keep a damp towel at hand, on which to wipe your fingers if they become soiled or sticky. Always

wipe them after touching your hair or pocket handkerchief, or after handling the coal-hod, or anything else not quite clean. Never wipe them on your apron, your handkerchief, or on a dish-towel.

6. Never dry dishes with a hand-towel.

7. The best way to taste of what you are cooking is to take a little of the food up with the mixing-spoon, put it in a teaspoon, and taste from the teaspoon. If you should happen to taste from the mixing-spoon, wash it before putting it back into the dish.

The history of soap and the process of soap-making are written of in *Chemistry of Daily Life*, pp. 204–213.

Section 5. Matter: its Nature and Changes

The chemistry of cooking is largely . . . the application of heat to the food material in such a way as to bring about the right changes and only these. — Ellen H. Richards.

100. We have seen that familiar substances may undergo great changes. The burning candle changes from an opaque white solid to a translucent liquid, and then to a mixture of invisible gases. Salt, upon being mixed with water, becomes a clear liquid not distinguishable from water itself. The solid carbon of wood and the gas oxygen unite to form carbon dioxide, a gas quite different from oxygen; and when the action is over, a handful of gray ashes is all the solid substance left. Heat readily changes ice to water, and water to steam.

We are so used to these happenings that they excite in us no wonder; yet, for hundreds of years men have been studying these and similar changes without finding out all there is to be known about them. So important is the part they play in our everyday work, especially in cooking, that a knowledge of the simpler facts about them is a great help to housekeepers.

101. Physical and chemical changes. — Liquid candle grease returns to the solid form when cooled; dissolved salt may be recovered by evaporating the water; even steam may be collected, condensed, and frozen. In these cases it is plain that the changes are only changes in form. **A change in the form of matter without change in its composition is called a physical change.** When, however, melted candle grease becomes gaseous, it will not return to its original form; burnt sugar will never be sweet and white again; water acted upon by sodium is neither water, steam, nor ice. In these cases the new substance has a different composition from the old one. **A change in the composition of matter is called a chemical change.** Heat, especially in the presence of moisture, often brings about chemical changes.

102. Elements and compounds. — Some substances are simple; that is, they consist of but one thing. Examples: iron, oxygen, carbon. A simple substance is an element. Other substances are composed of two or more elements. Examples: water, carbon dioxide. Into what elements may water be separated? Carbon dioxide? A substance composed of two or more elements combined is a compound. In a mixture each substance keeps its own properties; in a compound these give place to new properties belonging to the compound. Every chemical change involves either the forming or the decomposition (breaking-up) of a compound, usually both.

103. Four elements found in food; some of their properties. — **Foods** consist of compounds formed chiefly from oxygen, carbon, hydrogen, and nitrogen, with small quantities of other elements. **Oxygen** is an invisible, odorless gas. It is a very active element, always ready to unite with other elements to form new compounds. The combining of oxygen with another element is called **oxidation**. The rusting of metals and the decay of organic matter are slow forms of oxidation. Oxygen forms about one-fifth of the volume of air, eight-ninths of the weight of water, and two-thirds of the weight of the human body. **Hydrogen** in an invisible gas. It will burn, uniting with oxygen to form water. It forms about one-ninth of the weight of water, and one-eleventh of that of the human body. **Nitrogen** is an invisible, incombustible gas. It does not readily combine with other elements, and the compounds into which it enters break up easily. It forms about one thirty-ninth of the weight of the body. **Carbon** exists as an element in two forms, graphite, the so-called "lead" of pencils, and the diamond. It is most commonly met with in a slightly impure form as charcoal. Of all the elements, no other enters into so many compounds as does carbon. It is contained in all organic substance, as is shown by their blackening (carbonizing) when heated. All foods except common salt consist of organic matter.

104. Salts. — A salt is a compound resulting from the union of an acid with one of a class of substances called **bases**. Commonest among bases are the **alkalies**. §§ 63–66 and Chapter IV, Sec. 1. Common salt (sodium chloride) can be made by adding hydrochloric acid to caustic soda.

105. Action of acids on metals. — Acids act on metals, particularly those exposed to dampness and air, forming salts or oxides of the metals. The staining of steel and the corroding of tin and other metal ware by potatoes, fruit, etc., is caused by the action of organic acids in the food. The salts formed in this way are likely to be poisonous. Food not naturally acid becomes so by long keeping, or by decay.

Reading that may help you better to understand the topics briefly discussed in this section: *Early Chapters in Science;* connection, conduction, radiation, pp. 252–257; elements and compounds, pp. 313, 314; oxidation, p. 323; three states of matter, pp. 231–240.

Section 6. Definitions, Tables, Rules

If a man or woman has not the soul of a cook, the most minute recipes will end in failure. — KUTTNER.

106. Food and cooking ; how and why food is cooked.— Food is whatever nourishes the body. Cooking is making food ready to eat. This is done chiefly by means of heat.

Food is exposed to the action of heat, (1) to make it more digestible, (2) to improve its flavor, and (3) to kill any living things it may contain.

Many vegetable foods, and a few animal foods, oysters, for instance, may be eaten uncooked. All plant foods undergo a kind of cooking by the heat of the sun, as do animal foods by the heat of the animal body.

PRINCIPAL METHODS OF COOKING

1. **Broiling**: cooking over a glowing fire. 2. **Roasting**: cooking before a glowing fire.	Direct application of heat.
3. **Baking**: cooking in an oven.	Application by means of heated air.
4. **Boiling**: cooking in boiling water. 5. **Stewing**: cooking for a long time in water below the boiling-point.	Heat applied by means of water.

6. **Steaming**:	*a*. moist: cooking in steamer.	By contact with steam.
	b. dry: cooking in double boiler.	By the heat of steam surrounding vessel.
7. **Frying**: cooking in hot fat deep enough to cover the article to be cooked.		Heat applied by means of heated fat.
8. **Sautéing**[1]: cooking in a small quantity of hot fat.		
9. **Pan-broiling**: **Pan-baking**:	cooking in a frying-pan or on a griddle, with little or no fat.	Heat applied by means of heated metal.

10. **Braising**: a combination of stewing and baking.
11. **Fricasseeing**: a combination of frying and stewing.

Table of Measures

3 teaspoonfuls make	1 tablespoonful
16 tablespoonfuls of any dry ingredient make	[2] 1 cupful
12 tablespoonfuls of liquid make	1 cupful
4 cupfuls make	1 quart

Table of Comparison between Weights and Measures

2 cups of butter (packed solidly)	is equal to	1 pound
2 cupfuls of finely chopped meat (packed solidly)	"	1 pound
2 cupfuls of granulated sugar	"	1 pound

[1] Pronounced *sotaying*. [2] A half-pint cup is the standard.

2⅔ cupfuls of powdered sugar	is equal to 1 pound
2⅔ cupfuls of brown sugar	" 1 pound
2⅔ cupfuls of oatmeal	" 1 pound
4¾ cupfuls of rolled oats	" 1 pound
4 cupfuls of flour (about)	" 1 pound
9 or 10 eggs	" 1 pound
2 tablespoonfuls of butter	" 1 ounce
4 tablespoonfuls of flour	" 1 ounce
"The juice of one lemon"	3 tablespoonfuls

Directions for Measuring

107. 1. Sift, or shake up lightly with a spoon, all dry materials (flour, baking-powder, etc.) before measuring them. Always *sift* mustard.

2. All measures are to be taken *level* unless otherwise directed.[1]

3. To measure a cupful of dry material, fill the cup with a spoon or scoop, and level off with a case-knife. To measure a teaspoonful or tablespoonful of dry material, fill the spoon by dipping it into the material, lift it, and level off with a case-knife. To measure a half-spoonful, divide a spoon lengthwise with the knife. Divide a half-spoonful crosswise to measure a quarter, and a quarter-spoonful crosswise to measure an eighth. Less than an eighth of a teaspoonful is called "a few grains." (Plate IV.)

4. A cupful of liquid is all the cup will hold; a spoonful of liquid is all the spoon will hold. A *heaping*

[1] In most cookbooks, including all published before 1896, it is intended that spoonfuls of flour, baking-powder, sugar, butter, and lard should be measured rounded. One rounded spoonful is equal to two level spoonfuls.

PLATE IV.

Steamer Colander Strainers Fish-boiler
Double boiler Melon-mold Flour-sifter Funnel
Vegetable press (for puddings, ice-cream, etc.) Lemon-squeezer
Potato-masher Biscuit-cutter

COOKING UTENSILS.

One cupful of sugar weighing one-half pound
Quart-measure Measuring one cupful of dry material
Half-pint measuring-cup
One-half teaspoonful, One-fourth tablespoonful,
measured

spoonful of *dry* material is all the spoon will hold. A scant cupful is measured by filling the cup to within one-eighth of an inch of the brim.

NOTE. — Success in cooking depends greatly upon accuracy in measuring. Only after much practice in measuring as here directed, should you venture to measure even small quantities by your eye. The requirement of accurate measuring and the giving of exact quantities of material in the recipes in this book, are not intended, however, to do away with the exercise of individual taste and judgment. So long as flours vary in thickening quality, and spices and other cooking materials in strength, it will be impossible to write recipes that can be followed absolutely in all cases. Follow a recipe exactly the first time you use it; if it requires to be varied, you can then make the change intelligently; whereas, if you have not followed it exactly, you cannot be sure which is at fault, the recipe or the cook.

The quantities of seasonings given in this book are, as a rule, the smallest desirable. Increase them cautiously to suit your taste; but do not fall into the error, common in America, of over seasoning food with pepper and salt.

TABLE OF ABBREVIATIONS USED IN THIS BOOK

tb. stands for tablespoonful, or tablespoonfuls.
t. stands for teaspoonful, or teaspoonfuls.
c. stands for cupful, or cupfuls.
qt. stands for quart.
pt. stands for pint.
lb. stands for pound.
oz. stands for ounce.
f.g. stands for a few grains.
r. stands for rounded.
hp. stands for heaping.
sc. stands for scant.
min. stands for minute, or minutes.
hr. stands for hour.

Hints on how to Work

108. 1. See that the fire is ready for use, or so arranged that it will be ready by the time it is needed.

2. Collect all the materials that will be needed.

3. Collect all the dishes, spoons, and other utensils that will be needed, including a plate on which to lay sticky spoons, knives, etc.

4. Take care not to make work for yourself by using more utensils than are necessary. For instance, by measuring dry materials first, then liquids, and last, fats, you need use only one cup.

5. When milk and eggs are used, save a little of the milk to rinse out the bowl in which the eggs are beaten.

6. Use an earthen bowl and a wooden spoon for mixing cakes, muffins, etc. A tin dish and an iron spoon are likely to discolor the mixture.

7. Have all materials ready for use (flour sifted and measured, eggs broken, raisins stoned, etc.), before beginning to put them together.

8. Cover flour-barrel, sugar-bucket, baking-powder can, etc., as soon as you have taken from them what you need.

9. Clear up as you work, putting dishes to soak as soon as they are emptied, and washing them at once if you have a moment to spare.

10. When you have finished, collect all the dishes that remain, saving any unused material that is in good condition.

11. Learn to work neatly, carefully, quietly, and quickly.

Practical application is the only mordant which will set things in the memory. Study without it is gymnastics, and not work, which alone will get intellectual bread.

—James Russell Lowell.

Begin for Ex.

CHAPTER II

FUEL FOODS: SOME STARCHY PLANTS

Section 1. The Potato

Likewise a food, as also a meete for pleasure, being either roasted in the embers, or boiled and eaten with oile and vinegar, or dressed in anie other way by the hand of some cunning in cookerie. — GERARD.

RECIPES

BAKED POTATOES

Select medium-sized potatoes, scrub them well, and dry them. Bake them in a shallow pan on the rack in a moderately hot oven until soft (usually about forty-five minutes). Turn them occasionally, that they may bake evenly. When soft, press them between the fingers, and break the skin to let the steam escape. Serve them folded in a napkin in an uncovered dish.

BOILED POTATOES

(Put water to boil.)

Select potatoes uniform in size. Scrub or wash them, and if they are to be pared, pare them lengthwise, remove the "eyes" and any dark spots, and drop them into cold water. Put them into a kettle with enough boiling water to cover them.[1] When they have boiled

[1] To keep them from discoloring. The oxygen of the air forms with the potato a dark-colored substance. This acid also stains the paring-knife.

twenty minutes, add salt, using one tablespoonful to six potatoes. When the potatoes can be pierced easily with a fork or knitting-needle, drain off all the water, shake the kettle gently, sprinkle the potatoes with a little salt, cover the kettle with a cloth folded in several thicknesses, and let it stand in a warm place until the potatoes are served. Serve them uncovered.

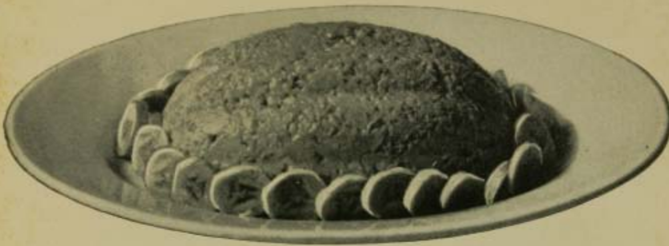
A Study of a White Potato

109. What is a potato? A root? let us see if by examining one we can find out. On its surface are

Fig. 8.—Potato-plant.

little scars, called "eyes." If a potato be buried in the ground in mild weather, or kept in a warm, dark place,

PLATE V.



COLD OATMEAL MOLDED AND GARNISHED WITH SLICED BANANAS.

IODINE TEST FOR STARCH.

Diluted tincture of iodine in one test-tube, starch-paste stained by iodine in the other.

what happens? It *sprouts;* that is, the eyes send out green shoots that in time have leaves. These eyes, then, must be buds, and the potato a stem, not a root; for, ordinarily, roots do not bud. A thickened underground stem like this of the potato, is a **tuber.**[1] Potato roots are slender and fibrous.

Hold a thin slice of potato to the light. Is its substance denser near the edges or at the centre? Can you make out an appearance of network?

110. Analysis of potato; experiments to find out what a potato contains. — A. Pare and grate a piece of raw potato. Squeeze it in a piece of cheesecloth held over a bowl. Rinse what remains in the cloth with cold water, and squeeze it as dry as you can. What does it seem like?

B. Let the liquid in the bowl stand until a white sediment settles; then pour it off carefully. Add a little water to the sediment and boil it. Does it act like anything you have seen before?

C. Mix one teaspoonful of cornstarch with one tablespoonful of cold water, add one-fourth cupful of boiling water, and stir until clear. Do the same with laundry starch. Dissolve about one teaspoonful of salt in one-fourth of a cupful of water; do the same with one teaspoonful of sugar. Add a few drops of *tincture of iodine* to a test-tube of water. Pour a little of this iodine solution into each of the starch pastes. What happens? Try a few drops in the salt solution. In the sugar solution. Has it the same effect on these as on the starch? (Plate V.)

Starch is turned blue by iodine. No other substance being affected in this way, iodine serves as a **test for starch.**

[1] The sweet potato is a true root, but from its resemblance to a tuber is called a tuberous root. It differs from a white potato chiefly in containing sugar.

D. Add a drop or two of iodine solution to the white substance obtained from the potato. What do you think it is? Test a slice of potato for starch.

COMPOSITION OF POTATO AS SHOWN BY ROUGH ANALYSIS

1. Plant fibre (partly *cellulose*):	Similar to fibre of wood. Forms walls of cells, or little divisions, in the potato.	Too tough to be digested; therefore of little food value.
2. Water.	About 75 per cent of the weight of the potato. Fills cells.	
3. Starch.	White insoluble powder floating in water in cells; with boiling water forms a jellylike paste.	The chief foodstuff in potatoes.

Potatoes also contain: —

4. Potash salts and other mineral matter.	Lying mostly just beneath the skin.	
5. Other substa	nces in such small quantities	as to be of little
food value.		

111. To find out how much water a potato contains, pare and weigh it. Lay it in a warm, dry place, weighing it every day until it ceases to lose weight by evaporation of its moisture. Compare the final weight with what it weighed at first. The difference between these shows how much water the potato contained.

To show mineral matter in potatoes, heat a bit of potato in a crucible or evaporating dish over a Bunsen burner till only gray ashes are left.

112. Experiment to show the relation between the sprouting of a potato and its composition. — Let a potato lie in a dark, warm place until it sprouts. Bring it to the light from time to time and observe the growth of the sprouts, also any change in the size of the potato. What do you think the sprouts feed on? Would a sprouted potato be as nutritious as an unsprouted one?

113. Growing and harvesting. — Potatoes are grown from cuttings, not from seed, each piece planted being cut so that it has two or more eyes. Why not leave one eye only? They are planted in April and May, and harvested mainly in early autumn.

114. How to choose and keep potatoes. — The tuber is a storehouse of starch *for the nourishment of the young shoot.* In potatoes dug too early the starch is immature or unripe. In those kept too long after digging the starch has been partly changed to gum, a substance more serviceable than starch to the growing plant, but not so nutritious for man.

Potatoes are best (fullest of starch) in the fall and winter. Select those *regular in shape*, of *medium size*, and with *smooth skin.* A bushel of very large potatoes gives the purchaser less than a bushel of smaller ones, which pack more closely. **Green bitter spots** are caused by the potatoes being grown too near the surface of the ground. Keep them in a cool, dry place. If sprouts appear pick them off.

115. Economy in paring and cooking potatoes. — Is the skin of a potato thick in proportion to the eatable part? Do we need to take off a thick paring?

By experiment it has been found that potatoes pared before being boiled lose much of their food value during cooking, nearly one-fifth of the mineral matter, with some other soluble substances, and a little starch, passing into the cooking water. The longer the potatoes lie in water before they are cooked, the greater is this loss. Observe therefore the following

Rules for paring Potatoes

116. 1. When potatoes are free from black spots or other imperfections, boil them in their skins, paring off only a narrow strip around the middle of each potato to prevent its bursting. 2. Always pare potatoes *thinly*, and take out eyes with the *point* of the knife. 3. To make the loss from pared potatoes as small as possible, put them at once into boiling water and as quickly as possible bring it to the boiling-point again. *Old or poor potatoes must be pared*, and are improved by soaking for one hour in cold water, to restore the moisture lost by long drying.

117. Potatoes cooked to make them digestible. — Hard compact granules of raw starch, enclosed by walls of woody fibre, are not easily acted upon by the digestive juices. The object of cooking potatoes is to break open these cell-walls and to soften and swell the starch. Heat and moisture are needed to do this.

118. Cross-section of a potato and potato starch under the microscope. — A. Soak the thinnest slice of potato you can cut in cold water for a few minutes. Examine a bit of this slice under the microscope. What shape are the cells? Compare their size with that of the starch grains in them. **B.** Draw from memory the cross-section as you saw it under the microscope, and write a description of it. **C.** Examine under the microscope a speck of potato starch the size of a pinhead. Observe the shape and markings of the granules. Draw a few granules from memory.

How to cook Potatoes

119. 1. Potatoes must be cooked till soft all through.

2. Since potatoes contain more than sufficient water to soften the starch in them, they may be baked. The excess of water is changed to steam during cooking, leaving the starch dry and flaky. If allowed to recondense, the starch reabsorbs it, making the potatoes "soggy" instead of "mealy," as they should be. Potatoes allowed to stand in water after they are cooked through absorb some of the cooking water with the same result. What precautions do we take to avoid this? (See recipes for Boiled and Baked Potatoes.)

3. Rapidly boiling water wears off the outside of the potato before the middle is cooked. Let it bubble *gently*.

4. If the outside of large potatoes becomes soft while the centres are still hard, add one pint of cold water. Enough heat remains inside of the potatoes to finish cooking them.

5. Potatoes baked in a slow oven become dry and hard. Quickly baked potatoes are more easily digested than boiled potatoes; slowly baked ones, less so.

Potato Recipes.

Riced Potato

Press boiled potatoes through a coarse strainer or a vegetable press into a hot dish.

Mashed Potato

Mash potatoes (boiled without their skins) in the kettle in which they were cooked, using a fork or a *wire* potato-masher. When free from lumps, add for each pint of mashed potato

1 tablespoonful of butter, melted in
3 tablespoonfuls of scalded milk,
¼ to ½ teaspoonful of salt, and
⅛ teaspoonful of white pepper.[1]

Beat all together until light and creamy. Heap in a dish without smoothing the top. It may be put in a baking-dish, the top brushed with milk, and browned in a hot oven.

Creamed Potatoes

Cut cold boiled potatoes into one-half inch cubes; put these into a saucepan, nearly cover them with milk, and cook gently until nearly all the milk is absorbed. Add white sauce, stir for one minute, sprinkle with finely cut parsley,[2] and serve.

[1] Always use white pepper on potatoes, in white sauce, and in any other food where black pepper would show distinctly.

[2] **To cut parsley.** — Pick off several sprigs; if wet, dry with a clean towel. Hold them in a firm bunch on a board or plate, and cut them through and through, repeating until very fine.

White Sauce (for Vegetables) [1]

Butter,	2 tablespoonfuls.	Salt,	½ teaspoonful,	mixed.
Flour,	2 tablespoonfuls.	Pepper,	⅛ teaspoonful,	
Milk,	1 cupful.			

Rub flour and butter together with a spoon in a small saucepan. Add milk, and stir steadily over a moderate heat until the sauce boils. Add salt and pepper.

For richer white sauce use part cream. **Cream sauce** is white sauce made with all cream instead of milk. Use one and one-half teaspoonfuls of flour to one cupful of cream.

Sweet Potatoes

Sweet potatoes are best baked. If to be boiled, leave the skins on, pare after cooking, and dry for a few minutes in a moderate oven. They may be riced.

120. Food value of potatoes. — Potatoes contain too small a quantity of foodstuffs to be valuable if eaten alone. Eaten with richer food, they form an important article of diet, and one we do not tire of, particularly if they be cooked in a variety of ways.

For more about sweet and white potatoes see pp. 193–199 in *Food Products of the World;* or pp. 59, 60, in *Foods and Beverages*, an interesting little book written for school children. Repeat at home the experiments in this section; use some of the starch you obtain to starch small pieces of cloth. Bring these and some of the dried starch and cellulose to school.

[1] This recipe makes one cup of sauce, enough for four moderate-sized potatoes, or one pint of potato cubes.

Section 2. Starch

Sources of Starch

121. Experiments. — **A.** Put one heaping tablespoonful of cracked or rolled oats with about one cupful of cold water in a small bowl; rub the oatmeal between your thumb and fingers for a few minutes, and observe the effect on the water. Fill a small test-tube (*a*) with the water and set it aside.

B. Half fill another test-tube (*b*) with the water and boil it. Compare the paste formed with that from potato starch (§ 110). Add a drop of iodine solution. What substance does oatmeal contain?

C. Soak rolled wheat, corn-meal, tapioca, rice, or any preparation used for breakfast mush, as you did oatmeal in Exp. **A**; boil the water, and test it for starch. Is there any substance common to all these foods? What is it?

D. Test any or all of the following substances for starch:[1] — flour, milk, fish, white of egg, cabbage, meat (in order to see the color, use cooked chicken, lamb, or veal), apple, turnip. Do any of the animal foods contain starch? Do all the vegetable foods contain starch? Explain why flour is used to thicken white sauce.

E. Pour off the water in test-tube *a* and dry the powder found at the bottom. Can you distinguish it in appearance and feeling from potato starch?

122. Starch (oat, potato, or any other kind) is a fine white glistening powder, insoluble in cold water, but partially soluble in hot water, with which it forms a jellylike paste. It is turned intensely blue by iodine. Starch is formed and stored up by many growing plants as food for the young shoots, collecting in autumn to be used in spring. Laundry starch is made from corn.

[1] Simply test with iodine without adding water or heating.

A Study of Starch

123. Starch under the microscope. — Under the microscope starch is seen to consist of irregularly shaped granules formed of layers folded around a central point. Starches from different plants differ from one another, granules of potato starch being larger than those of any other kind, and something like oyster shells in shape and marking, while rice starch granules are angular and very small. When cooked the granules lose their distinctive appearance.

A. Examine potato starch, rice starch, cornstarch, and other starches under the microscope. Do the different kinds of starch granules look alike? Are they all the same size? Which kind is largest? Which smallest? Make memory drawings of two or more kinds of starch granules as they appear under the microscope.

B. Examine samples of starch paste under the microscope. Can you tell which is made from rice starch, which from potato starch, and so on?

124. Experiments showing how to prevent starch from lumping while cooking. — **A.** Pour about two tablespoonfuls of boiling water upon one teaspoonful of dry cornstarch, stirring as you pour. What happens? Break open one of the lumps. What do you find inside? Would pouring boiling water upon starch be a good way to cook it? Why not?

When boiling water is poured upon dry starch, lumps form, because the starch first touched by the hot water swells suddenly, forming a sticky envelope around the rest, thus keeping it from swelling.

B. Repeat **Experiment A**, mixing one-half tablespoonful of granulated sugar with the starch before stirring in water. **Result?**

Explanation. — The grains of sugar, by separating the starch granules, give the latter room to swell and thicken the liquid smoothly.

C. Repeat **Experiment A**, mixing one-half tablespoonful of cold water with the starch. Note result and explain.

D. Mix one-half tablespoonful of starch with one-half tablespoonful of butter or other fat, add two tablespoonfuls of cold water, and cook, stirring until the mixture thickens. Result?

125. **Starch used to thicken sauces.** — Starch is used to thicken liquid in making sauces and gravies. In what three ways may lumping be avoided? Which of these ways is used in making white sauce?

126. **Starch, dextrin, and caramel.** — Starch, heated dry, changes to **dextrin**, which is soluble in cold water. In browned flour part of the starch has undergone this change, lessening the thickening property of the flour, and at the same time part of the dextrin has been further changed to **caramel**, which causes the brown color. The inside of baked potatoes is partially dextrinized, and the crust under the skin is largely caramel and dextrin. It is the presence of these soluble substances that makes baked potatoes more easily digestible than boiled ones. A temperature of 320° F. is required to dextrinize starch. Explain why dextrin is not formed in boiled potatoes.

127. **Experiments in heating starch dry.** — **A.** Heat about one tablespoonful of starch in a test-tube (or on a small tin pan kept for use in experiments). When brown, take out part of it and test it for starch, (1) by heating with water, (2) by adding iodine.

B. Continue to heat the rest of the starch in a test-tube, until black. What is the black substance? What do you observe on the sides of the test-tube?

128. **Composition of starch.** — Starch is composed of carbon, oxygen, and hydrogen. When heated, the two last pass off as water, leaving the carbon.

129. Digestion of starch. — Digestion is a process of solution. Saliva begins the digestion of starch by changing some of it first into soluble starch, then into **dextrin** and a sugar, **maltose.** Starch digestion is completed in the small intestine. (See § 326.)

A substance in saliva, called **ptyalin**, causes this change. (§ 230.) The test for maltose is Fehling's solution,[1] which combines with it to form a reddish or orange-colored substance.

Experiments to show the action of saliva on starch.[2] — A. Make a thin starch paste (about one-half teaspoonful of starch to three or four tablespoonfuls of water). Divide this between two test-tubes; in a third collect some saliva. Pour part of the saliva into one of the tubes of starch paste. Add a few drops of Fehling's solution to (1) the saliva, (2) the starch, (3) a portion of the mixture of saliva and starch. Do any of these change color? Does either saliva or starch alone contain maltose? Explain the presence of this sugar in the mixture of starch and saliva.

B. At the end of fifteen minutes, test the mixture for starch with iodine. A violet or a red color shows that the starch is partially changed to sugar. Is the action of saliva on starch chemical or physical? The action of the sugar on Fehling's solution?

STARCH AS FUEL FOR THE BODY

130. The work of the body. — How does eating help to keep us alive? Life involves activity; work, play, activity of any sort, makes us hungry; food gives us energy to go on working and playing. Any activity

[1] A mixture of copper sulphate and caustic potash.

[2] **Precaution.** — Test starch for sugar before adding saliva. Some starches are mixed with a little sugar. Cornstarch and starch prepared from hominy are usually pure. For best results, keep the tubes standing in lukewarm water (98° F.).

that uses up energy is, in the scientific sense, **work.** Your muscles work as hard in playing a game as in going on an errand, and just as truly does the heart work in pumping blood, the stomach in digesting food, the brain and nerves in giving rise to thought and feeling.

What else does food do for us? Breathe on your fingers; your breath is warm. Evidently heat is produced in the body.

131. The body compared to a steam-engine. — Just as heat and mechanic power are produced by burning fuel under the boiler of a steam-engine, so force and heat are produced by the oxidation of food in the tissues of the body.[1] Starch slowly oxidized in the body gives off just as much heat and force as if burnt (*i.e.* rapidly oxidized) in the air. How is oxygen taken into the body? What combustible elements does starch contain? What other kinds of slow oxidation do you know of? (§§ 68 and 103.) Thus food serves as fuel to warm the body and to keep its machinery running, its oxidation, as in the case of other fuels, giving rise to carbon dioxide, water, and also to waste products corresponding to the ash of coal or wood.

132. The body, unlike an engine, repairs itself. — A steam-engine differs from the body, however, in one important respect, — *it cannot repair itself* No fuel we

[1] About one-third of the energy contained in the food we eat can be utilized in productive work; the other two-thirds is used up internally in life processes.

can feed it with will stop a leak in the boiler or restore a missing rivet; but **food renews the tissues of the body as fast as they wear out,** making bone, nerve, muscle, and skin for us continually. Then, too, in a steam-engine, fuel and air meet and unite in one place, whereas in the body combustion goes on in all its parts.

133. Different kinds of foodstuffs serve the body in different ways; for instance, starch cannot build tissue, but is efficient, first, as a force-producer, secondly, as a heat-giver. Fat and oil have greater fuel value than starch has, because they contain a much smaller proportion of oxygen and so can unite with more.

Experiment. — Throw a bit of butter or lard and a bit of starch into the fire. Which burns best?

Chemists are able to calculate exactly how much work a certain amount of starch or of other food will enable a man to do.

Other kinds of starch and the manufacture of starch are described on p. 248 of *Food Products of the World*. Repeat at home the experiments given in this section.

Section 3. Cereals; Simple Cereal Foods

On either side the river lie
Long fields of barley and of rye
That clothe the wold and meet the sky.
— TENNYSON.

134. Cereals, or grains, are grasses the seeds of which are used for food; among the most important being **wheat, Indian-corn** or **maize, oats, rice. rye,** and **barley.** From these are prepared various breakfast foods, — oatmeal, wheatena, and others, besides corn-meal and other preparations sometimes served for breakfast.

135. Cereals compared with potatoes. — Cereals, like potatoes, contain starch. How may we prove this? If they were like potatoes in other respects, they could be cooked in much the same way. Unlike potatoes, however, they do not contain nearly enough water to soften the starch, and must, therefore, be so cooked that they can absorb more. All except rice contain much woody fibre tougher than that in potatoes, and so need longer cooking.

136. Breakfast cereals *may be either boiled or dry-steamed.* Steaming is the slower process, because the food in the upper part of the double boiler never quite reaches 212° F.; but is preferable, since it insures even cooking of the cereal, prevents it from wasting or drying on to the vessel, as it does when a saucepan is used, and makes stirring unnecessary.

137. How to use a double boiler. — Fill the lower part (*b*, Fig. 9) one-third full of boiling water, and keep it boiling. Add more boiling water from time to time, if needed to keep it one-third full. If allowed to stand over the fire, for even a short time, without water in the lower part, the boiler will become leaky and useless. Keep the two handles of the boiler in line, so that both parts may be readily lifted together.

See that both parts are dry before putting them away.

A home-made double boiler may be contrived by setting one saucepan inside of another.

RECIPE FOR WHOLE OATMEAL (steamed)

Oatmeal, 1 cupful. Salt, 1 teaspoonful.
Water, 4 cupfuls.

Put the water, with the salt, in the upper part of the double boiler, and set it directly over the heat. When it boils, stir in the oatmeal, put the two parts of the boiler together, and cook over night, or six hours by a day fire. Reheat in the morning. *Or*, soak the oatmeal in the water for several hours, add the salt, and steam for three hours.

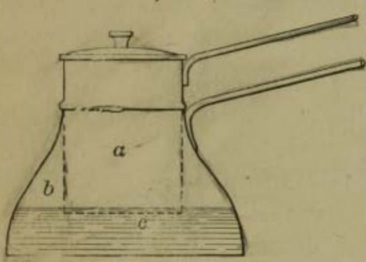


FIG. 9.—Diagram of double boiler, showing proper depth of water.

RECIPE FOR BOILED RICE (to be served as a vegetable in place of potatoes)

Rice, 1 cupful. Salt, 1 teaspoonful.
Water, 2 quarts (or more).

Put the water in a saucepan to boil. Pick over and wash the rice. When the water boils rapidly, drop in the rice—*slowly*, so as not to stop the boiling. If the grains settle to the bottom, stir them gently *with a fork*. Boil rapidly, uncovered, from twenty to thirty minutes, or until the grains can be crushed between thumb and finger, adding the salt when nearly done. Then turn into a strainer to drain, rinse with hot water, and dry in the serving-dish in the oven (with the door open) for a few minutes. Each grain should be white, soft, and distinct, the motion of the water keeping them separate, and the washing and rinsing removing loose starch that would tend to stick them together.

138. To wash rice. — Put it in a colander or strainer, and set this in a bowl of cold water; rub the rice with the hands; change the water, repeating until it is clear.

139. Steam-cooked cereals not economical. — Many cereal preparations, including most of those sold in packages, have been partially steam-cooked at the factory. This shortens the time required to prepare them for the table; but, on the other hand, it injures their flavor, and adds to them a large quantity of water, for the weight of which the purchaser pays. As a fire kept up for other purposes can usually be utilized for cooking cereals, it is more economical to buy these uncooked.

140. In good rice, the grains are yellowish white and whole, with little starch-dust on them. **Cornmeal** and **hominy** spoil quickly; purchase them in small quantities. Keep cereals in jars or cans; in paper bags mice and insects may get to them.

141. Fruit with cereals. — Try serving fruit with cereals: —

1. Serve berries, apple sauce, sliced peaches, or sliced *well-ripened* bananas in the saucer with the mush.

2. Stir figs or dates cut in pieces, into mush before serving it. (Especially good with farina.) The mush may be moulded with the fruit in it. 3. Serve cold moulded cereals with peaches or bananas, sliced. (Plate V, facing p. 61.) 4. Serve baked bananas on separate plates. (For recipe see p. 233.)

Directions for cooking Cereals

142. 1. Stir the cereal gradually into the required quantity of boiling salted water, and cook over hot water until done. (See table on p. 79.)

2. To save time and fuel, soak uncooked cereals (Irish oats, cracked wheat, hominy, etc.) in cold water before cooking. Those requiring more than one hour to cook should be cooked the day before they are to be eaten and reheated in the morning. If necessary to hasten the cooking of a cereal, boil it from fifteen to thirty minutes, then steam until done.

3. Cook steam-cooked cereals, as a rule, twice as long as is directed on the package. *Only by long cooking are cereals made wholesome and well-flavored; undercooked, as most people eat them, they occasion sickness often laid to other causes.*

4. Stir coarse, flaky cereals as little as possible. Fine, granular cereals may be beaten. To keep these fine cereals from lumping, mix them with cold water instead of sprinkling them dry into boiling water.

5. Cereals should absorb all the water they are cooked in; if too moist when nearly done, cook uncovered for a time.

6. To improve rice, farina, or hominy, stir in one-quarter of a cupful of milk about fifteen minutes before taking from the fire, and leave the cover off during the rest of the time.

143. Food value of cereals. — Cereals are the most important of vegetable foods. From the plains of northern Europe and Asia, where barley grows in a climate too cold for other grains, to the rice-fields of India and our Southern states, man depends on some cereal for his daily bread. One reason for this is that they contain in varying proportions all the kinds of foodstuffs necessary to support life. Containing so much starch as they do (63 to 76 per cent), they are valuable chiefly as fuel foods. Oatmeal and cornmeal, having more fat than other grains, are especially good winter foods. Oatmeal is richer in food material, but on account of its indigestible fibre, less nutritious, except for strong, hard-working people, than other grains. Rice is almost pure starch; as it contains no fat, we naturally eat butter or cream with it; but this lack of fat makes it all the better for use in a tropical climate.

Things to be remembered about Breakfast Cereals

144. 1. It is better not to eat cereals at all than to eat them under-cooked.

2. Have the mush stiff enough to be chewed. If too soft, it is swallowed without being mixed with saliva, and is, in consequence, less readily digested.

3. Sugar, a heat-giver, is not needed with cereals; milk and cream, on the other hand, supply fat and other substances, of which cereals have little.

TABLE SHOWING TIME OF COOKING, AND PROPORTIONS OF SALT AND WATER, FOR BREAKFAST CEREALS

Kind.	Teaspoonfuls of Salt to One Cupful of Cereal.	Cupfuls of Water to One Cupful of Cereal.	Method of Cooking.	Time of Cooking, in Hours.
Oatmeal (Raw) .	1	4	Steam.	If soaked, 3; if not, 6 or more.
Oatmeal (Steam-cooked), Rolled Oats, H–O, etc. .	1	1¾	Steam.	
Rice	3	8 or more.	Boil.	½
Rice	1	2½	Steam.	1
Wheat (Rolled and Steam-cooked) .	1	1¼	Steam.	1
Indian Meal . .	1	[1] 6	Boil.	If soaked, 3; if not, 6.
Hominy	1	4	Steam.	If soaked, 2; if not, 4.
Wheaten Grits . .	1	3 (or if soaked over night in 1 cup of cold water, add 2½ cups of boiling water).	Steam.	If soaked, 2; if not, 3.
Farina and other fine Wheat Preparations . . .	1	3¾	Steam.	1 to 3

[1] If the meal is sprinkled in dry, continue adding it until it begins to float; after that, add no more.

Reading. — Chapter XVIII, Cereals, in *Food Products of the World*. (Drawings of stalks of rice and millet), pp. 1–30 and 36–39 in *Foods and Beverages*. Rice Culture, p. 66, in the *Domestic Science Reader*.

For poetry, read "Hiawatha's Fasting" and "Blessing the Cornfields." Also see pictures illustrating grain shipping in *Harper's Weekly*, October 9, 1897. (Vol. 41, pp. 1000 and 1001.)

Begin

Section 4. Wheat, the King of Cereals

When summer's hourly mellowing change
May breathe, with many roses sweet,
Upon the thousand waves of wheat
That ripple round the lonely grange. — TENNYSON.

145. Wheat, being capable of cultivation in a greater variety of soils and climates than any other grain, and being also better suited for bread-making and for use as a constant article of diet, has been called "the King of Cereals."

A STUDY OF WHEAT. PART I

146. — **A.** Note the elliptical scar at the base of a wheat grain. This shows where the **germ**, or **embryo**, lies, from which the seedling springs.

B. Crush a few grains of wheat, moisten them with boiling water, and test them for starch.

If sprouted grains[1] be tested for starch, much of it will be found to have disappeared, and, under the

[1] Wheat and other cereals may be grown in earth or sawdust, o1 on moist blotting paper laid on a plate and covered with a glass jai or cheese-dish cover.

microscope, the granules left will appear rough, as if eaten into.

147. How the seedling is fed. — What has become of the starch? We have before seen that Nature is careful to provide food for baby plants. In what part of the potato plant is starch stored? What connection is there between that part of the plant from which the young plant springs and the location of the food supply?

The plant, like the human body, cannot make use of starch until it is digested. In what does the digestion of starch consist? This digestion in grains is effected by **diastase**, a substance developed in the seed during sprouting. What animal substance do you know of that can effect this change?

148. Kinds of wheat. — Wheat is called **winter wheat** or **spring wheat**, according to whether it is best suited to being sown in autumn or in spring. Wheat that endures the cold and dampness of winter is soft and starchy; wheat that comes up quickly in sunny spring weather is hard. Even spring wheat is soft in a rainy, cold season. These two sorts of wheat produce quite different kinds of flour, as you will learn in the next chapter.

149. Harvesting. — Wheat ripens in our Southern states in early summer, in the most Northern states in the autumn. When the ears are heavy and golden, it is cut down and bound into shocks. The grains are threshed out of the husks and sent to market. Until recently this work was done mostly by hand, but now steam-reapers, binders, and threshers are common on the great farms in the wheat regions.

Home-work. — Grow different kinds of grain at home in different ways; make drawings of the seedlings in different stages of growth.

CHAPTER III

TISSUE-BUILDING FOODS: EGGS AND MILK

The palate is the janitor; unless he be conciliated, the most nutritious food will find no welcome.

Section 1. Eggs; Albumin

150. A hen's egg consists of shell, membrane, white, and yolk, the yolk being kept in place by two twisted cords of white. The little mass in the yolk is the embryo from which the chicken grows, just as the seedling grows from the embryo of the seed. The contents of the egg, like the seed-contents, nourish the developing embryo; when ready to be hatched, the chick has absorbed all of these contents and part of the shell, the egg being a perfect food for an unhatched chicken, as starch is for a seedling.

151. Why eggs spoil. — If not brooded, an egg loses water by evaporation through the pores in its shell, air enters to take the place of this, and the egg spoils. We may keep eggs good by keeping air out of them. Can you suggest any ways of doing this?

Selecting and Testing Eggs[1]

152. To tell whether an egg is fresh. — 1. Observe the shell. A fresh egg has a thick, rough shell. 2. Hold

[1] As some eggs are larger and heavier than others, it would be fairer to sell them by weight than by number.

the egg between your eye and the light. If clear and translucent, it is fresh ; if cloudy, it is stale. By egg dealers this test is made in a dark room with a candle, and it is then called "candling" eggs. 3. Drop the egg into cold water. If it sinks, it is fresh ; if it floats, it is stale. 4. Shake the egg, holding it near your ear. If the contents move, it is somewhat stale ; if they rattle, it is spoiled.

Think out the explanation of these tests.

Directions for the Care and Preservation of Eggs

153. 1. Wash eggs with a damp cloth when they come into the house. The shells may be saved to clear coffee.

2. Keep eggs in a cool, dry place.

3. In spring or early summer, when eggs are plentiful and cheap, they may be preserved by packing them, small end down, in bran, sawdust, lime, or sand ; by immersing them in lime-water ; or by coating them with varnish or fat. Dealers sometimes keep eggs in cold storage several months. Preserved eggs may be combined with other materials in cooking, but only fresh ones are fit to serve plain, or in omelets and other egg dishes.

154. Experiment to find out the best temperature for cooking eggs. — Cook one egg (*a*) in boiling water for three minutes ; another (*b*) in boiling water for ten minutes ; put a third (*c*) into boiling water enough to cover it (about one pint in a small saucepan), remove the saucepan from the fire, and let it stand covered on the table from six to ten minutes. Break the eggs and compare their contents. In which is the white hard and the yolk unchanged? In which is the white hard and the yolk sticky or partly dry? In which is the white a tender jelly and the yolk thick?

155. An egg put into boiling water and removed from the heat is, at the end of about ten minutes, evenly cooked through, the temperature of the water falling during this time to about 168° F. The temperature of the egg averages about 185° F.

156. Experiment to show why eggs should be cooked below the boiling-point of water. — Put a little white-of-egg in a test-tube; hold the test-tube and chemical thermometer in a vessel of water. Heat the water gradually. How does the white-of-egg look at 150° F.? At 180°? Stir with glass rod or a stick to show degree of solidity. Note appearance and degree of solidity at 212°. Keep the water boiling for several minutes; then take out some of the white of-egg and examine it.

Albumin

157. Composition and food value of eggs. — The most important foodstuff in eggs is albumin (from *albus*, white), a sticky, glairy substance, found in both the white and the yolk. The white is nearly pure albumin and water; the yolk contains much fat in the form of oil.[1] Eggs also contain a small quantity of valuable mineral salts. What important foodstuffs do eggs lack? Name some foods that may be eaten with eggs to supply this lack.

Albumin is a tissue-builder, the first foodstuffs we have learned about that contains nitrogen, the element

[1] For distinction between oil and fat see § 342.

essential to tissue-building. Plants draw nitrogen from the soil; animals obtain it from their food, neither being able to make use of it as it exists uncombined in the air. Foodstuffs containing nitrogen, also foods having a considerable amount of such foodstuffs, are called **nitrogenous**; others are called **non-nitrogenous.** Potatoes contain a little albumin, distinguishable as froth on the water squeezed out in analyzing them. (§ 110.)

Make a table showing the composition of eggs, similar to that showing the composition of potatoes on p. 62.

158. Tests for albumin. — A common test for albumin is heat. If potato water or other albuminous liquid be boiled, the albumin can be recognized by its solidifying.

159. The chemical test for nitrogenous substances is *nitric acid*, which turns albumin and other nitrogenous foodstuffs yellow. *Being a dangerous liquid it must be used only by experienced persons.*

160. The solidifying of albumin is called **coagulation.** Have you known more substances to be changed from liquid to solid, or from solid to liquid, by heat?

161. Digestion of albumin; gastric juice. — The digestion of albumin begins in the stomach, which secretes for the purpose a fluid called **gastric juice,** containing **pepsin** and **hydrochloric acid.** These together change tissue-building foodstuffs, including albumin, into more soluble substances. (For completion of process, see § 326.)

Experiments to show how eggs are digested. — Label three test-tubes *a*, *b*, and *c*, respectively. Into *a* put about one teaspoonful of the finely chopped white of a hard-boiled egg; into *b* an equal quantity of the chopped white of a soft-cooked egg (see recipe), and into *c* a piece of hard-boiled white, not chopped. Half fill the test-tubes with pepsin and dilute hydrochloric acid,[1] and set them in warm water (about 98° F.).

At the end of an hour and a half examine them. In which has the white-of-egg been most rapidly dissolved, *i.e.* digested? After five or six hours look at them again. If any of the egg is still undigested set it aside and look at it again the next day. Does white-of-egg digest more quickly in one piece or when chopped? What do we learn from this about chewing food? Which digests more quickly, hard-boiled or soft-cooked albumin?

TABLE SHOWING EFFECT OF HEAT ON ALBUMIN[2]

Degree of Heat.	Appearance.	Digestibility.
Raw.	Clear, sticky, pale straw-colored liquid.	Quickly and easily digestible.
Heated to 134° F.	Fine threads of semi-solid white substance appear in liquid.	Still readily digestible.
Heated to 160° F.	Tender, white jelly.	Readily digestible.
Heated to 212° F.	Tough, white jelly.	Less easily and quickly digestible.
Heated to 300° F., or higher.	Hard, horny substance.	"Indigestible"; *i.e.* digested with difficulty.

[1] A digestive juice similar to that in the stomach may be made from 1.1 parts of pepsin and 7.5 parts of hydrochloric acid to 500 parts of water.

[2] Yolk albumin coagulates at a lower temperature than white albumin. In a "three-minute" boiled egg, however, the white is hard and the yolk nearly or quite raw, the heat not having had time to penetrate to the centre of the egg.

162. It has been found that eggs cooked at 180° can be completely digested by artificial means in five hours, while boiled eggs take longer. It is probable that the same is true of their digestion in the stomach.

RECIPES

SOFT-COOKED EGGS

For two eggs allow one pint of water; for each additional egg three-fourths of a cupful of water additional. Put the water in a saucepan, let it come to the boiling-point, lower the eggs into it with a spoon, remove at once from the fire, and let stand covered about ten minutes. The fewer the number of eggs to be cooked, the smaller should be the saucepan, in order that the smaller quantity of water may cover them.

163. To toast bread. — Cut stale bread (at least two days old) into slices one-third of an inch thick. Trim off the crusts, leaving the slices rectangular; lay the bread in a toaster, and hold over a bright coal fire, turning frequently in order that both sides may brown alike. Hold the bread well above the fire at first, to dry it; then nearer, until both sides are an even golden brown. It may be buttered at once, but is more wholesome if buttered as it is eaten. Serve on a doily on a hot plate, uncovered.

For **water toast** dip the toasted slices quickly into boiling salted water (half a teaspoonful of salt to one cupful of water), using a fork. Spread with softened butter[1] and serve at once.

[1] **To soften butter** work it with a spoon or knife, — in cold weather in a warmed bowl.

PLATE VI.

Breaking an Egg.

Separating Yolk from White.

Making Butter-balls.

Eggs dropped on Toast (Plate VII, facing p. 102)

Prepare squares or circles (cut with a muffin ring) of water toast; arrange on a platter. On each break carefully a soft-cooked egg, keeping the yolk whole and in the centre of the slice of toast; sprinkle a little salt, and if you like, a tiny bit of white pepper, on each yolk, and serve.

164. How to break eggs. — To break an egg, hold it in the left hand and crack the shell by striking it sharply with a knife; then put your thumbs together at the crack, and gently break the shell apart. (Plate VI.)

To separate the yolk from the white, hold the egg upright while breaking the shell apart, so that the yolk will remain in one half of the shell: slip the yolk from one piece of shell to the other several times, letting the white run over the edge into a bowl or plate. **Caution.** — When using several eggs, if you are not *sure* of their freshness, break each singly into a cup, and examine it before adding it to the rest.

165. Beating eggs; distinction between beating, stirring and folding. — Beat yolks in a bowl with a fork or a Dover beater; beat whites in a bowl with a Dover beater, or on a deep plate or platter with a fork or wire whisk. Whites are beaten *stiff* when a knife-cut made in the mass does not close; *dry*, when the gloss is gone from them, and flaky bits fly off as you beat. Yolks well beaten are thick and much lighter colored than before beating.

Eggs are beaten *slightly* (*i.e.* until the white and yolk are mingled) to make them smooth and creamy, for French omelet, custards, and some sauces. They are beaten till light to entangle air in fine bubbles in the albumin. Can you beat in more air by beating the whole egg or by beating the white separately from the yolk? To *beat* with a spoon or fork, carry it swiftly through the material, tilting the dish so that the material will be "flopped" over at each stroke. To *stir*, move the spoon steadily in a widening circle. To *fold* one ingredient into another, put the spoon in edgewise, lift the ingredients, and turn them over; repeat until thoroughly mixed. ***Avoid stirring after beating or folding.*** Why?

Recipes

Eggs in a Nest (Plate VII)

Separate the white of an egg from the yolk. Beat the white stiff and dry; put it in a cup or small bowl, making in the top of it a hollow the size of the yolk; into this hollow slip the yolk. Cook in a covered saucepan containing boiling water until the top of the white is firm (about two minutes). Serve in the cup.

French Omelet

Eggs, 4.	Salt, ½ to ¾ teaspoonful.
Water, 4 tablespoonfuls.	Pepper, a few grains.

Butter, 1 tablespoonful.

Beat the eggs lightly (about twelve strokes with a fork), add water, salt, and pepper. Melt the butter in a hot omelet-pan without letting it brown. Turn in the eggs, shake pan gently, and as the egg thickens lift it lightly with a fork or knife, letting the uncooked part run underneath. *The omelet should slip on the pan without sticking anywhere.* When creamy all through, roll it up, rolling toward the left side of the pan. Hold a hot platter over the edge of the pan, and turn pan and platter over, so that the omelet will fall in the centre of the platter; or lift it out on two broad knives. Garnish with parsley, and serve *at once;* if it stands, it will fall.

The omelet is puffed up with steam from the moisture in the eggs and the water added to them. What happens to steam when it cools? What will be the effect on the omelet?

Fancy omelets. — French Omelet may have spread over it before it is folded a rounded teaspoonful of fine-cut parsley, a few teaspoonfuls of chopped ham or other cooked meat, or of grated cheese; or cooked, chopped oysters or clams may be used, or peas or tomatoes, — almost any cooked food, in fact, this being a good way to utilize "left-overs." These fancy omelets are named according to the ingredient added, Cheese Omelet, Ham Omelet, etc. Have the filling hot when put into the omelet.

Cup Custards

Scalded milk,	1 quart.	Sugar,	½ cupful.
Eggs,	4 to 6.	Salt,	¼ teaspoonful.

Nutmeg.

Beat the eggs slightly, stir in the sugar and salt, then, slowly, the hot milk. When the sugar has dissolved, pour into cups (about six), and grate a *little* nutmeg over each cup. Set the cups in a pan of hot water, and bake in a moderate oven until a pointed knife inserted in the custards comes clean. Do not let the water in the pan boil. Why?

Reading. — "Poultry and Eggs," *American Kitchen Magazine*, April, 1900. Vol. XIII, No. 1. P. 114, in *Foods and Beverages.*

Section 2. Milk and other Dairy Products

166. What the seed is for the seedling, and the egg for the unhatched chick, milk is for the young of milk-giving animals, — that is, a perfect food. Why it comes nearer than eggs do to being a perfect food for any human being we shall see when we have found out its composition.

A Study of Milk

167. — Analysis of milk; experiments.— A. With a spoon remove the cream from one pint of milk that has stood over night. Drop a little of the cream on unglazed paper. Examine the paper after it has dried for a time. Can you tell from the spot one foodstuff that is present in milk?

B. Test a little of the milk with iodine. Is there any starch in milk?

C. Boil the rest of the milk. What do you see on the top of it? What do you think this scum is? Is there water in milk? Air? How do you know?

D. Remove the albuminous scum and put a little of the milk in a test-tube. Add a few drops of vinegar. What happens? Strain the milk through a cloth, and examine the solid substance (*curd*) and the watery liquid (*whey*).

E. Shake a little white-of-egg and water together in a test-tube; add a few drops of vinegar, and note the coagulation.

168. If a drop of nitric acid be added to milk, what result would you expect? What would this show?

169. Composition of milk. — Cow's milk contains fat, albumin, and another substance that is not coagulated by heat, but is coagulated by vinegar. This substance is **casein**,[1] a tissue-builder. What element must it contain? What other tissue-builder can you name? Coagulated casein, when dried, is a hard, horny, yellow solid.[2] Dissolved in the whey is a little **milk-sugar** and mineral matter. Sugar closely resembles starch in composition, and, like it, is energy-producing. What elements does it contain?

170. Its food value. — Milk is seen to contain one or more of each of the chief kinds of foodstuffs, tissue-building, heat-giving, and strength-giving; besides water and mineral matter. For the calf it is a perfect food, and almost perfect for a human baby. For older people, however, it is not a well-balanced food, *i.e.* these foodstuffs are not in the right proportions. There is not enough sugar to give the strength a grown man needs for his work, and there is so much water that he would have to drink an enormous quantity of milk to obtain the necessary quantity of foodstuffs.

[1] The albumin is in true solution, the casein in partial solution only. In this state it is called by chemists *caseinogen* (casein-maker).

[2] It can be so toughened as to resemble celluloid, in which state it is made into buttons and similar articles.

Mention some foods commonly eaten with milk. What foodstuff or foodstuffs, lacking in milk, do these foods supply? Remember that milk is food, not drink merely; less of other food is needed at a meal with which milk is drunk. Drink it slowly. It is more readily digested when taken in sips.

171. Buying milk; dangers of cheap milk. — Good milk is a yellowish white, opaque liquid, having a slightly sweet taste. It should have no sediment and should not look blue around the edges. **Skim milk** sells for about one-half the price of whole milk. It is, of course, poor in fat, but is richer than whole milk in casein and albumin, and may be used instead of it for many purposes in cooking. Skim milk is far more desirable and economical than so-called whole milk sold at less than the regular market-price. This is likely either to be of poor quality, perhaps colored to make it look rich, or to be watered, in which case a quart of it may contain no more nourishment than a pint of "honest" milk.

172. Care of milk. — Milk quickly absorbs tastes, odors, and impurities. It is more liable than almost any other food to contain disease germs. From the time it is drawn from the cow it should be kept in *clean vessels* (glass, earthenware, or *bright* tin; not wood), in a cool, clean place. Otherwise it rapidly sours, and sometimes undergoes changes that make it actually poisonous. Milk sold from open cans in cities is more likely than bottled milk to contain dirt, and to sour quickly.

173. Scalding milk. — To make sure that milk is safe for use, especially for children, who are most likely to be made sick by impure milk, scald it (*i.e.* heat it to about 160° F.). This is best done in a double boiler.[1] When small bubbles appear at the edge of the milk it is scalded. Use when cool. Boiling makes it less digestible. What substance in the milk should never be heated to the boiling-point? Explain why milk tumblers should not be put directly into hot water.

A Study of Milk (*continued*)

174. Souring of milk. — **F.** Examine sour milk. Notice the separation of the curd from the whey. What substance, added to milk, makes it separate like this? Taste the sour milk. Does it taste at all like vinegar?

The sour taste of the milk is caused by the presence of an acid. When milk is kept at the ordinary temperature more than a few hours the sugar in it changes to **lactic acid** (*milk* acid). This acid, like the acid in vinegar, coagulates casein.

175. The change from sugar to lactic acid is caused by certain bacteria (*bacilli of lactic acid*) that get into milk from the air. (§ 446.)

Recipe for Cottage Cheese

Thick sour milk, 1 quart.	Salt, ¼ teaspoonful.
Butter, 2 teaspoonfuls.	Cream, enough to make cheese as moist as desired.

Heat the milk in a pan set on the back of the stove, or into another pan of hot water; as soon as the curd

[1] For directions for pasteurizing milk, see §§ 466 and 469.

separates from the whey, strain the milk through a cloth. Squeeze the curd in the cloth until rather dry. Put it in a bowl, and with a spoon mix it to a smooth paste with the butter, salt, and cream. Serve lightly heaped up.

176. Action of rennet on milk. — A different kind of coagulation of casein is produced by **rennet**, a substance prepared from the lining of a calf's stomach. Rennet is sold for use either in an alcohol solution ("liquid rennet") or in tablets.

Recipe for Rennet Custard or Slip

Milk, 1 quart.
Sugar, ¼ cupful.
Extract of vanilla, 1 teaspoonful.
Liquid rennet, 1 tablespoonful,
or
1 rennet tablet dissolved in 1 tablespoonful of water.

Heat the milk in a double boiler until it is lukewarm. Add the sugar and stir until it is dissolved. Stir in the vanilla and rennet, and pour into a glass dish. Let it stand in a warm room until it begins to thicken; then set it in a cool place, and leave it until it is firm. Sprinkle with one-eighth teaspoonful of cinnamon or nutmeg, and serve with cream (or milk) and sugar.

To make Coffee Rennet Custard, use two and three-fourths cupfuls of milk and add one and one-fourth cupfuls of strong, cold coffee after taking from fire. Use one-fourth to one-half cupful of sugar.

177. Does the curd formed by rennet differ in any way from that formed by an acid? If so, how? Does curdling make milk sour, or does souring make it curdle?

178. Digestion of milk. — **Rennin**, the ferment that gives rennet its power to coagulate milk, is secreted by the human stomach as by the calf's to prepare milk for digestion.

If milk is poured rapidly into the stomach, it forms with rennin a thick mass of curd. If it trickles in, it forms a flaky curd, much more easily digested. (For Digestion of Albumin, see § 161, for Digestion of Sugar and Fat, §§ 326 and 348.)

BUTTER

179. Fat naturally exists in milk in little spheres or *globules* about $\frac{1}{1500}$ of an inch in diameter. When fat or oil is suspended in this way in a liquid it is said to be emulsified.

Experiment to illustrate emulsion. — Shake some lime-water and linseed oil together in a bottle; hold the bottle still and observe the oil globules rise.

180. Milk under the microscope. — Look at a drop of milk through a microscope, then at a drop of cream. Which has the greater number of fat globules? Make memory drawings of what you see.

181. The fat globules, being lighter than the rest of the milk, tend to rise to the top as cream. If cream be vigorously beaten or churned, the globules lose their shape and stick together, forming butter. Some of the casein clings to them. This is usually washed out, as it decomposes easily. Butter is salted to further protect it from spoiling. It is usually packed in wooden tubs for market. Butter moulded in "prints" for immediate table use is made less salt than tub butter. "Sweet" butter contains no salt and sells at a high price.

182. Economy in buying and using butter. — **Good butter** *has about eighty-seven per cent of fat*, is *firm*, not crumbly, *yields little water* when pressed, and *foams when heated*. It is wiser to economize by using some less expensive fat, such as beef fat, in cooking, than to buy a poor grade of butter because it is cheap. So-called "cooking-butter" is often an imitation of butter, or rancid (spoiled) butter, worked over and unfit to be eaten.

Milk from grass-fed cows makes rich, yellow butter. Winter butter comes white, and is usually colored for market with anatto, a substance obtained from the seeds of a tropical plant. Sour cream makes the finest-flavored butter.

183. Experiment to illustrate butter-making. — Put half a cupful of thick cream into a small bowl and beat it with a Dover egg-beater until it separates into buttermilk and specks of butter. Gather the butter into a lump, and after pressing out as much of the buttermilk as you can, wash the butter under a stream of cold water. Work with a wooden spoon to remove the water, and add a few grains of salt. Dip butter-spatters into hot water, then into cold, and with them roll the butter into a ball. (Plate VI, facing p. 89.)

184. Butter as food. — Does butter rank as tissue-builder, strength-giver, or heat-giver? Name some of the foods with which butter is commonly eaten. Does it supply anything that these foods lack? If so, what? Do you need as much butter with corn bread as with white bread? As much when you eat bacon for break fast as when you eat lean meat?

Recipe for Whipped Cream

Cream, ½ pint. Powdered sugar, 2 tablespoonfuls.
Extract of vanilla, ¼ to ½ teaspoonful.

If the cream is thicker than ordinary milkman's cream, dilute with milk, or it will turn to butter when whipped. Whip it with a wire whisk or a Dover beater until stiff enough to hold its shape, beat in the sugar and vanilla, and keep in a cool place till served. In warm weather, set the bowl of cream in a pan of cracked ice while whipping it. Serve on hot chocolate, or as a sauce with desserts.

CHEESE

185. Cheese is the curd of milk, drained, salted, and pressed. Cheese made from unskimmed milk is about one-half fat, the fat globules being entangled in the curd. Skimmed milk cheese is sometimes "filled" by having lard or other cheap fat added to it. "Filled" cheese is greasy when warm, has little flavor, and does not keep well. Neufchâtel and other cream cheeses are made from milk to which cream has been added.

186. Food value of cheese. — Cheese, like eggs, is a food containing much nourishment in small bulk, — a concentrated food. It should be used more commonly than it is. Cheese may take the place of meat, macaroni cooked with cheese being hearty enough to form the main dish of a meal. (Recipe on p. 121.) One pound of cheese contains as much nutriment as two pounds of meat. Unfortunately, it is somewhat difficult of digestion, and for this reason should not be eaten by delicate persons or by young children. For healthy people, particularly for men engaged in active work, it is one of the best of foods.

Which one of the three kinds of foodstuffs does cheese lack almost entirely? Name some foods suitable to be eaten with cheese.

Recipes

Cheesed Crackers

Crackers (zephyrettes),	6.
Grated cheese,	about 6 rounded teaspoonfuls.
Cayenne pepper,	a few grains.
Butter.	

Butter zephyrettes lightly, spread with cheese and cayenne well mixed, and heat on a pan in a hot oven till the cheese melts.

Cheese Fondue

Bread crumbs,	1 cupful.	Eggs,	2 yolks, 3 whites.
Milk,	½ cupful.	Butter,	¼ cupful.
Grated cheese,	4 tablespoonfuls.	Salt,	½ teaspoonful.

Pepper, a few grains.

(*Butter a baking-dish.*)

Cook bread crumbs and milk together, stirring until hot and smooth; add butter, cheese, salt, and pepper, cook one minute longer, and remove from the fire. Beat yolks and whites separately, the whites till stiff and dry. Mix the yolks thoroughly into the cheese mixture, and fold in the whites. Bake in baking-dish in hot oven fifteen or twenty minutes; when firm to the touch, the fondue is done. Serve at once in the same dish.

Baked in ramekin dishes, this mixture forms **Cheese Ramekins.**

Perhaps you would like to write a composition about milk. You can learn more about it in *Food and Beverages*, pp. 66–79 and 83–87. Pamphlets written for grown people, but not hard to understand, are *Facts about Milk* and *Butter-making on the Farm*, printed as Farmers' Bulletins, Nos. 42 and 57, by the U.S. Department of Agriculture, Washington, D.C. (Sent free.)

CHAPTER IV

BREAD

Section 1. Quick Breads; Baking-powders

Cookery is become an art, a noble science.

187. Heretofore the dishes that you have cooked have consisted of one principal ingredient, with small quantities of others added to make this more palatable. In cooking you have had to consider the nature of but one, or at the most two, of the foodstuffs of which the principal ingredient was composed. What foodstuff did you consider in cooking eggs? In cooking cereals?

In this chapter you are to deal with mixtures of several kinds of food-material, and success will depend upon your understanding of the properties of each of the materials you use, and upon your care in measuring, mixing, and baking them.

188. Quick breads include biscuits, muffins, griddle cakes, and the like. They are so called to distinguish them from *yeast-breads*, which require a longer time for preparation.

RECIPE FOR POPOVERS

Flour, 1 cupful.	Salt, ¼ teaspoonful.
Milk, 1 cupful.	Eggs, 2.

(*Set the popover cups on the stove to heat.*)

PLATE VII.

EGG IN A NEST, AND DROPPED EGG ON TOAST GARNISHED WITH PARSLEY.

Popover Muffin Biscuit

QUICK BREADS.

FRENCH LOAVES, FINGER ROLLS, AND FRENCH ROLLS, WITH BAKING-PANS FOR EACH.

Put the flour in a bowl ; make a well in the centre of it ; drop in the salt, then the unbeaten eggs. Add the milk gradually, stirring in widening circles from the centre. Bake in buttered muffin-pans, or in earthen cups, in a hot oven for thirty minutes.

189. To grease baking-pans. — Melt the butter or other fat, and with a bit of soft paper, or a brush kept for this purpose, apply it evenly to the pan, being careful to grease the corners carefully.

190. The uncooked popover mixture is called **batter.** **Popovers are made light** by the expansion of the water in them as it is changed to steam by the heat of the oven, the heat at the same time forming a crust, which keeps the steam from escaping. When done the popovers should be crisp, hollow shells, several times the height of the batter, and well "popped-over." (Plate VII.)

RECIPE FOR GRIDDLE CAKES

Flour,	2 cupfuls.	Salt,	½ teaspoonful.
Baking-soda,	1 teaspoonful.	Sour milk,	2 cupfuls.

Eggs, 1.

(Put the griddle where it will be hot by the time the cakes are mixed.)

Sift the flour, salt, and baking-soda together. Beat the eggs well. Stir the milk into the flour. Add the beaten egg, and beat all together until well mixed. Bake by spoonfuls on a hot greased griddle.[1] When

[1] Beat the batter well before pouring a fresh batch of cakes on to the griddle.

the cakes are full of bubbles on top, and brown on one side, turn them over with a broad knife or a cake-turner, and brown them on the other side. If large bubbles rise at once to the top of the cakes, the griddle is too hot. If the top of the cake stiffens before the under side is brown, the griddle is not hot enough. Never turn a cake twice ; a twice turned cake will be heavy.

Serve the cakes as soon as they are baked, piled (not more than six or eight together) on a hot plate. Eat them with butter, butter and syrup, or butter and sugar.

In making griddle cakes with sweet milk, omit soda, and add two teaspoonfuls of baking-powder and one tablespoonful of melted butter.

191. To grease the griddle. — Use a piece of beef-suet on a fork, or drippings applied with a swab made by tying a strip of clean cloth around the end of a fork or skewer. Leave no spot ungreased, but do not have more than just enough grease to keep the cakes from sticking. If they should stick, scrape the griddle clean before greasing it again. **A soapstone griddle** *must never be greased.*

A Study of the Leavening Power of Baking-soda

192. What makes griddle-cake batter light?

Experiments with soda and acids. — A. Put a pinch of soda into a little sour milk. Put another pinch into vinegar. Observe the results in both cases.

B. Arrange an apparatus like that shown in Fig. 10. What change takes place in the lime-water? What gas is being formed?

193. Baking-soda is one of a class of substances called **carbonates.** When an acid is added to a carbonate in the presence of water carbon dioxide is formed, producing *effervescence.* Is this a physical or a chemical change? How do you know?

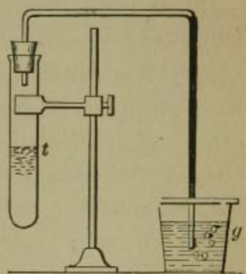


FIG. 10. — Apparatus for testing for carbon dioxide.

Test-tube (*t*) containing soda-solution with a little vinegar. Glass tube connected with *t* dips into lime-water contained in glass (*g*).

194. Batter made light by carbon dioxide produced by union of an acid with a carbonate. — The carbon dioxide formed in the batter from the union of the baking-soda and the acid in the sour milk expands when heated, making the griddle cakes light and porous. Moreover, although made with sour milk, the cakes are not sour; by an experiment we can find out if the soda has anything to do with this.

195. Experiments with acids and alkalies. — A. Add a little sal-soda solution to water in which red cabbage has been boiled.[1] What change in color takes place? Try adding ammonia, a drop of soapsuds, and baking-powder solution to the cabbage water. What effect do they have?

In general, substances that turn cabbage water green are termed **alkalies.** Baking-soda is an alkaline carbonate. Taste it. Its slightly soapy taste indicates its similarity to the alkalies used in cleaning.[2]

[1] Or use red and blue litmus paper for testing. *Alkalies turn red litmus blue; acids turn blue litmus red.*

[2] Chemists call washing-soda *sodium carbonate*, and baking-soda *mono-sodium carbonate.*

196. Experiment B. — Try the effect of vinegar and of sour milk upon cabbage water.

Substances that turn cabbage water violet are (or contain) **acids.**

197. Neutralization. — Acids and alkalies have the power of neutralizing each other (*i.e.* of destroying each other's characteristic properties). If exactly the right amounts of soda and of sour milk are used, the batter will be neutral; that is, it will not turn cabbage water either green or violet, and will taste of neither acid nor soda. (Test some of the batter left in the bowl.)

To one pint of thick, recently soured milk use one teaspoonful of baking-soda. The more acid the milk is, the more soda it requires. Bitter or mouldy sour milk is unfit to be used.

Batters and Doughs

198. Quick-bread mixtures are either **batters** or **doughs**. Dough means "that which is moistened"; batter means "that which is beaten."

One measure of liquid with one to one and a half measures of flour makes a thin or **pour-batter.**

One measure of liquid to two measures or a little more of flour makes a thick or **drop-batter.**

A mixture stiff enough to be handled on a board is a **dough.**

One measure of liquid to two and two-thirds measures of flour makes a **soft dough.**

One measure of liquid to three or more measures of flour makes a **stiff dough.**

What kind of a batter is the popover mixture? What kind of a mixture will the recipe for biscuit make?

199. Ingredients; means of lightening; shortening. — A mixture of flour and water or flour and milk alone would be, when cooked, hard and indigestible. We have found that the introduction of carbon dioxide makes it light and porous, and that, in a watery batter cooked by intense heat, the steam produced puffs the batter up. Eggs are used to stiffen batters. Either the eggs, or the batter after the eggs are mixed with it, is in most cases well beaten, in order to fill the mixture with air, which, expanding, makes it light. (See Muffin Recipes.) With very glutinous flour (§§ 205 and 214) eggs are unnecessary except to make the bread richer. Fat *shortens* bread, *i.e.* makes it more tender by separating the starch-grains of the flour. Butter gives a fine flavor; beef fat is less expensive than butter and in many cases serves equally well; the peculiar greasy flavor of lard makes it less desirable than either of these.[1]

Recipe for Tea-biscuit

Flour,	2 cupfuls.	Salt,	½ teaspoonful.
Baking-powder,	3 teaspoonfuls.	Butter,	1 tablespoonful.

Milk (or milk and water), about ¾ cupful.

Sift the flour, baking-powder, and salt together. Rub in the butter (which should be cold and firm) with the tips of the fingers, or cut it with a knife, until

[1] When substituting lard or beef fat for butter, add one-eighth teaspoonful of salt for each two tablespoonfuls of shortening.

the mixture looks like meal. Pour in the milk slowly, cutting, not stirring, the mass with the knife. As soon as one portion of the flour becomes slightly moistened, push it to one side. When all is moist turn it on to a floured board. Knead it for a minute with the hands. Pat and roll it lightly with a rolling-pin to a thickness of three-fourths of an inch. Cut into biscuit with a small biscuit-cutter dipped in flour. Bake on a pan from twelve to fifteen minutes in a hot oven.

For richer biscuits use from two tablespoonfuls to one-fourth cupful of butter.

A Study of Baking-powder

200. Experiments with baking-powder. — **A.** Taste baking-powder. Test it with cabbage water (§ 195). How would you describe it?

B. Add two tablespoonfuls of cold water to one teaspoonful of baking-powder; two tablespoonfuls of hot water to another teaspoonful of baking-powder. Which foams the most? What kind of bubbles do you think these are?

C. Arrange an apparatus like that in Fig. 10. Use a cold-water solution of baking-powder instead of vinegar and baking-soda. Test for carbon dioxide. When the gas ceases to come off, heat the test-tube gently, and observe the result.

Explain how biscuit are made light. Is heat necessary to make all the gas come off? What would be the effect on the biscuit if hot milk were used in mixing the dough?

D. Taste cream of tartar. Test it with cabbage water, or with litmus. What kind of a substance is it?

E. Try to dissolve cream of tartar in cold water; in hot water. Try to dissolve baking-soda in cold water; in hot water. What can you say of the solubility of baking-soda?

F. Mix one-half teaspoonful of baking-soda with one teaspoonful of cream of tartar, and taste the mixture. Add water to the mixture (or, make separate solutions of soda and of cream of tartar, and pour one into the other). Compare the result with what happened when water was added to baking-powder. Of what do you think baking-powder is composed?

G. Test the mixed solution with cabbage water. If it is not neutral, try to make it so by adding either soda or cream of tartar, a little at a time.

201. What baking-powder is; how it makes mixtures light. — Pure cream of tartar baking-powder contains one part of baking-soda to two parts of cream of tartar.[1] In solution these unite, forming carbon dioxide and Rochelle salts.[2] Cream of tartar being partly soluble only without heat, little of the gas is set free until the mixture is put into the oven.[3] It then comes off

[1] Two teaspoonfuls of cream of tartar and one scant teaspoonful of baking-soda are equal to three teaspoonfuls of baking-powder. When *pure* baking-powder can be obtained, it is wiser, as well as more convenient, to use it; because the housekeeper cannot proportion the soda and cream of tartar as accurately as does the manufacturing chemist, and any excess of either is not only wasted, but may be injurious to the health. Soda, since it gives off some carbon dioxide when wet, even if no acid is present, might be used alone to lighten bread, did it not when so used make the bread yellow, unpalatable, and unwholesome. Baking-soda is made by passing carbon dioxide over ordinary sal-soda. Cream of tartar is an acid salt prepared from the crystals called "argols" that form on the inside of wine-vats and wine-casks.

[2] Rochelle salts is a soluble, white powder, harmless *in small quantities.*

[3] Enough moisture to start this action is, however, readily absorbed by the baking-powder from the air. A little cornstarch is therefore added by the manufacturer to take up moisture and keep the powder dry. A solution of baking-powder may be tested for a starch (*a*) by boiling and (*b*) with iodine.

rapidly, filling the batter or dough with bubbles, and making it rise higher and higher. As the gas expands, the walls of the bubbles stretch and become thin. Just at this stage, if the oven is right, the heat sets the mixture and imprisons the gas. In too hot an oven a crust forms before all the gas is set free; in too cool an oven the bubbles break and the gas escapes. In either case the result is heavy bread.

Use one to one and one-half teaspoonfuls of baking-powder to one cupful of flour. If more than this is required, the baking-powder is of poor quality. The more air there is beaten into the mixture, the smaller will be the quantity of baking-powder required. Bread or cake made with "generous" measures of baking-powder is dry, and owing to the excess of Rochelle salts produced, unwholesome.

Helpful Hints about mixing and baking Quick Breads

202. 1. As a rule sift the baking-powder with the flour; in a very thin batter it may be sprinkled in after the other ingredients have been mixed, provided the whole mixture is then well beaten.

2. A quick bread should be quickly mixed, and put into the oven without delay. This is most important in the case of thin batters, those raised wholly with air, and those raised by using soda and sour milk, or any other liquid acid, which sets free at once almost all the available gas.

3. The proper degree of heat for baking must be learned by experience. In general, doughs require a hotter oven than batters do. Too great heat causes bubbles of air or gas to burst and run together, which is undesirable when a fine-grained bread is desired. Popovers, when baked, should be hollow shells. Bake these, therefore, in a hot oven.

4. Set the pan at first on the bottom of the oven; after the bread has risen it may be placed on the rack to brown the top.

5. Open and close the oven door gently — "as if there were a baby inside," — and avoid moving the pan while the bread is rising. A draft of cold air will cause the bubbles to collapse; a sudden jar will break them. In either case the bread will fall.

Recipes

Plain Muffins

Flour,	2 cupfuls.	Salt,	½ teaspoonful.
Baking-powder,	3 teaspoonfuls.	Butter,	1 tablespoonful.
Milk,	about ¾ of a cupful.		

Mix and sift the flour, baking-powder, and salt. Stir in enough milk to make a drop-batter, beat well, and add the butter melted. Bake about twenty minutes.

Egg Muffins

Flour,	1½ cupfuls.	Milk,	1 cupful.
Baking-powder,	2 teaspoonfuls.	Eggs,	1.
Salt,	½ teaspoonful.	Melted butter,	1 tablespoonful.

Mix and sift the dry ingredients. Separate the egg; beat the yolk slightly, the white to a stiff froth. Stir the milk, beaten yolk, and melted butter, in the order named, into the dry ingredients. Last, fold in the beaten whites. Bake in muffin-pans twenty-five minutes.

Whole-wheat Muffins

Flour,	1½ cupfuls.	Salt,	½ teaspoonful.
Baking-powder,	2 teaspoonfuls.	Butter,	1 tablespoonful.
Sugar,	1 tablespoonful.	Milk,	¾ cupful.

Mix and sift the dry ingredients. Stir in the melted butter and milk, and beat well. Bake in greased muffin-pans about twenty-five minutes.

Cornmeal Muffins.

Cornmeal,	¾ cupful.	Salt,	½ teaspoonful.
Flour,	1 cupful.	Milk,	1 cupful.
Baking-powder,	2 teaspoonfuls.	Butter,	1 tablespoonful.

Eggs, 1.

Scald half of the milk. Separate the egg, and beat the white to a stiff froth. Put the cornmeal in a bowl, make a well in the centre, into the well put the salt and butter. Stir in the scalded milk.[1] Add the yolk unbeaten, the cold milk, and the flour and baking-powder sifted together. Beat well, and fold in the beaten whites. Bake in a hot oven thirty minutes.

203. Digestion of quick breads. — Quick breads are most delicious when fresh. No bread, however, should

[1] Cornmeal is scalded to soften its starch, the time in the oven being too short to cook this.

be eaten *steaming hot*, because in this state the inside part, or crumb, forms in the mouth a pasty mass not easily digestible. The crust contains dextrin and caramel, and is therefore more wholesome than the crumb. Little children and all persons with weak digestive powers should never eat the crumb of warm bread; those who do eat it should chew it slowly and thoroughly.

Try at home the experiments with acids and alkalies; test as many different substances as you can with litmus or cabbage water, and write them down, acids in one column, alkalies in another.

From the following books and articles you can learn how people make bread without baking-powder or yeast. *Woman's Share in Primitive Culture*, Chapter II; "Bread in the East," *Penny Magazine*, Vol. III, p. 2; "Tortillas," *American Kitchen Magazine*, Vol. VII, p. 3. The *Domestic Science Reader* has articles about crackers, hot cross buns, Mexican bread, and Zuñi Indian bread, pp. 78–83.

Section 2. Flour

A Study of Wheat. Part II (*continued from p.* 82)

204. Analysis of wheat-flour. — A. Make half a cup of flour into a very stiff dough with a little water. Knead this several minutes on a very fine strainer set in a bowl of water. Examine what is left in the strainer. How does it look? Feel? Spread some of it on a saucer to dry and examine it again. Heat some in the oven, notice how it swells. (Plate VIII, facing p. 122.)

B. Test the sediment in the water for starch in two ways.

205. Gluten. — Wheat-flour, when kneaded with water, yields a yellowish gray substance that when moist is elastic and sticky like glue, and for this reason is called **gluten.** When dry it is horny and translucent. If moistened and heated, it expands to many times its original bulk.

206. Flour or gluten may be tested for nitrogenous substances by mixing with it a few drops of nitric acid. How will the nitrogen show itself?

Strictly speaking, *gluten* does not exist in wheat or in dry wheat-flour. What we do find is a mixture of *gliadin* and *glutenin*, which, when kneaded with water, unite chemically to form gluten; but since they are always found together, we may consider them together as gluten.

207. Composition of wheat. — Wheat owes its value as a tissue-builder to its gluten, which contains nitrogen. The body of the wheat grain is composed of starch and gluten; the **germ** contains *fat* and tissue-building materials. Just beneath the **bran** coats are **mineral salts,** valuable as bone and nerve builders; the cell-walls consist of plant-fibre. Wheat also contains sugar.

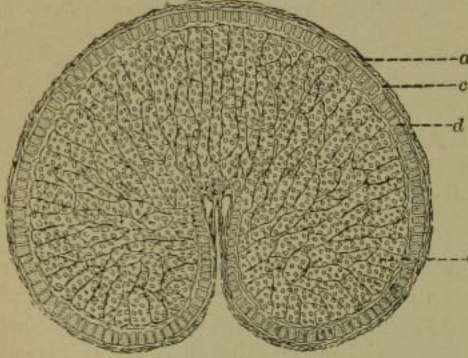


FIG. 11. — Cross-section of a wheat-grain, enlarged.

a and *c* = bran-coats; *d* = layer of aleurone cells; *e* = cells containing starch and gluten.

208. — Microscopical examination of a wheat grain. — A. Preliminary. — Cut a wheat grain in two and draw the outline of its cut surface.

B. Examine a mounted cross-section of a wheat grain. Observe that it is the same shape as the cut surface of the grain you sliced in two. Look first at the mass of cells forming the body of the grain. These collectively are called the **endosperm.** They are full of starch and gluten. Are they larger or smaller than the starch cells in a potato? If the cross-section is taken from the near base of the grain, you may be able to find the germ or embryo, a little dark body near its centre. If so, notice how the cells of the endosperm seem to radiate from it. What is the use of the endosperm to the embryo? (§§ 146, 147.) Around the outside of the grain you will see a layer, in some places a double layer, of large, square cells. These contain tissue-building material (*aleurone*).[1] This layer is generally removed in milling. Outside of it are three coats of bran.

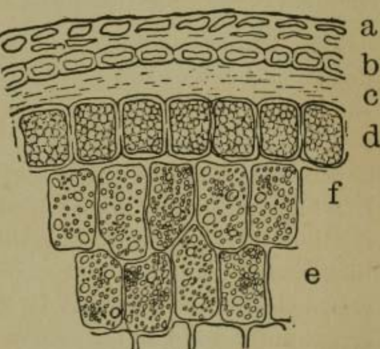


FIG. 12. — Portion of a cross-section of a wheat grain greatly enlarged.

a, *b*, and *c* = bran-coats; *d* = layer of *aleurone* cells; *e* and *f* = cells containing starch and gluten.

C. Make a sketch from memory of the cross-section of the wheat grain.

[1] These were formerly supposed to contain most of the gluten of the grain, hence they are incorrectly termed "gluten cells" in many books.

The Manufacture of Flour

209. Cleaning. — If you ever visit a flour-mill you will first be shown the wheat as it is shovelled from cars into bins, mixed with other seeds, and with dirt, sticks, and nails. It is freed from these by being run through wire screens, scoured clean by revolving steel blades, and steamed slightly to soften its hard coats, before going to the rollers.

210. Rolling. — Each pair of rollers turns in the same direction, but one moves two or three times as fast as the other; both are grooved, so that they cut or break rather than crush the grain. Each passage between a pair of rollers is accordingly called a *break*. From the first break the wheat comes out warm from the friction of the roller and looking and feeling something like coarse, damp sawdust. Next it passes to a machine called a *scalper*, where it is shaken on a wire tray to separate the bran as far as possible from the *middlings*, or bits of the white middle part of the grain — the part to be made into flour. Then back go the branny parts to be ground over by a second set of grooved rollers, and again "scalped"; while the middlings are crushed between *smooth* rollers, sifted, mixed with more middlings from the second break of the wheat, and ground over and over till reduced to flour.[1]

211. Bolting. — After five breaks no more middlings are left in the bran, but a little fine bran called *shorts*

[1] Part of the fine middlings may be taken out to sell as farina.

is still left to be taken out of the middlings. This is done by sifting, or *bolting* through silk gauze stretched over cylindrical frames called *reels*. The middlings are further purified by air-blasts that blow away flour-dust and light chaff.

Having explained the milling process, the miller may show you a quantity of yellow disks the size of a pinhead. These are germs flattened by the smooth rollers, and sifted out. If this were not done the diastase in them (§ 147) which prepares the starch for digestion by the seedling would spoil the flour by working in it the same change that it does in the seed.

212. Packing. — Lastly, you may see the finished flour packed by a machine that forces just one hundred and ninety-six pounds into each barrel, to be sold, some of it, perhaps, to the farmers who raised the wheat it is made from, some to city people who never saw a wheat-field.

213. The best flour the most economical. — Most mills make several grades of flour. **High grade** patent flour is the whitest and the highest in price, although in some cases the next grade, called **baker's,** may be fully as nutritious. Lower grade flours are not desirable, but so long as people buy them millers will sell them. There is no waste in a flour-mill; screenings and bran are sold for cattle and horse feed, germ is made into a breakfast food, and, because people want cheap flour, a mixture of flour-dust, shorts, and other by-products is put up to satisfy the demands of their purses, if not of their bodies.

Do not buy cheap flour, thinking you are saving money; you are only helping the manufacturer to save.

214. Flour made from the whole grain. — **Graham flour** was formerly made by grinding the whole grain, without bolting it; what is now sold as "graham" is usually low-grade flour mixed with coarse bran, indigestible and irritating to the stomach and intestines. **Entire or whole-wheat flour** is produced by grinding together all parts of the kernel except the bran and the germ.

215. Good bread flour, and how to tell it. — Glutinous flour, besides being more nutritious than starchy flour, makes the elastic dough necessary for producing light yeast bread. Hard spring wheat, being rich in gluten, yields such flour. You may know it (1) *by its creamy white color*, (2) *by its gritty feeling*, (3) *by its capacity for absorbing water*, nearly one and one-half cupfuls of water being taken up by one quart of good flour in making dough stiff enough for yeast bread, and (4) *by its caking but slightly when squeezed in the hand.*[1]

Where to find more about flour and flour-mills. — In *Foods and Beverages*, pp. 30–36; *Food Products of the World*, pp. 149–155; and in "Flour-milling in the Northwest," *The Nation*, Vol. LIV, p. 424.

Section 3. Macaroni and Other Flour Pastes

216. Macaroni, spaghetti, vermicelli, and other Italian pastes made from the glutinous flour of hard wheat, are to Italians what our various kinds of bread are to us. To make them, a stiff mixture of flour and hot water is

[1] For cake and pastry, flour made from winter wheat is desirable. Unfortunately, poor bread flour is often sold under the name of pastry flour.

placed in an iron cylinder, the end of which is closed by a disk pierced with holes. A piston forces the paste out through these in threads, rods, or tubes, according to the shape of the openings. When dry, the threads form vermicelli (Italian for *little worms*), — the rods, spaghetti (Italian for a *cord*), and the tubes, macaroni (Italian for *crushed*). Italian macaroni is dried by hanging over wooden rods in the open air or in ovens; American macaroni is laid on flat frames.

217. Excellent macaroni is made in this country by cleanlier methods than those used abroad, but because of a common, though mistaken, belief that Italian wheat is superior to ours, people will not buy it, except with Italian or French labels. Why not show sense and patriotism by preferring a domestic article, if it is as good or better than an imported one, and, by so doing, make it unnecessary for manufacturers to use deceptive labels?

218. How to know good macaroni. — Good macaroni is yellowish in color and rough in texture; it breaks cleanly without splitting, in boiling swells to double its bulk, and neither becomes pasty nor loses its tubular shape. Imitations made of starchy flour colored, are made both here and abroad.

219. Macaroni contains so much gluten that it is almost equal to meat as a food, especially if cooked with cheese.

220. Spaghetti may be prepared in any way suitable for macaroni, but is usually served with Tomato Sauce.

Vermicelli is used only in soups. **Noodles**, to serve in soup, are made in various shapes from a paste of flour, water, and eggs.

Recipes

221. To grate cheese. — Use Parmesan, or any cheese stale enough to be dry. Grate on a coarse grater, and *do not pack the grated cheese* in measuring it.

222. To prepare buttered crumbs for scalloped dishes. — Mix *dried* crumbs (§ 234) with melted butter, using one-fourth of a cupful of butter to one cupful of crumbs.

Tomato Sauce (for Spaghetti, Macaroni, or Boiled Rice)

Tomato (canned or steamed),	1 cupful.
Butter,	2 tablespoonfuls.
Flour,	2 tablespoonfuls.
Onion (chopped),	1 teaspoonful.
Salt,	½ teaspoonful.
Pepper,	⅛ teaspoonful.

Cook the onion with the tomato fifteen minutes. Mix butter and flour together. Strain the tomato and add it to the butter and flour. Cook all together for ten minutes, or until smooth, then add salt and pepper.

Spaghetti with Tomato Sauce

Spaghetti,	⅓ of a box.	Salt,	1 tablespoonful.
Boiling water,	2 quarts.	Tomato sauce,	1½ cupfuls.

Hold the sticks of spaghetti in a bunch, and dip the ends into the boiling salted water. As they soften and bend, lower them into the water, letting them coil around in the saucepan. The spaghetti may thus be cooked without breaking. Boil for twenty minutes, or until soft, drain, rinse with cold water (to remove starch that might make it sticky), and mix with the tomato sauce.

Recipe for Baked Macaroni with Cheese

Macaroni broken in one-inch pieces,	¾ cupful.
Boiling water,	2 quarts.
Salt,	1 tablespoonful.
Grated cheese,	¼ to ½ cupful.
White sauce (made from 2 tablespoonfuls of butter, 1½ tablespoonfuls of flour, 1 cupful of milk, and ½ teaspoonful of salt).	
Buttered crumbs,	¾ cupful.

Boil the macaroni in the water for twenty minutes, or until soft, adding salt when nearly cooked. Drain in a strainer, and rinse with cold water.

Put a layer of macaroni in a buttered baking-dish, sprinkle with cheese; repeat until all the cheese and macaroni have been used; pour the white sauce over the top. Cover with buttered crumbs, and bake until these are brown.

Section 4. Yeast Bread; Yeast

Remember thy bread and bake it well, for he will not be kept well who eateth his bread as dough.

223. The perfect loaf of bread is regular in shape, has a crisp crust, evenly browned, and a tender, but rather firm crumb of even grain. It tastes sweet and nutty, smells fresh, and keeps good for several days. How may we make such a loaf? The ingredients are few, the process is simple, and with care, skill is not hard to acquire.

Recipes (Plate VII, facing p. 102)

White Bread

Flour,	From 3 to 3½ cupfuls.
Cold water,	½ cupful.
Milk,	½ cupful.
Lukewarm[1] water,	2 tablespoonfuls.
Compressed yeast,	½ cake.
Salt,	½ teaspoonful.

Mixing. — Scald the milk; sift and measure the flour (three and one-half cupfuls); put the salt in a bowl and pour the milk upon it. Add the cold water, then the yeast mixed smoothly with the lukewarm water. Having stirred all together, stir in enough flour (about two and three-fourths cupfuls) to make a drop-batter. Beat this batter until it is full of bubbles; then beat in gradually enough more flour to make a rather soft dough. When too stiff to beat, rub a little flour on the moulding-board, and turn the dough out.

Kneading. — Dust a little flour on the dough and on the palms of your hands. Fold the edge of the dough farthest from you toward the centre of the mass, immediately pressing the dough down and away from you with a gentle rolling motion of the palms of the hands, twice repeated. Turn the dough so that what was the right-hand part of it shall be farthest away from you; fold over and knead as before; continue to do this, turning the dough and flouring your hands, the board

[1] Of the same temperature as your hand, 98° F.

PLATE VIII.

SEPARATING GLUTEN FROM FLOUR.

KNEADING BREAD.

FIRST RISING OF BREAD DOUGH; TAKING THE TEMPERATURE OF THE WATER.

and the dough, to keep the latter from sticking. Should it stick to the board scrape it free with a dull knife, and flour the board anew. Knead the dough until it does not stick to your hands or the board, is smooth on the surface, feels spongy and elastic, and rises quickly after being indented.

First rising. — Replace the dough-ball in the bowl, brush the top with water, cover the bowl with several thicknesses of cloth, and set it near the stove or in a pan of warm water, turning another pan over it.

Second rising. — When the dough has risen to twice its original bulk, lift it on to the board and shape into small loaves, handling lightly and using little or no flour. Put into pans, and let it stand in a warm place covered with a thick, clean cloth, until it has again doubled in bulk.

Baking. — When nearly risen, test the oven; it should be hot enough to turn a piece of writing paper dark brown in six minutes. Bake small French loaves thirty-five minutes; brick loaves, four inches thick, fifty to sixty minutes. Turn the pans if the bread does not bake evenly.

Plain Bread Rolls, Finger Rolls, and Bread Sticks

Shape these from white bread-dough after its first rising. For bread rolls, cut or pull off pieces the size of an egg; draw up and pinch the edges together, forming balls; then with your hand roll each into a cylindrical shape on the board. Put into French roll-pans, let rise until more than doubled in bulk, and bake from twelve to fifteen minutes. Or, put the balls on a flat pan, and when they have risen cut a cleft nearly an inch deep across the top of each one. Bake twelve to fifteen minutes. For finger rolls, roll pieces of dough half the size of an egg into cylinders five inches long. For bread sticks, roll out sticks of dough about half an inch thick and from six to ten inches long. Bake these and finger rolls ten minutes. The oven may be a little hotter for rolls than for loaves. (Plate VII, facing p. 102.)

Whole-wheat Bread

Flour,	About 3 cupfuls.
Lukewarm water,	1¼ cupfuls.
Compressed yeast,	½ cake.
Salt,	½ teaspoonful.

Mix the yeast smoothly with one-fourth of a cupful of the lukewarm water; dissolve the salt in the rest of the water in a bowl; stir the yeast into this; and then stir in enough flour to make a drop-batter. Beat until the batter is full of bubbles (not less than five minutes), cover the bowl, and let the batter, or *sponge*,[1] rise until doubled in bulk. (See recipe for White Bread.) Beat in the rest of the flour, and knead for five minutes.[2]

[1] *Sponge* is yeast-batter; allowing it to rise before adding more flour is called "sponging" or "setting a sponge." Sponging makes bread finer-grained, but lengthens the time required to make bread with white flour, which needs two risings after the sponge has risen. Whole-wheat bread may be made without setting a sponge, but should then rise twice after being kneaded.

[2] Whole-wheat dough, if made stiff enough for thorough kneading, is close and hard when baked. Beat it well, knead slightly, and mould while still somewhat sticky.

(For directions for kneading, see recipe for White Bread.) Mould into loaves, let rise in pans until again doubled in bulk, and bake like white bread. **Whole-wheat rolls** may be made like white-flour rolls.

Either white or whole-wheat bread may be mixed with water, milk, or half milk and half water, as may be preferred. Water bread is sweeter, tougher, and keeps longer than "half-and-half" or all-milk bread. Bread properly made from good materials requires neither shortening nor sweetening, but keeps moist longer if one tablespoonful of shortening (butter, lard, or drippings) is added for each cupful of liquid.

224. These two kinds of bread contain neither soda nor baking-powder. What do they contain that is not used in quick breads? Does yeast make bread light? and if so, how? The first thing to find out is: —

225. **What yeast is.** — Yeast is a mass of tiny plants, each a single, rounded cell consisting of a sac filled with watery matter. Under a microscope new cells may be seen budding out of old ones, forming branching chains. Each cell, however, lives and grows independently. Sometimes, usually in old yeast, daughter-cells form as *spores* inside a mother-cell, and burst through the enclosing sac. The home of yeast is on the skin of grapes and on parts of some other plants.

A Study of Yeast

226. **Microscopical examination.** — Examine under a microscope a drop of yeast grown in Exp. **A** (preferably in molasses and water). Note (*a*) the shape of the cells, (*b*) their walls, (*c*) granular appearance of cells, if existing. This is more noticeable in old cells. Try to find a cell just budding. Make one or more memory drawings of what you see.

227. The growth of yeast; experiments. — A. Mix one tablespoonful of flour, one of sugar,[1] and three-fourths of a yeast-cake to a smooth paste with four or five tablespoonfuls of cold water. Divide the mixture between three six-inch test-tubes (or three tumblers). Label the test-tubes *a*, *b*, and *c* respectively. Fill *a* with boiling water; half fill *b* with lukewarm water, and stand it in lukewarm water or in a warm place; half fill *c* with cold water and keep it at a temperature of 32° F. or below (by placing it in a bowl of cracked ice, or outside the window on a freezing day). In a fourth test-tube, *d*, put one-fourth of a yeast-cake mixed with water only; treat it like *b*.[2]

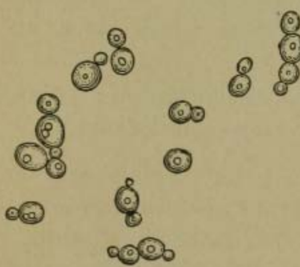


FIG. 13. — Yeast-cells.

After fifteen minutes examine all four test-tubes. What do you see on the top of the liquid in *b*? What goes on in the liquid? Let *a* and *c* stand for a time where they will be about as warm as *b*; what change do you notice in either of them? Is there any foam on *d*? The quantity of foam produced is a measure of the vigor of the yeast. At what temperature does yeast thrive best? Will it grow at all at 32°? After being frozen and thawed? After being heated to 212°? Will it grow in water alone?

B. (To be done during the progress of Exp. **A.**) Prepare in a generating flask a mixture like the first used in Exp. **A**, using

[1] Adding sugar hastens the growth of the yeast; for bread-making the sugar in the flour is sufficient.

[2] A mixture of molasses and water may be used instead of a flour mixture in this series of experiments.

three or four times the quantity. Arrange an apparatus like that shown in Fig. 14. Or use test-tube *b* instead of a flask, standing it in a tumbler of warm water. What gas comes from the yeast mixture? In what other ways may this gas be produced? What effect has it when introduced into batter or dough? As it is heavier than air, this gas may, with care, be *poured* into a tumbler from the bowl in which bread is rising, and tested by pouring lime-water into the tumbler.

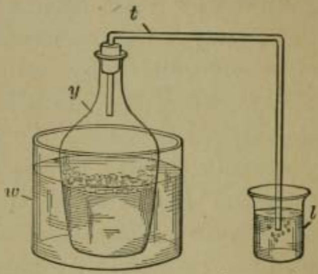


FIG. 14. — Apparatus for proving that growing yeast produces carbon dioxide.

y = flask containing yeast mixture.
w = vessel of warm water.
l = beaker containing lime-water.
t = glass tube.

228. Story of the yeast plant; what it needs in order to grow. — Like mushrooms and other fungi (singular *fungus*) which have no green coloring-matter (*chlorophyll*), yeast needs no light; and like these, it grows and multiplies fast. It is like green plants in that it grows only when kept warm and moist. It thrives best at 78° F. It may be forced to grow and bud unnaturally fast by a higher temperature, just as hot-house plants are; but at about 130° F. it loses its liveliness, and by heat greater than this it is killed. Cold checks its growth, but even after being frozen it will, if thawed, revive and grow as well as ever. It needs water, and either some nitrogenous foodstuff, such as gluten, or some mineral matter containing nitrogen to feed upon. Dried yeast-cells floating in the air revive if they fall where conditions are right for their development, and grow just as seeds do that fall on good ground.

229. How yeast obtains oxygen. — A name meaning *sugar-fungus* has been given to yeast, because, while most vigorous when well supplied with air, it will always, when sugar is at hand, take from this a part of the oxygen it needs. To get oxygen out of sugar, the yeast-cell digests the latter by means of a fluid it secretes. It is not known whether this fluid acts inside or outside of the yeast-cell, but it is known that it splits the sugar into simpler compounds, the most important of these being alcohol and carbon dioxide.

230. Fermentation; ferments. — A chemical change of this kind, where one organic substance is decomposed by another, is called **fermentation**, and the substance causing the change is called a **ferment**. The action of yeast in bread-raising is an alcoholic fermentation of sugar.

231. The digestion of starch, both in animals and in plants, the digestion of proteids, the souring of milk, and the clotting of milk by rennet are other kinds of fermentation. What is the ferment in each of these cases? What are some of the substances produced? (§§ 129, 174, 175, 176, 325.)

232. Cultivated yeasts. — Liquid yeast is yeast cultivated in a mixture of potatoes, sugar, water, and hops. No home-made or baker's yeast can be as uniformly good as the pure yeast cultivated by brewers and distillers. Distiller's yeast, skimmed from fermented rye, washed, mixed with starch and pressed, is most commonly used for making bread. Each cake contains about fifty billion yeast-cells.

233. The yeast-garden. — Dough, after yeast is mixed with it, becomes a yeast-garden, which we must tend carefully in order to have a good crop of yeast and a plentiful yield of carbon dioxide. The water supplies moisture; the flour supplies sugar, which the yeast-plant, in its greed for oxygen, turns into alcohol and carbon dioxide. More oxygen is supplied by beating and kneading in air. The right temperature, 78° to 90° F., is insured by using lukewarm liquid and by keeping the sponge and dough warm until it is ready to be baked. What is the result? A dough filled with bubbles of gas given off by the lively yeast-cells; a dough that has lost a little of its sweetness, but gained other pleasant flavors through various fermentative actions of the yeast on the flour.

After alcoholic fermentation has gone on for some time, another ferment begins to work on the alcohol, turning it into *acetic acid* (the acid found in vinegar). This is why dough sours if allowed to rise too long or at too high a temperature.

When the dough is just light enough,[1] it is put into an oven so hot that the yeast is quickly killed. Nearly all the alcohol is driven out of the bread as vapor during baking.

[1] Do not try to neutralize sour dough with baking-soda. Soda forms with acetic acid an unwholesome compound, and besides, since there is no way of knowing exactly how much acid has been formed, you

Helpful Hints about Bread-making

1. To keep the dough from cooling, mix and knead it quickly. In cold weather, warm the flour, the board, and the mixing bowl.

2. The longer the batter is beaten, the less kneading the dough will require. When the dough can be lifted in a mass on the spoon, it is ready to knead.

3. We knead bread (1) to mix the ingredients thoroughly, (2) to make the gluten elastic, and (3) to work in air. Dough is sufficiently kneaded when it can be left on the board for a minute or more without sticking. Use as little flour as possible.

4. Sponge rises faster than dough. Why? It is desirable to set a sponge (1) if you have to make bread with a scant quantity of yeast; (2) if using home-made or other yeast that you fear may not be very active; (3) when butter and eggs are to be added, as these can be mixed more easily with sponge than with dough.

5. By using not less than one yeast-cake to one pint of liquid the following advantages are gained: (1) The bread can be made and baked within five hours. (2) It may more easily be kept clean and free from kitchen odors than if it stood longer. (3) It has not time to sour.

6. If you are unable to attend to the dough as soon as it is risen, it may be cut down (*i.e.* scraped away

are likely to use too much soda. Bread "sweetened" with soda is more unwholesome than bread a little sour.

from the sides of the bowl and pressed over into the centre) and allowed to rise again.

7. Dough that contains large bubbles has risen too fast or too long. It should be cut down and rekneaded to distribute the gas evenly. Sour dough falls in the middle, is stringy, and smells and tastes acid.

8. Use round or French bread-pans; in the corners of rectangular pans the dough has not room fully to expand. Make small loaves always, to insure the bread's being baked through; in large loaves, the heat may fail to penetrate to the centre, and some yeast may remain alive. This yeast, fermenting in the stomach of the person that eats the bread, is likely to cause serious indigestion. If obliged to use pans more than four inches broad, bake the bread from one hour and a quarter to one hour and a half, decreasing the heat after the first half hour. Why should it be decreased?

9. If the oven is too hot, set a pan of water in it for a few minutes. If bread rises much after being put into the oven, the heat is not great enough; if it begins to brown in less than fifteen minutes, the heat is too great. If the loaf rises or browns more on one side than on the other, turn it around.

10. The crust, by preventing the inside of the loaf from drying, keeps the centre from becoming hotter than about 212° F. Which is more digestible, crust or crumb? Why?

11. Bread is baked when it shrinks from the sides of the pan. To make the crust crisp and tender, rub it

while hot with a bit of butter twisted in a piece of cloth or paper. Set fresh loaves on edge in such a way that air reaches all sides of them. When cool put them in a tin box or stone jar, without wrapping. Wrapping bread in cloth makes it damp and musty.

234. Uses for stale bread. — Stale bread, if heated in a closely covered pan, becomes almost like new. Keep pieces of stale bread by themselves in a jar or covered bowl. Stale slices may be used for toast. (See directions for toasting bread, § 153.) Dry broken pieces in a warm oven until they are crisp, but not brown. Crush them on a board with a rolling-pin kept for this purpose; sift the crumbs, and keep them in a jar to use for croquettes, etc. They will keep several weeks. Coarser or browned crumbs may be used for the *tops* of scalloped dishes. Stale crumbs not dried are suitable for bread puddings and *filling* of scalloped dishes. Bread dried slowly in the oven till brittle and brown all through is liked by many people and is excellent for children.

Fancy Bread Recipes

Parker House Rolls

Flour, 4 cupfuls.	Scalded milk, 1 cupful.
Salt, ½ teaspoonful.	Compressed yeast, 1 cake, mixed with
Butter, 2 tablespoonfuls.	Lukewarm water, ¼ cupful.

Sugar, 1 tablespoonful; extra butter melted.

Reserve one-half cupful of flour. Sift the salt with the rest, rub in the butter, and sift again. Let the milk cool until lukewarm; then stir into it the yeast and add the flour gradually, using as much of the reserved portion as is necessary. When stiff enough, knead the dough on a board. Let it rise until tripled in bulk. Roll out about one-half inch thick, cut with a biscuit-cutter, spread lightly with melted butter, crease with the back of a knife-handle dipped in flour, and fold almost double. Let the rolls rise until doubled in bulk (about twenty minutes). Brush them with water or milk, and bake in a very hot oven fifteen minutes.

Swedish Rolls

Flour,	about 4 cupfuls.	Scalded milk,	1 cupful.
Sugar,	2 tablespoonfuls.	Compressed yeast,	1 cake mixed with
Salt,	½ teaspoonful.	Lukewarm water,	¼ cupful.
Butter,	2 tablespoonfuls.	Eggs,	2.

Currants, about ½ cupful; extra butter and sugar.

Pour the milk over the butter, salt, and sugar. When these have melted or dissolved, stir in the yeast mixed with the water. Add enough flour to make a drop-batter, beating till full of bubbles. Let it rise until very light. Add the eggs unbeaten, beat well; add enough more flour to make a soft dough, knead thoroughly, and let it rise again. When tripled in bulk, roll out, with as little handling as possible, into a rectangle a little less than one-half inch in thickness; spread thinly with softened butter, working from the centre toward the edges. Sprinkle with currants and sugar. Roll the dough up into a cylinder one inch in diameter, and cut it into slices one inch thick. Place these close together cut side down on shallow greased pans, and let them rise till very light. Dissolve one teaspoonful of sugar in two tablespoonfuls of milk; brush the tops of the rolls with this mixture, and bake them twenty minutes in a hot oven.

235. To clean currants. — (1) Sprinkle with flour and rub between the folds of a clean cloth, (2) pick off stems, (3) rinse currants in a wire strainer until the water comes through clean, (4) shake to remove water, and (5) dry in the sun, or in a warm, *not hot*, oven.

Digestion and Food Value of Bread

236. Try to crumble fresh bread, stale bread, bread-crust, soft toast, crisp dry toast. Which crumble more easily? Which will be most readily broken up by the teeth? Well-chewed bread tastes better and satisfies hunger more quickly than bread swallowed hastily.

237. Reasons for chewing bread. — Not only does chewing aid solution, but, by exciting the nerves communicating between the mouth and other digestive organs, it starts a flow of digestive juices toward the stomach and intestines; so that well-chewed food meets in them a welcome not given to food hurried down the esophagus before its arrival in the mouth has been announced. For the gluten, pepsin is ready; and any starch not wholly digested is awaited in the small intestine by fluids which complete its conversion.

238. Completion of starch digestion. — Saliva, which is alkaline, loses its digestive power when attacked by acid. After being swallowed, it continues to digest starch for about three-quarters of an hour before sufficient hydrochloric acid accumulates in the stomach to check its action.

239. White bread compared with other foods. — A family eating a one-pound loaf of white bread for breakfast obtains about three times the nourishment they would from a pound of potatoes, and more than four times what they would from a pound (about one pint) of oatmeal mush; indeed, oatmeal being less completely digested than wheat bread, its food value is even lower than this estimate makes it. The value of any food depends on its digestibility quite as much as on the amount of foodstuffs it contains. Entire-wheat bread, for instance, although richer than white bread in gluten and mineral matter, supplies to the body less of these materials, much of them going to waste. For constant use, white bread is probably best.

"The Staff of Life," "More about Bread," "A Machine Baker," and "Crackers" are the titles of short articles about bread in *Food and Beverages*, pp. 39–50. Farmers' Bulletin No. 112, sent free on application to the U.S. Department of Agriculture, Washington, D.C., gives many interesting facts about *Bread and Bread-making* not included in this little text-book. *Boys and Girls in Biology*, by Sarah Hackett Stevenson, contains in its first chapter an excellent description of the life of yeast. Books published several years ago, however, before the processes of fermentation and bread-making were as well understood as they are now, may contain incorrect statements; new facts are discovered daily, so, as a rule, use the most recent books you can find.

CHAPTER V

FOOD IN ITS RELATION TO LIFE

Section 1. Bodystuffs and Foodstuffs

It is essential that the body should be perfect in order that the brain may have a chance to do its work. — G. Stanley Hall.

240. **Body, organs, tissues, cells.** — The body of a human being, like the bodies of most animals and plants, consists of parts called **organs.** The special work of each organ is called its **function.** What is the function of the eye? Of the lungs? Of the stomach? Of a root? Of a leaf? Organs differ from one another, not in function only, but also in make-up, or structure. The various kinds of material composing the organs of the body are called **tissue,** bony tissue being found in bones, nervous tissue in nerves, muscular tissue not in muscles only, but in other organs. The tissues of the body are made up of **cells,** as the walls of a house are constructed of bricks. Instead, however, of being laid together, as bricks are, these cells grow together, each kind of tissue being built of similar cells of a particular kind.

241. **Cells in the body not all alike.** — One yeast-cell is much like another, but how about the cells in a grain of wheat? Starch-cells differ from bran-cells in structure because they differ in function. Each yeast-cell is

independent, doing all its own work ; but in higher forms of life, both plant and animal, where many cells are joined together in one individual, some have one function, some another. We may compare a yeast-plant to a man living alone, preparing his own food and making everything he needs ; while a tree or a horse or the body of a human being is like a nation, in which some men are farmers, some manufacturers, some merchants, and so on. And just as the merchant does not understand farming, nor the man that raises wheat know how to make it into flour, so a cell of one kind cannot do the work of another. Cells in lung tissue, for example, are adapted for absorbing oxygen, and cells in the retina of the eye for receiving rays of light ; but neither of them are able to take in food until it has been prepared for them by stomach-cells.

242. **Bodystuffs.** — In the cells of the body many compounds are found, most of them being combinations of some or all of the following elements : carbon, hydrogen, oxygen, nitrogen. Calcium is found in bones, phosphorus in nerves, iron in blood, coloring it red ; and these and other elements in small quantities in various tissues.

243. **Three chief classes of organic foodstuffs : proteids,[1] fats, carbohydrates.** — Proteids, which are compounds of carbon, hydrogen, nitrogen, oxygen, a little sulphur, and in some cases phosphorus, are found in every living thing, and are the most important of the bodystuffs.

[1] *Proteid* comes from a word meaning "I take first rank."

Water and proteids together make up most of the flesh and blood and a large part of the rest of the body. It is plain now why albumin, casein, and gluten are such good tissue-builders; being made up of these same elements, they supply the material necessary for building and repairing tissue. Henceforth, we shall speak of tissue-builders as **proteids**, and of foods in which they are found abundantly as **proteid foods.**

244. Closely related to the proteids are the **gelatinoids**, a group of foodstuffs comprising **gelatin**, **collagen**, and other substances similar to proteids in composition. Gelatinoids do not build tissue, but help indirectly to build it, for when present they keep proteid from being used as fuel. Their chief function, then, is that of "proteid sparers."

245. **Fat**, like proteid matter, is both a foodstuff and a bodystuff. In the body fatty tissue is found both in masses and mixed with other tissues. Such parts of the fats of food as are not oxidized at once, go to build up this tissue, which serves as a reserve supply of fuel. A third class of foodstuffs, the **carbohydrates**, includes starch, sugar, and all other foodstuffs composed of carbon, hydrogen, and oxygen, the two latter being in the right proportions to form water. Very little carbohydrate matter is found in animal bodies, that taken in vegetable food being largely consumed in producing energy. The **acids** of vegetables and fruits, though forming but a minute part of our food, are essential to the healthy condition of the blood.

246. Animal and plant foods. — Animal foods consist chiefly of proteids; plant or vegetable foods, while in many cases containing proteids, contain much greater proportions of carbohydrates. Which is most like the human body in structure and composition, animal or plant food? Which would you expect to find most easily digested?

247. Two classes of inorganic foodstuffs. — Since **lime, potash, sodium,** and **other mineral matters** form part of our living bodies, these too must be included in food. We take them in chiefly as soluble salts in the juices of meats, fruits, and vegetables, the only mineral substance *added* to food being common salt (*sodium chloride*). **Water** by itself does not nourish the body; that is, it neither builds tissue nor yields energy; but so necessary is it to the carrying on of these and other life processes that it may be considered a foodstuff. (§ 41.)

248. Functions of food. — Tissue-building, heat-giving, force-making; these are the *primary* functions respectively of proteids, fats, and carbohydrates. But no one of them is limited to one kind of work. Have we not learned that carbohydrates yield energy in the form of heat as well as of force, and that fats yield both these and build one kind of tissue besides? Proteid, a tissue-builder by reason of its nitrogen, is also, because of its unoxidized carbon, a fuel food. Thus a temporary lack of one of these chief classes of foodstuffs is readily made good by another. Bear in mind, however, that only nitrogenous foodstuffs build tissue (fatty tissue excepted); so, while a diet of proteids (with water and mineral matter) may sustain life, on a diet of carbohydrates, or fat, or both, a person would waste away and die. A normal diet, however, contains both nitrogenous and non-nitrogenous food. A person limited to proteid food, such as lean meat, would have to take in more nitrogen than would be good for him in order to get enough carbon.

249. Food adjuncts are substances not nutritious, but taken for their pleasant taste or stimulating effect. Such are spices, flavorings, tea, coffee, and some other beverages.

250. Fermented liquors (wine, beer, whiskey, gin, etc.) are taken for the sake of the alcohol they contain.[1] In small doses alcohol yields a little energy. But not all substances that yield energy in the body are foods, any more than all combustible substances are fuels. Some of the latter are dangerous explosives. Some of the former are poisons; morphia and carbolic acid, for example. Alcohol, like these poisons, is more powerful for harm than for good. Instead of satisfying a want, it produces an unnatural craving; in spite of the feeling of warmth it gives, it really lowers the bodily temperature; instead of building tissue, it injures it, particularly that of the nerves and brain. Alcohol is not, therefore, in the ordinary sense of the word, a food, although, like other drugs, it may sometimes be used as a medicine.

Section 2. Diet

Simple diet is best, for many dishes bring many diseases. — PLINY.

251. It is impossible to fix a dietary standard. In a temperate climate an average person needs about five to five and one half times as much carbohydrate as proteid. The proportion of fat to carbohydrate is variable, depending partly on the amount of proteid taken (§ 347), but it is always a smaller factor than the proteid.

Most people who can provide themselves with all the food they want eat too much. A grown man commonly consumes each day about 700 grams (24.5 ounces) of food, of which 100 to 150 grams (3.5 to 5.25 ounces) is proteid yielding about 16 grams of nitrogen. It has recently been shown, however, that men living on about half this quantity of food work as well and keep in better health.

To eat much more than we need is dangerous. In trying to get rid of the excess the body is overtaxed. If its efforts fail, as they often do, the useless food clogs the system, or decomposes into poisons. This kind of poisoning is called *autointoxication*, literally, self-poisoning. An excess of meat or other animal food is particularly likely to cause it.

That most diseases are the result of imperfect digestion or assimilation[1] has long been known. It is now believed that in autointoxication lies the key to much of the trouble.

[1] Assimilation is the taking up of digested food into the tissues.

Practical Points about feeding a Family

252. 1. Brain-workers (teachers, students, clerks, etc.) need easily digestible food; muscle workers (workingmen, etc.) find coarser food better suited to their needs.

2. No one meal need be "balanced," that is, need contain proteids, carbohydrates, and fats in a certain proportion, but each day's dietary should approach the proportion of one part proteid to five and a half parts carbohydrate.

3. Diet should be varied as well as mixed; for example, do not depend too much on potatoes for starch; have rice or macaroni sometimes instead.

4. When planning a meal, think what was served at the preceding one; if starchy foods chiefly, supply plenty of proteid. Do not forget that butter, eggs, milk, etc., used in cooking count as food just as much as if served by themselves on the table. By planning meals, in part at least, for several days ahead, you will find it easier to provide varied and rightly balanced fare.

5. Food is not necessarily nutritious in proportion to its cost. (See Economy in Marketing, § 320, and Selecting Vegetables, § 395; also Appendix B.)

6. Remember that plant proteid may take the place of animal proteid; if you have but a small piece of meat, serve peas or beans with it rather than beets. (§ 392.)

7. Familiarize yourself with the composition of common foods so that you may readily think of suitable

combinations and know how to supply lack of one food by another of similar character.

Helpful Reading in the *American Kitchen Magazine*. — "Everyday Breakfasts," Vol. XIII, p. 18; "Food for a Typical American Family," Vol. VI, p. 26 (for pupils who have had a year of cookery); "A Twenty-four Cent Dinner," Vol. XI, p. 9; and "Menus" in each month's issue during 1898.

CHAPTER VI

TISSUE-BUILDING FOODS: THE FLESH OF ANIMALS

Section 1. Meat: Its Structure, Composition, and Cooking

253. In general, flesh-food is called **meat**. In our markets, however, this term is applied only to the flesh of cattle, sheep, and swine, that of mature animals being known as **beef**, **mutton**, and **pork**, respectively, that of calves as **veal**, and of lambs as **lamb**.

Lean Meat: A study of it in connection with its preparation in some simple ways.

DIRECTIONS FOR ONE WAY OF PREPARING BEEF-JUICE

254. Use a one-half pound slice of the top round of beef cut three-fourths of an inch thick. Let a small bowl stand in a pan of boiling-hot water until thoroughly heated; then lay in it the beef, letting first one side, then the other, lie next to the bowl. When the heat has whitened it, cut it into small pieces, and squeeze these, a few at a time, in a meat-press, vegetable-press, or lemon-squeezer. (For serving Beef-juice, see p. 305.)

255. **Composition and structure of lean meat**. — What foodstuff have we found in the animal foods we have already used? How can we find out if it is also contained in meat?

Experiment. — A. Test beef-juice for albumin. If albumin is shown to be present, observe the form in which it appears. Compare with pure white-of-egg cooked, and with white-of-egg mixed with water and heated. What besides albumin do you think beef-juice contains? Note that heating destroys the red color of beef-juice. What gives it this color?

256. Nitric acid added to beef-juice clots it and turns it yellow. What does this prove? What other nitrogenous substance is coagulated by acid? Human flesh, too, is stained yellow by nitric acid. How do you explain this?

257. Beef-juice contains albumin and other proteids, mineral salts, and extractives, dissolved in water; boiling coagulates the albumin into a brownish jelly. In the bits of beef we have pressed there remains some albuminous juice; what besides may be shown by another experiment?

Experiments. — B. Observe the fibrous appearance of a piece of round of beef. Can you see any fat among the fibres? Scrape with a knife first one side, then the other, of one of the pieces of meat from which the juice has been squeezed, until only the fibres are left. Pick some of them apart with a needle. Try to break or tear them. **C.** Heat the mass of fibre, and note the effect.

Each fibre is a bundle of tube-shaped cells filled chiefly with proteid substance. These tubes are covered and bound together with a web of white **connective tissue**, threaded by tiny blood-vessels. Toward the ends of the muscles the fibres dwindle down till only a firm mass of connective tissue, called **tendon**, is left.

The contents of the tubes and blood-vessels may be scraped out, leaving these, with the connective tissue, in a pale-colored, stringy mass.

258. Two facts important to bear in mind in cooking meat. — 1. Heat, by causing the collagen in the connective tissue to swell, tends to force the juices out of the muscle-fibres.[1] 2. Dry heat hardens connective tissue.

259. The pulp of meat consists chiefly of **myosin**, a jelly-like proteid similar to the fibrin of blood. Both myosin and fibrin are liquid during life, but clot after death.[2]

skip

Directions for making Raw Beef Sandwiches (for Invalids)

Cut juicy, lean beef into thin strips. Scrape the pulp from them, season it highly with salt and pepper, and spread between *thin* slices of bread.

260. Microscopical examination of meat fibre. — Soak in salted water a few fibres of beef from leg or round. Examine them under a microscope, using a one-inch objective. Look at the ends of the fibres. Can you see that they are hollow tubes? Observe the fine stripes (*striæ*) on the fibres. The muscles of the stomach and some other organs are not striped.

261. Tests for mineral salts in meat. — A. Heat a bit of meat in a crucible or evaporating dish over a Bunsen burner for several

[1] See § 244. Though collagen swells, a mass of connective tissue, as a whole, shrinks when heated. This shrinkage is caused by loss of water.

[2] The liquid forms, *myosinogen* and *fibrinogen*, differ chemically from the clotted substances, bearing the same relation to them that caseinogen does to casein. (§ 169, note 1.)

hours, or until only ash is left. **B.** Into a test-tube of water put a pinch of common salt, and add a few drops of *silver nitrate*. The latter forms with the salt a white cloud. Now add silver nitrate to beef-juice diluted with water. What salt does beef contain?

Directions for preparing Bottled Beef-juice

Cut into small bits *one pound of lean beef from the top round.* Put it in a glass jar, put on the cover, and set the jar, wrapped in cloth, or supported on a trivet, in a kettle of cold water. Heat the water slowly to about 130° F., or till it steams, let it remain at this temperature four or five hours, then strain, pressing the meat to obtain all the juice. (For directions for serving, see p. 305.)

Albuminous food being most easily digestible raw, raw beef-juice is desirable for persons with weak digestion. In preparing bottled beef-juice the object is to apply just heat enough to express the juice, without coagulating it. If the water in the kettle becomes too hot, the juice thickens and turns brown.

262. Experiments showing the action of cold water and of salt upon meat. — A. Cover a bit of raw meat with cold water, and observe how quickly the water becomes red. What does this show? Is anything besides blood drawn out?

B. Filter the water through filter-paper and heat the filtrate, *i.e.* the liquid that passes through. Has any albumin dissolved in the water?

C. Sprinkle a bit of raw meat with salt. What does the salt do to the juices of the meat? How do these afterward act upon the salt?

What conclusions do you draw from these experiments with regard to (1) putting meat into water to wash it, and (2) salting meat before cooking it?

263. Care of uncooked meat. — As soon as meat is brought into the house, take it out of the wrapping-paper, wipe it with a damp cloth, cut out any part discolored by a meat-hook, and set it away in a cool place.

HOW TO COOK TENDER MEAT: BROILING, ROASTING, BOILING

264. When the whole piece of meat is to be eaten, we desire so to cook it as to retain all the juice. This is done by exposing it for a short time to heat intense enough to harden the albumin on its surface, thereby sealing up the juices inside, and then for a longer time to a lower temperature, to complete the cooking of these juices. Can you think of two reasons for not cooking it at a high temperature all the time? Would you choose a thick or a thin piece of meat for broiling? Why? One with much or little connective tissue? Why?

265. Meat: tough and tender. — Meat, to be wholesome, must come from a healthy animal; to be nutritious, from a well-nourished one. Much-used muscles absorb much food material, making rich, juicy meat. This is, however, tougher than that of parts less used, because the connective tissue and fibre increase as well as the contents of the muscle-tubes. In which parts of the ox or sheep would you expect to find tender meat? In which parts tougher, juicier meat?

266. How to know good beef. — The lean of good beef is firm, elastic, and, when first cut, purplish red, the surface becoming bright red and moist after exposure to the air. The tenderer cuts are fine-grained and well-mottled with fat; a thick layer of firm, light straw-colored fat extends over the rib and loin cuts; the kidney suet is white and crumbly. Flabby, dark, or coarse beef with yellow fat is poor; if it has little fat, it is from an old or under-fed creature.

267. The characteristics of good mutton and lamb are similar to those of good beef, excepting that the lean is lighter-colored, and the fat whiter.

268. The best cuts for broiling are steaks from the loin of beef (short, porter-house, and sirloin), and rib or loin chops of mutton and lamb. (For other broiling pieces, see table, pp. 180–187.)

DIRECTIONS FOR BROILING BEEFSTEAK

269. Time. — For a steak one inch thick, five or six minutes; one and one-half inches thick, eight to ten minutes.

Steak properly broiled is puffy from the expansion into steam of the imprisoned moisture, well browned on the outside, and juicy and red, without being purplish, to within one-eighth of an inch of the surface. Steak less than one inch thick loses so much water by evaporation that the inside is dry before the outside is brown.

(*Put a platter to warm before beginning to broil the steak.*)

(1) To broil by a coal fire. — Have the coals glowing hot, without flame or smoke. Grease a double broiler with beef fat, place the steak in it, and hold it near the coals while counting ten slowly. Turn the broiler, and hold the other side down for the same length of time. Continue to turn the meat about once in ten seconds for about one minute, or until it is well seared; then hold it farther from the fire, turning occasionally until the surface is brown.[1] Just before taking it from the fire sprinkle with salt and pepper, turning each side once more to the heat to cook the seasoning in. When the steak is cooked, lift it on to the platter, spread both sides with butter, or with Maître d'Hôtel butter, garnish, if you like, with water-cress and slices of lemon, or with parsley, and serve without delay.

270. (2) To broil by gas. — Have the broiling oven hot. Lay the meat in a double broiler or directly on the rack over the pan. In the latter case turn the meat with two spoons to avoid piercing it. Proceed as in broiling over coals, except that the meat requires turning only three or four times. Turn down the gas and lower the pan, if necessary, after the meat is seared.

271. Lamb and mutton chops are broiled like beefsteak, allowing six to eight minutes, according to thickness. Mutton chops may be slightly red in the middle; lamb chops are usually preferred less rare. Tomato Sauce or green peas may be served with chops.

272. Pan-broiling. — Meat cooked on a pan may be almost as well-flavored and juicy as broiled meat, *if properly done.*

[1] Reasons for turning the meat: 1. To prevent the escape of juice. The meat must be turned just before the juice forced out of the tissues nearest the heat begins to escape from the upper side; if it overflows, it will drip and be lost. 2. To insure even cooking.

Use a *cast-iron*, not a sheet-iron, pan, and let it become almost red-hot before putting the meat in. Rub it lightly with a bit of fat from the meat, let the meat lie on one side till seared, then turn it, and continue turning it occasionally until done. If melted fat collects in the pan, pour it off. Season and serve like broiled meat. Turn chops on edge for a few moments to brown the fat.

Is pan-broiling the same as what is commonly called "frying"? Why not? What objection is there to "frying" meat and other albuminous foods? Are griddle cakes fried? (Methods of cooking, § 106.)

RECIPE FOR MAÎTRE D'HÔTEL BUTTER

Butter,	½ cupful.	Pepper,	a few grains.
Lemon-juice,	1 tablespoonful.	Parsley, cut fine,	1 tablespoonful.

Salt, ½ teaspoonful.

Cream the butter and stir in the other ingredients.

RECIPE FOR TOMATO SAUCE (FOR MEAT)

Tomato,	1 pint.	A sprig of parsley.	
Chopped onion,	1 teaspoonful.	Butter,	¼ cupful.
Whole cloves,	2.	Flour,	¼ cupful.
A bit of bay-leaf.		Salt,	1 teaspoonful.

Pepper, ⅛ teaspoonful.

Cook the first five ingredients together for about ten minutes. Mix the others in a saucepan and strain into them the tomato mixture. Cook, stirring, till the sauce boils.

273. Which is the largest, a short-steak, a porter-house, or a sirloin? Observe that each contains one-half of one of the bones of the spine (*vertebræ*, plural), and that between this bone and the kidney fat lies the tenderest part of the steak. These tender parts are sections of the **tenderloin**, a little-used muscle which extends along the spine from the rearmost rib to the hip joint, being thickest near the forward end of the hip-bone, where hip-bone sirloin steaks are cut.

Beef grows tougher and coarser the farther down it lies on the flank. Which of the three loin cuts of steak has most flank? Flank ends of steak should be trimmed off and used for soup or stew. Why not broil them? Compare sirloin or porter-house steak with a lamb or mutton loin chop, finding in both spinal vertebra, tenderloin, outside fat, kidney fat, and flank. Compare a rib chop with the cut of beef called prime roasting ribs. What advantage have loin over rib chops?

274. For **roasting**,[1] as for broiling, tender cuts are best. Sirloin and porter-house roasts are compactly rolled; rib pieces may be either roasted whole, forming a standing roast, or boned and rolled. Leaving in the bones improves the flavor, but the thin end of a standing roast is likely to be overdone by the time the thick end is sufficiently cooked.

Directions for roasting Beef

275. Time. — Ten or twelve minutes to the pound. The smaller the piece of meat the shorter the time per pound.

[1] To roast meat, properly speaking, is to cook it before an open grate, a method superseded in this country by "oven-roasting," which is really baking.

In properly roasted beef, the outside fat is brown and crisp, the lean brown to a depth of not more than one-fourth of an inch, the interior evenly red and full of juice.

Have the oven at first as hot as for bread.[1] Skewer or tie the meat into compact form, place on a rack in a pan, skin side down, and dredge meat and pan with flour. In the pan put one tablespoonful of salt and one-fourth teaspoonful of pepper. If the meat is very lean, put a few bits of fat in the pan. When the beef is seared and the flour brown, reduce the heat, and baste the meat; that is, dip over it the melted fat from the pan.[2] Baste about once in ten minutes until done. After half an hour turn the roast over to brown the skin side.

276. To make brown gravy. — After removing the roast to the plate, take out the rack and pour or skim off most of the fat from the liquid in the pan. Set the pan on the stove, and dredge into this liquid about three tablespoonfuls of flour. Add one and one-half cupfuls of boiling water, and boil five minutes, stirring. Taste to see how much salt and pepper are required, add these, and strain into a gravy boat. If not brown enough, add a few drops of "kitchen bouquet." (Browning of flour, § 126.)

[1] The smaller the roast the hotter should be the oven. It is well to sear a small roast by holding each part of its surface in turn on a hot frying-pan; if this is done, less heat is required in the oven.

[2] Reason for basting. — The fat and flour, aided by heat, form a crust, imprisoning the juices of the meat, and preventing the lean from charring.

277. Experiment to show the effect of cold and of hot water upon meat. — Into each of two test-tubes put two bits of meat of the same size. Cover one with cold water, the other with hot water, and boil the latter for two or three minutes. After letting both stand for ten or fifteen minutes, observe (*a*) differences in the appearance of the bits of meat, (*b*) in the appearance of the water in the two test-tubes. Which piece of meat has lost the most juice? Explain why.

Should the cooking water for meat be cold or hot when the meat is put into it? Why? How may we contrive to retain the juice and yet not overcook the meat? Is it strictly correct to call meat properly cooked in water "boiled" meat? Which is higher flavored, roasted or so-called boiled meat?

The great heat to which meat is exposed in broiling or roasting decomposes some of its constituents, producing new compounds of richer flavor. A temperature of 212° F. being too low to produce these chemical changes, the flavor of meat cooked in water is, by comparison, insipid.

Directions for "boiling" a Leg of Mutton

278. Time. — Fifteen minutes per pound.

Cover the leg of mutton with boiling water, let this come to the boiling-point again, and boil five minutes; skim off the coagulated albumin ("scum"); then simmer until the meat is tender. Serve with Caper Sauce, made by adding *one-half cupful of capers*, drained, to *one and one-half cupfuls of Drawn Butter* (recipe on p. 203) made with the mutton liquor.

279. Salt meats. — Corned beef, ham, and tongue, which are better for having some of their salt drawn out, should be put to cook in cold water. After this boils, follow the directions for cooking a leg of mutton.

The taste of water in which meat has been cooked shows that some of the substance of the meat has escaped into it; save it, therefore, to use in soup-making. Can we use the cooking water from salt meat for soup?

USES FOR THE GELATINOUS PARTS OF MEAT: SOUP-STOCK AND SOUPS

280. Soup an economical dish. — Soup, by some people mistakenly thought to be an expensive luxury, is generally a means of economy; since a soup, tempting and nutritious, can be made of the cheapest materials, including remnants of food unfit for other use. Economy means *management*, not *saving* merely, though sometimes wrongly understood in the latter sense. Good economy includes wise spending and using; it is as wasteful to broil meat too tough to be chewed or digested as it would be to throw away meat that might be used; it is as prudent to purchase a small quantity of vegetables and seasonings, which will help to make a savory soup or stew out of material useless by itself, as to refrain from buying something not needed.

Soup-making

281. Soup-stock. — Soup-stock is the basis of all meat soups. It consists of the soluble portions of meat, vegetables, and sometimes other ingredients dissolved in water.

Directions for making Soup-stock

Raw meat and bone,	about 2 pounds.
Cooked meat, or meat and bone,	about 1 pound.
Cold water (fresh, or from cooked meat or vegetables),	3 quarts.

To each pound of meat and bone allow of onion, carrot, turnip, cut into half-inch cubes, 1 heaping tablespoonful each.[1]

Celery, 1 stalk or 1 root.	Salt,	about ½ teaspoonful.
A bit of bay-leaf.	Peppercorns, 2,	
A sprig of parsley.		or
	Pepper,	a few grains.

Have the bones sawed into inch lengths and split; cut the meat into inch cubes or smaller. Why? If the raw meat only is used, brown one-third of it in a little of the fat in a frying-pan.[2] Let meat and bones soak in the water for one hour, then simmer in a covered kettle four or five hours, or until the meat is in fragments. About one hour before taking the stock from the fire, add to it the vegetables and seasonings. When the vegetables are very soft strain the stock through a coarse strainer and set it aside for twenty-four hours, or until the fat solidifies on its surface. Remove every speck of this fat, saving it to try out, and if the stock is to be used for clear soup, clear it according to the directions on p. 161.

Bone, commonly regarded as refuse, is called for in the Directions for making Soup-stock. If we compare

[1] Seasonings and flavorings may be varied or, in part, omitted.

[2] By this means the soup gains in flavor, though at the cost of some food value.

this stock with bouillon, or with any broth made from meat with little or no bone, we shall find that the first is jellied when cold, the second liquid. What is there in bones to make this difference?

A Study of Bone

282. **A.** Examine the ends of a shin-bone sawed in two. Where is the bone the hardest? Where is it spongy? Where soft? The soft substance is marrow. Try to bend or break the bone. Observe the tough fibrous covering on the ends of it.

B. Put one piece of the bone in diluted hydrochloric acid (six parts of water to one part of acid); after a few days compare it with the other piece. Has the acid changed the shape of the bone? Its size? How has it affected it? See if you can tie it in a knot. What makes bone hard? What, then, has the acid taken out of the bone?

C. Tie a wire around the other piece of bone, and lay it for half an hour in a hot coal-fire. Remove it by means of the wire. How has it been changed? Does it break easily? What part of the bone has been burned?

283. Structure and composition of bone. — Bone is the hardest of animal tissues, yet it is one-half water; the other half consists of about two-thirds mineral, and one-third animal matter, the mineral being largely **calcium phosphate**, commonly called phosphate of lime; the animal matter chiefly fat and collagen[1]. In the centre of hollow bone is a mass of fatty stuff, the **marrow**. Surrounding, and, in some cases, forming the end of the bone is the flexible, slippery substance called **cartilage**, or **gristle**; and, connecting bones at the joints,

[1] Often called *ossein* in bones.

are bands or ligaments of cartilage. Cartilage may be considered soft bone, since it differs from bone mainly in having less mineral matter. The bones of children and young animals are soft because cartilaginous; the older the individual grows, the harder the bones become. The two kinds of material in bone may be separated by soaking in acid, which dissolves the inorganic substance; or by burning, which destroys the organic.

284. How cooking affects bones. — By long cooking in water the insoluble collagen and other gelatinoids of connective tissue, tendon, cartilage, and bone are changed to **gelatin,** soluble in hot water.[1]

But will hot water best draw out the meat juice? How may we contrive to extract all possible food value from both meat and bone? And how may we also give to soup that rich flavor produced only by heating meat to above 212° F.? All these points must be considered if we mean to make the best possible soup out of our materials.

285. The soup-kettle or stock-pot. — Have for stock-making a deep kettle with a tight-fitting cover; the tighter the cover the smaller is the amount of water lost by evaporation. In an ordinary kettle, stock may, during cooking, lessen by one-half; in a soup-digester with a steam-tight, valved cover, evaporation is so slight that one pint of water instead of one quart may be allowed to one pound of meat and bone.

[1] The change from collagen to gelatin, like that from raw starch to starch-paste, is a process of hydration, *i.e.* of combination with water.

Fresh material may be added to that already in the stock-pot, provided that once a week the contents are removed and the pot cleaned. Fresh material must be combined with "left-overs" for a satisfactory stock, cooked meat alone yielding too little soluble material. Fresh herbs and, unless a varied stock of cooked vegetables is on hand, a few fresh vegetables are required for flavoring.

286. Materials for soup-stock. — Put raw-meat trimmings cut off by the butcher, flank ends of steak, etc., into one jar, bits of cooked meat and bone, except mutton fat, which is rank in flavor, into another, first rinsing in cold water pieces left on the plates at table. Keep also water in which meat has been cooked, and, *separately*, because it sours in about two days — quicker than meat-liquor spoils — the cooking water from rice and vegetables. Use sparingly that from strong-flavored vegetables, such as onion and turnip, and do not use cabbage or potato water at all.

Celery and asparagus water may be used either for soup-stocks or for cream-of-vegetable soups. (Chap. VIII, sect. 3.) Keep by themselves, and separate from one another, if possible, remnants of vegetables, rice, macaroni, etc.

287. How to choose soup meat. — What sort of meat shall we choose for soup-making, — tender or tough, with bone or without? What advantage has the meat from young creatures over that from old? Soup meat should include some fat, because the cake formed by it when cold, if kept unbroken, helps to preserve the stock.

Compare a cut from the loin of beef with one from the leg (shin). Compare a shin of beef with a knuckle of veal (the joint of a calf's hind leg). Which will yield the most juice? The most gelatin? The highest flavor? Which of these cuts would you expect to find the cheapest? Why?

Helpful Hints about making and using Soup-stock

1. Have all trimmings sent home by the butcher to be used in making stock.

2. On account of its strong, fatty flavor, avoid using much mutton in stock containing other meat.

3. For white stock use veal, or veal and chicken; for dark brown stock use beef, part of it browned; and brown all the vegetables. Caramel or Kitchen Bouquet is used to darken and flavor stock.

4. Stock made without vegetables keeps best in hot weather. When taking out a portion of such stock for soup, add for each pint of it one heaping tablespoonful of each vegetable included in the Directions for making Soup-stock, cook them in it one hour, and strain.

5. A little salt helps to preserve stock, but it must be used sparingly at first, the stock growing salter as it lessens by evaporation.

6. Do not try to extract the last bit of gelatin from bones; the result will be glue, not soup.

7. If you must use the stock the day it is made, skim

off what fat you can, and remove the rest as completely as possible with absorbent paper, or with a bit of ice wrapped in cloth. The fat hardens on the cloth and can be scraped off.

8. Cook vegetables, macaroni, and other materials to be served in soup in a small quantity of stock, and add this with them to the portion to be served. If, however, the stock is weak, so that it would be improved by boiling down, cook this material in the whole quantity to be sent to table.

9. Stock used instead of water in meat sauces, gravies, and stews makes them richer. By boiling meat in stock the stock itself is enriched.

In spite of care in keeping soup-stock below the boiling-point, some albumin coagulates, part settling, part rising as scum. Skimming off this scum lessens the food value of the soup, already small; soup, both skimmed and cleared, is a stimulant merely, still, for the sake of appearances, a perfectly clear soup is sometimes desired.

To clear soup-stock. — Put into a saucepan the stock to be cleared, and into it stir the whites and crushed shells of as many eggs as there are quarts of stock. Heat and stir until it has boiled for two minutes; then keep it hot, without letting it simmer, for twenty minutes, in order that the albumin, as it coagulates, may entangle every solid particle in the stock. Pour through a fine strainer held above double cheese-cloth laid over another strainer. The first strainer keeps the scum from clogging the cloth.

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Recipes for Meat Soups

The following soups may be made from either cleared or uncleared stock. Season them to taste before serving. For macaroni and vermicelli soups beef stock is preferable; for rice and barley soups, mutton or chicken stock.

Tomato soup. — Add to one pint of stock one-half can of tomatoes, stewed and strained, and one-half teaspoonful of sugar.

Mixed vegetable soup. — (*In winter.*) To one quart of stock add two heaping tablespoonfuls each of chopped onion fried, chopped celery, and turnip either chopped or cut with a vegetable cutter, one tablespoonful of carrot prepared like the turnip, and one cupful of cooked and strained tomato. (*In summer.*) Omit the tomato and onion, and add small green peas, and flowerets of cauliflower, asparagus tips, or all three.

Noodle soup. — To one quart of stock add one-fourth cupful of noodles.

Macaroni, vermicelli, rice, and **barley soups** take their names from the material served in them. Serve with these soups crusty bread (plain rolls, or inch thick slices from a French loaf), toasted crackers buttered, or croûtons. The dextrin in these, like the extractives of meat, stimulate digestion. (Directions for Preparing Croûtons on p. 249.)

288. Food value of soup and soup meat. — A strong broth contains only about five per cent of nutritious material. Soup as ordinarily made is weaker than this.

Yet soup has a strong meat flavor, while the meat left in the soup kettle is almost tasteless. This is because the extractives, which give meat its flavor, pass wholly into the stock. The extractives, although not nutritious, stimulate the secretion of gastric juice. The combined stimulating and warming effect of soup prepares the stomach for solid food.

Soup meat, if well seasoned, may be used in croquettes and rechauffés (§ 299). It is found to be better digested if flavored with meat extract, or if served after a meat soup.

What class of foodstuffs does gastric juice act upon? Which of these are found in meat? How does the gelatin in soup help to nourish the body?

GELATINE JELLIES

289. Gelatin extracted by steam under pressure, purified, and dried, is sold as **gelatine**[1] for making jellies and desserts. One ounce of gelatine will stiffen from three and one-half to four cupfuls of water in ordinary weather. In hot weather or on a wet day more is required; in cold weather, less. If fruit is to be molded in the jelly, use one and one-half ounces of gelatine.

290. General directions for using gelatine. — First soften the gelatine by soaking in cold water,[2] then dissolve it

[1] Pronounced like *gelatin*.

[2] Cooper's gelatine softens in ten minutes; Knox's requires at least fifteen; some kinds take longer, Follow the directions on box. Granulated gelatine is more easily measured than that in sheets or shredded. A two-ounce box of granulated gelatine holds five tablespoonfuls.

in boiling water, *but never boil it.* If stirred much while hot the gelatine may become stringy and refuse to jelly; for this reason, do not stir to help sugar dissolve, but keep the gelatine mixture hot by setting the bowl over hot water. Strain it through cheese-cloth or muslin doubled, into a mold, and set it away to cool, in summer on ice. It will jelly in from three to six hours. The larger the proportion of gelatine to liquid, the sooner it sets, but too much makes the jelly taste of gelatine, and also makes it tough. Use a mold of earthen or enamelled ware wet with cold water just before it is filled. See that it stands level while the jelly is cooling.

Recipes for Gelatine Jellies

Lemon Jelly

Gelatine, 1 ounce, or if granulated, 2½ tablespoonfuls.

Cold water,	½ cupful.	Sugar,	1 cupful.
Boiling water,	2½ cupfuls.	Lemon juice,	½ cupful.

Soak the gelatine in the cold water, add the boiling water, then the sugar, and stir till the latter is dissolved. Add the lemon juice, and strain through a cloth wrung out of hot water and laid over a wire strainer into a mold wet with cold water.

To vary the flavor, boil in the water *one inch of stick cinnamon*, and *the thinly shaved peel* (yellow only) *of one or two lemons*

For **Coffee Jelly** *use one cupful of strong boiled coffee,*[1]

[1] Made with two tablespoonfuls of coffee to one cupful of water.

and *two of boiling water.* Strain through a fine cloth, doubled.

Serve these jellies turned out in a glass dish, with cream, whipped or unwhipped; or make them a little less stiff, and serve lightly broken up, as "Sparkling Jelly."

291. The manufacture of gelatine. — Gelatine is obtained by extracting under pressure the gelatinous parts of cleaned bones, horns, hoofs, and hides of animals. The first product strained off is made into size and glue; the rest, purified by treatment with sulphuric acid, is the gelatine of commerce, which is used not only in jellies, but for medicine capsules, photograph films, and many other purposes. Gelatine is made also from fish-bones, and a very pure kind, called **isinglass,** from the air-bladder of the sturgeon.

292. Digestion of gelatin. — Gelatin is more readily digested than collagen. Like proteids, gelatinoids are changed to peptones by the gastric and pancreatic juices.

HOW TO COOK TOUGH MEAT: STEWING AND BRAISING

293. We have seen that tender meat is cooked chiefly to improve its color and flavor, not to make it more digestible; but tough meat requires first of all that its connective tissue be softened to enable the digestive juices to reach the albuminous matter within. What substance in plant foods corresponds to connective tissue in meat? How does this have to be cooked? By stewing, tough meat may be softened with the least possible sacrifice of juiciness and flavor.

Recipe for Lamb Stew

Breast of lamb,	1½ pounds.
Boiling water	about 1 pint.
Potatoes,	4, medium-sized, quartered and parboiled.[1]
Onion,	1, about 1½ inches in diameter, sliced.
Rice,	2 tablespoonfuls.
Tomato, strained,	1 cupful,
or	
Tomato ketchup,	1 tablespoonful.
	Salt and pepper.

Brown the onions in a little of the fat in a saucepan; put with them the meat cut roughly into cube-shaped pieces about one and one-half inches thick, and sprinkled with salt and pepper. Cover them with boiling water, heat this to the boiling-point again, then let it simmer directly over the heat for two hours; or cook it over hot water for three hours, or until the meat is tender. After one hour of simmering add the rice; half an hour before dishing the stew add the potatoes; when they are done remove the bones and pieces of fat, stir in the tomato or ketchup, add salt and pepper, if needed, and serve.

How does stewing differ from boiling? From soup-making? Why not leave the meat whole? Why not cut it as small as for soup?

[1] Boiled by themselves for five minutes. Why is this done?

294. What makes a stew good. — In a good stew the meat and vegetables are tender, the broth thick and savory. Onion, ketchup, minced parsley, tomato, Worcestershire sauce, or other vegetables and condiments may be used to give flavor. Lamb or mutton stew may be thickened with rice ; in beef stew flour is commonly used. Stew may be served in a platter within a border of boiled or steamed rice.

295. For a brown stew, the meat and sometimes the vegetables are browned in hot fat before being simmered. A brown stew without vegetables is a **fricassee** (French, *fricasser*, to fry).

Start a brown stew in cold water. Why?

Dumplings for Brown Beef Stew. — Sift together *two cupfuls of flour*, *two teaspoonfuls of baking-powder*, and *one teaspoonful of salt.* Stir in enough *milk* or *water* to make a stiff drop-batter. When the stew is cooked, set it where it will boil. Drop in the dumpling mixture by tablespoonfuls, cover closely, and boil the broth steadily *without lifting the cover*, for twelve minutes. Boiling the meat for a short time *after* it is tender will not harden it.

How do dumplings differ from biscuit? Why is no shortening used in biscuit?

296. Choosing stew meat. — Stew meat should be selected from a cheap cut, as higher-priced meat is better cooked in other ways ; it should contain bone enough to make the broth gelatinous and well-flavored, also fat, since lean that lies next to fat is less watery than an all-lean piece. What cuts of beef, of lamb or mutton, and of veal, possess these points?[1] (See table on pp. 180 to 187.) Part of the melted fat may be skimmed off before thickening the stew; the flour or rice will absorb the rest.

297. Braising is steaming meat in its own juices in the oven — a method suitable for solid pieces of meat not tender enough for roasting, but of better quality than those utilized in soups and stews. (For cuts of meat suitable for braising, see table.) The retention of steam under a cover, together with basting with the broth, keeps the meat moist enough to permit the juices to flow, while the oven heat is intense enough to develop a rich flavor in both meat and broth.

Recipe for Rolled Flank of Beef (Plate X)

One flank steak, or one pound of top-round steak one-half inch thick.

Suet, 2 or 3 small slices.	Carrot, cubed, ¼ cupful.
Onion, 1 small one, sliced.	Boiling water or stock, 1 cupful.

Stuffing made from: —

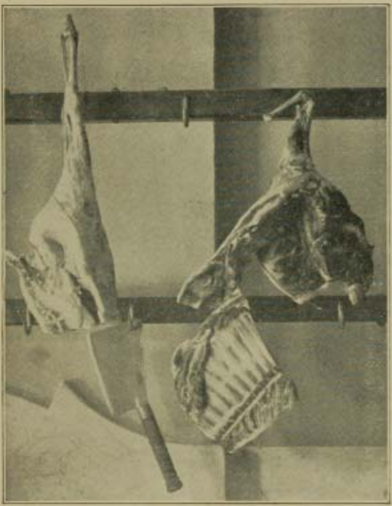
Soft bread crumbs, 1 cupful.	Celery cut fine, 2 tablespoonfuls.
Melted butter, 2 tablespoonfuls.	Salt, ½ teaspoonful.
Parsley cut fine, 2 tablespoonfuls.	Paprika, ⅛ teaspoonful.

Onion juice, ½ teaspoonful.

Trim the edges of the steak, spread over it the stuffing, roll and tie it, and lay it on the onion and carrot

[1] Top round of beef may be larded, browned, and stewed very slowly for four or five hours. Cooked in this way with vegetables it is called **Beef à la Mode**.

Top Sirloin ready for Roasting.



a, leg of mutton (hind); *b*, forequarter of mutton (rib portion separated from shoulder).

a *b*

Rolled Flank of Beef, larded, braised, and arranged on a Bed of Vegetables.

in a pan, with the suet on top. Pour the water or stock into the pan; cook closely covered for twenty minutes or more in a hot oven; then uncover, and cook thirty minutes longer. Serve with Brown Gravy made from the drippings in the pan.

The steak may be larded instead of covered with suet. Insert with a larding-needle two rows of salt-pork strips (*lardoons*) two inches long and one-fourth of an inch thick.

Helpful Hints about Braising and Stewing

298. 1. Remnants of cooked meat may be stewed, either by themselves, or with uncooked meat.

2. Only the best portions of stew meat should be browned; very coarse or gristly pieces may be simmered by themselves, and only the broth added to the stew.

3. To make sure that the stew shall not boil, cook it in a double boiler, allowing half again as much time as for cooking by direct heat. Stew meat that has boiled may look tender because its fibres, loosened by the softening of the connective tissue, fall apart; but the fibres themselves will be found hard to chew and digest.

4. In stewing, add water from time to time, enough to keep the meat covered. If the broth is too watery, boil it down before pouring it over the meat.

5. Braised meat may be cooked uncovered the latter part of the time.

WARMED-OVER DISHES (RECHAUFFÉS[1])

299. Delicious meat dishes may be prepared from remnants of cooked meat such as thriftless housekeepers throw away and unskilful ones warm over carelessly in a frying-pan.

Learn to combine acceptably whatever materials you have on hand, varying the regular recipes to suit the case. For example, you may substitute bread-crumbs or macaroni for potatoes, stewed tomatoes for gravy, rice for macaroni, and so on. Be sure to make the dish look attractive, and if possible find for it an appetizing name. Skill in using up left-overs provides many a dainty and saves many a dollar.

300. How to prepare meat to be used in rechauffés. — Remove all bone and gristle, and, when the meat is to be hashed, trim off the fat. Save the bones for soup-stock, the fat for trying out. Cut the meat in cubes or thin slices, or chop it fine. If tender and well-cooked, take care to *reheat* it only, not *recook* it; if tough or underdone, simmer it until tender, saving the cooking water to make a sauce. Season it rather highly, since meat after cooling is less savory than when fresh-cooked.

Recipes

Directions for making hash. — Mix and heat together equal parts of *chopped cooked meat* and *chopped boiled potatoes.* If dry, add for each pint of hash *one table-*

[1] French, *rechauffer*, to heat again.

spoonful of butter or *drippings*, and *two of hot water* or *stock*. Season with *salt* and *pepper*, adding *onion juice*, *parsley*, or *other seasoning*, if desired.

To brown hash, add two teaspoonfuls of milk; let the hash cook unstirred till brown on one side; fold like omelet.

Corned Beef Hash

Boiled corned beef (about one-fourth fat),	1 part.
Boiled potatoes,	2 parts.
Onion juice,	a few drops.
Pepper.	

Chop the meat moderately fine, push it to one side of the tray; chop the potatoes and mix them with the meat. Season and heat over hot water, or in a frying-pan over moderate heat.

Minced meat on toast. — Chop fine any cold, lean meat. Season, and warm in gravy or sauce sufficient to moisten it. Spread on slices of crisp toast dipped in salted water. (§ 163.)

Chartreuse of Rice and Meat

Rice,	1 cupful.	Hot water, stock or gravy
Cooked meat, minced,	2 cupfuls.	enough to enable the meat
Bread or cracker crumbs,	¼ cupful.	to be packed solidly.
Salt. Pepper.		

Other seasonings to taste; *e.g.* with *chicken*, *two teaspoonfuls of parsley*, fine cut, and *celery salt;* with *veal*, *two tablespoonfuls minced onion* fried in butter, and ten or twelve drops of *lemon juice;* with *mutton* or *lamb*, *fried onion* and *minced celery*, or *celery salt;* with *beef*, *fried onion*.

Boil the rice. (For directions, see p. 75.) Prepare and mix the other ingredients. Line a buttered mold with a one-half inch layer of boiled rice, well pressed down; pack in the meat mixture; cover it with rice; set the bowl in hot water, and steam for about forty-five minutes. Turn out of the mold and serve with Tomato Sauce (p. 151) around it.

Curry of Mutton

To each pint of finely chopped mutton use: —

Butter,	1 tablespoonful.	Salt,	½ teaspoonful.
Stock or water,	1 cupful.	Pepper,	a few grains.
Flour,	1 tablespoonful.	Curry powder,	1 teaspoonful.

Mix in a saucepan the butter, flour, and seasoning; add stock or water, and cook till thick. Mix in the meat; when hot turn out on a platter. Serve with a border of boiled rice. (For Directions, see p. 75.)

Section 2. Meat: Cuts, Marketing and Food Value

Here's to the housewife that's thrifty.
— Richard Brinsley Sheridan.

The secret of thrift is knowledge. Knowledge of domestic economy saves income; knowledge of sanitary laws saves health and life.
— Charles Kingsley.

301. Section 1 has made us familiar with a number of cuts of beef and mutton, and with ways of cooking them. In the market we find all these cuts and many more; in order to select wisely from them the housekeeper must study them until she not only knows one kind of meat from another, and poor meat from good, but can readily recognize any cut, trimmed or untrimmed, and knows the market value and food value of each.

302. How beef is cut up for sale.[1] — Let us see first in what shape the butcher receives his stock-in-trade. The beef-creature is sent to market split into halves called "sides of beef." These the butcher divides, first into forequarter and hindquarter, then into pieces (see Diagram I, p. 188), and these into cuts to suit customers. The weight of a side of beef as it hangs by the hind leg throws the shoulder-bone forward and the thigh-bone backward, reversing the angles which, in the living animal, they make with the back-bone, and altering the position of the muscles attached to them.

303. Description of the cuts of beef. — Upon severing the forequarter from hindquarter just back of the ribs, we recognize on the latter the small end of the loin. The first few steaks cut here are short in the flank and have little tenderloin; they are called **short, club,** or **Delmonico steaks. Porter-house** cuts lie between these and the junction of the hip-bone with the spine, and the **sirloin** between this joint and the thigh-bone. In the hollow of the loin lie the **kidneys,** surrounded by hard fat, the **suet.** A solid chunk of flesh below the sirloin is known, queerly enough, as **top sirloin**; the **round,** of

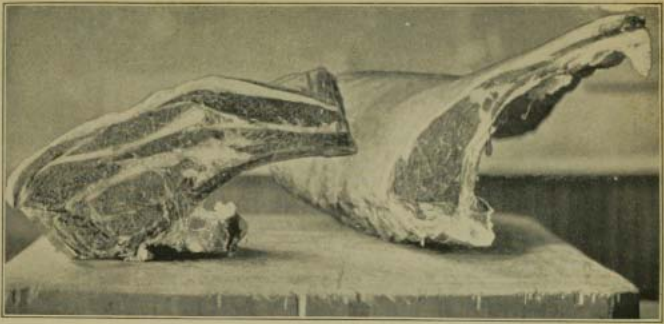
[1] Customs with regard to cutting up meat vary somewhat in different parts of the country. Diagrams and descriptions in this text-book follow New York City customs.

which top sirloin is really part, consists of the mass of flesh back of the hip-bone. A streak of gristle running down through this portion divides it into "top" and "bottom" round, properly *inside* and *outside* round, but called otherwise because the round is always laid on the block inner side up. (Plate IX.) The leg severed from the round at the lower end of the thigh-bone furnishes upper and lower **shin.** The **rump,** a wedge-shaped piece of coarse meat containing the lower vertebræ and the end of the hip-bone, comes out between the sirloin and round.

304. The most notable feature of the forequarter is the chest with its arch of ribs, the first six of which, counting forward from the loin, are, both from quality and from position, termed **prime ribs.** Over the seven **chuck ribs** lies the shoulder-blade, which appears at the seventh rib as a streak of yellow gristle, and grows bonier and thicker from there forward. Across the ribs lies the **cross-rib,** a boneless piece of flesh, corresponding to the top sirloin in the hindquarter. The diaphragm inside the ribs forms the thin, coarse strip called **skirt steak.** The **brisket,** adjacent to **chuck, neck,** and **fore leg,** includes the breast-bone and part of the four forward ribs.

The muscular wall covering and supporting the creature's belly is sold in sections (Diag. I) as **plate, navel,** and **flank.** The floating ribs end in the navel. The flank includes the **flank steak,** a thin strip of lean embedded in fat.

PLATE IX.



a *b*

a, chuck ; *b*, prime ribs.

a *b*

a, round of beef with slices of top round taken off. *b*, flat-bone sirloin steak, trimmed ; trimmings shown.

305. Cuts of mutton and lamb. — Mutton and lamb are usually quartered like beef. The **loin** is cut into **chops. Hip chops,** corresponding to sirloin steaks, are sold as loin chops, but are inferior, containing bone. The **neck** and **shoulder** sell cheap; the latter is cut for roasting with the fore leg, and if desired, with two or more ribs left on. "**Leg-of-mutton**" is the hind leg together with what corresponds to the round in beef. A sheep between two and three years old furnishes the best mutton. The age of mutton may be told by breaking the joint of the fore leg; the bones in a lamb are ridged, the less distinct these ridges, the older is the animal. By what signs would you know good beef? Good mutton?

306. Cuts of veal. — Of the forequarter cuts of veal, the **breast** and **shoulder** furnish stew meat or second-quality roasting pieces, and the ribs are sold together as **rack of veal,** or separately as **chops.** As in beef, the hindquarter cuts are choicer. Roasting pieces or steaks and chops are cut from both loin and leg, slices from the leg being called **cutlets.** These contain a section of the round leg-bone. Breast and leg, tough in the full-grown animal, are tender in the calf. Hard mutton-fat purified makes **tallow.**

307. How good veal looks. — The best veal, that of a calf about two months old, is pale pink or flesh-colored, with clear white fat. White lean veal is unfit to eat.

308. Cuts of pork; the appearance of good pork. — The ribs and loin of pork are sold for roasting, or as chops. **Hams** are the hind legs, salted and smoked; **bacon**, the flank similarly prepared. The thick layers of fat on the back and flank are commonly salted. The strips or "leaves" of kidney fat are "tried out," or rendered, and purified, to make **leaf-lard**; fat from other parts of the hog yield lard of poorer quality. Fat salt pork of good quality is white, or faintly tinged with pink, and has a thin rind. Fresh pork should be pale red and firm, with white fat. Trimmings of fat and lean chopped and packed in cleaned intestines form **sausages**.

309. Diseased pork. — Pork is more likely than any other kind of meat to be diseased. Diseased or measly pork looks lumpy or speckled. The specks are coiled-up worms (*trichinæ*), which make their way into the muscles of the hog, remaining there inactive until taken into the human body, where they produce *trichinosis*, a disease often fatal. Smoking does not kill *trichina*, but thorough cooking kills this as well as other disease-producing forms of life in food. To be safe, never buy speckled pork.

310. Internal organs used for food. — **The tongue, liver, kidneys, heart,** and some other organs of the ox and sheep are used for food. **Tripe,** the lining of a beef's stomach, is sold boiled. The **brains, pancreas,** and **thymus gland of calves** are considered dainties; the latter two are termed **sweet-breads**.

311. Economy in marketing; the cheapest meat not always the most economical. — Since less than one-fourth of the weight of a dressed beef consists of very tender meat, these tender portions are necessarily expensive. The less tender cuts, being more nutritious, are more economical; and, if properly cooked, are good eating, better, indeed, than higher-priced cuts badly cooked. The value of any cut depends not alone upon the quality of the edible portion, but also upon the proportion this bears to the refuse (bone, gristle, etc.). For example, prime ribs are even more expensive than they seem, because the purchaser pays for so much bone. Again, a cheap piece, containing much refuse, may be less economical than a higher-priced one, all of which is eatable. Veal is never economical. Being really immature beef, it is dry and poor, both in flavor and in food value, notwithstanding which it is expensive.

312. Meat must be kept to make it tender. — Recently-killed meat is tender, but soon stiffens, owing to the clotting of certain proteids (§ 259), softening so as to be fit to eat only after being "hung" for some time. Beef should be kept at least for three weeks, mutton longer.

313. The food value of meat. — Because we have teeth adapted to chewing both animal and vegetable food,[1] and digestive juices capable of dissolving both, we believe that a mixed diet is our natural one. In almost every part of the world flesh is eaten, in some places the flesh of animals we should not think of using for food. So much is taste a matter of custom that the idea of eating horseflesh is unpleasant to most people who have never tried it; yet horseflesh is perfectly

[1] Vegetable food means all food from plant sources.

wholesome, and in some parts of Europe is commonly sold for food.

Practically all the proteids in meat are assimilated,[1] but one-third or more of the proteids of vegetable food goes to waste in the body. This is accounted for by the closer likeness of animal food to the tissues of the human body. Beef and mutton are grain and grass made partly ready for us by the ox and the sheep, whose digestive organs are better fitted than ours to take care of a purely vegetable diet. Meat-eating nations surpass in vigor those that live mainly on fruit and grains.

American and English people, *however, are in more danger of eating too much meat than too little.* Meat three times a day is probably unnecessary for any one, and hurtful except to people actively working or exercising. Since only a certain amount can be made use of, no matter how much is swallowed, the system is overtaxed in getting rid of the surplus. Take care, therefore, that the meat bill is not out of proportion to other household expenses, and that the children are not made cross, and the men in the family dyspeptic, by too free use of this concentrated, stimulating food.

314. Red meat, *such as beef and mutton, is more stimulating than the white meat of veal and poultry.* Beef is the most nutritious of meats; mutton comes next, veal and lamb being less nutritious than the flesh of full-grown creatures. Corned meats lose in food value by the drawing

[1] Assimilation is the taking up of digested food into the tissues; assimilate means literally "to make like."

out of their juice into the brine; but dried or smoked meat, pound for pound, contains more nutriment than fresh meat.

315. Digestibility of meat. — Of the comparative digestibility of different kinds of meats little is known, except that some kinds digest much more rapidly than others. In general, short-fibred flesh, such as that of some kinds of game, the breast of chicken, and the tenderest beef and mutton, remain in the stomach for a shorter time than coarse-fibred meats. The muscular tissue of heart and kidneys, being peculiarly tough and close, is hard to digest. Pork is too fat to be easily digested.

316. Experiment to illustrate the gastric digestion of meat. — Put a few bits of raw lean meat into a test-tube, and cover them with water; add a little pepsin and a few drops of hydrochloric acid. (§ 161 and footnote.) At the end of one hour and a half, and at intervals afterward, examine the meat, noting its gradual solution.

Reading. — Fulton Market is described and pictured in the *American Kitchen Magazine* for January, 1896, Vol. IV, p. 149. *Home Economics* contains a good chapter on "Marketing," pp. 168–201.

Foods and Beverages gives pp. 91–114 to meats. "Feeding the World" (p. 277 of same book) is an account of the transportation of cattle, grain, etc. In the *Boston School-kitchen Text-book* the position of the different qualities of meat in the animal's body is well described, pp. 55–59. The *Chautauquan* for December, 1896 (Vol. XXIV, p. 332), contains a description of the "Markets of Some Great Cities."

A TABLE OF INFORMATION ABOUT CUTS OF MEAT

BEEF

Name and Location of Cut.	How Sold.	Character and Quality of Meat.	Prepared for Eating.
Loin. All between first rib and rear end of hip-bone.	In slices: *a*, one to two inches thick: Delmonico, porter-house, and sirloin steaks; *b*, thicker slices for roasting.	Lean, mostly tender; fat on edges; little bone. Sirloin steaks: 1, Hip-bone sirloin, next to the porter-house, with large tenderloin, is the best; 2, flat-bone sirloin second choice. Larger tenderloin, round-bone sirloin, poorest.	Best quality for roasting and broiling.
Rump. Back of loin.	Sold either whole or in halves. In latter case, aitch-bone is split in two.	Tough, with considerable bone.	Corned and boiled.

ROUND. 1. Top: inside of thigh.	Sliced, or cut thick. Best part of bottom round sometimes cut with top for dealer's advantage.	Solid piece of juicy, fairly tender, lean, bordered with fat. Good meat has thick piece of fat between top and bottom round.	Excellent for braizing, pot-roast, and beef à la mode, also for beef juice and beef tea; fairly good roasted or broiled.
2. Bottom: outside of thigh.	Cut thick.	Similar to top round, but tougher, has streaks of gristle.	Pot-roast, soup, mince-meat.
TOP SIRLOIN. Between sirloin and round.	In steaks, or for roasts.	Solid piece similar to top round.	Fairly good steak; excellent pot-roasted.
PRIME RIBS. First six ribs.	Sold in pieces containing upper parts of two or more ribs; may be boned and rolled; with ribs left in is called "standing roast."	Similar in quality to loin, but has more bone and no tenderloin.	Fine roasts.
BLADE. 7th, 8th, and 9th ribs.	Cut like prime ribs; blade removed.	Similar to prime ribs, but has more gristle and bone.	Fairly good roasting-piece.

A TABLE OF INFORMATION ABOUT CUTS OF MEAT.—CONTINUED

NAME AND LOCATION OF CUT.	HOW SOLD.	CHARACTER AND QUALITY OF MEAT.	PREPARED FOR EATING.
CHUCK. 10th, 11th, 12th, and 13th ribs.	In steaks, or boned and rolled.	Spinal processes long; tough.	Braizing, pot-roasting, or stew; steaks broiled.
NECK.	To suit purchaser.	Juicy and well flavored, but tough.	Excellent for stews and soup.
BRISKET. Between the fore-legs.	To suit purchaser.	Layer of juicy, well-flavored meat over fat and bone.	Corned and boiled.
CROSS-RIB. Lies across the ribs.	To suit purchaser.	Muscles all run one way; no waste.	Pot-roast or inferior steak.
PLATE. On the side, below ribs.	To suit purchaser.	Has layers of fat and lean, with thin bones (ends of ribs) at bottom.	Corned and boiled.

NAVEL. Middle part of belly.	To suit purchaser.	Similar to plate, but has less bone.	Usually corned and boiled.
FLANK, below the loin. 1. Thick flank. 2. Flank steak.	1. To suit purchaser. 2. Whole.	Coarse and tough; no bone, fine flavor.	1. Stewed or boiled. 2. Rolled and braized. (Should not be corned, because it has no fat or bone to protect its juices.)
FORE LEG OR SHIN.	Whole, or to suit purchaser.	Tough, with bone and tendon.	Soup.
HIND LEG OR SHIN.	To suit purchaser.	Fat, lean, and bone; juicy, but tough and full of tendons.	Soup.
SKIRT STEAK (diaphragm). Inside of plate and navel.	Sold whole.	Lean; juicy, but lacking in flavor.	Stew.

A TABLE OF INFORMATION ABOUT CUTS OF MEAT. — CONTINUED

VEAL

NAME AND LOCATION OF CUT.	HOW SOLD.	CHARACTER AND QUALITY OF MEAT.	PREPARED FOR EATING.
LOIN. Includes what in beef is loin and rump.	Sliced into chops, or sold in roasting-pieces.	Next in value to the leg.	Roasted ; chops fried.
LEG (hind).	Sliced into cutlets one-half inch thick, or into thicker slices for *fricandeau.*	Most valuable part of the calf; no waste.	Cutlets fried ; *fricandeau* roasted.
KNUCKLE. Lower part of hind leg.	Sold whole.	Gelatinous.	Soup and stew.
RACK. Ribs.	Chops.	Tender.	Fried.
SHOULDER. Includes fore leg and part of ribs.	Sold whole.	Tender and well flavored.	Stuffed, and roasted or braized.

NECK. May include last four ribs.	To suit purchaser.	Gristly.	Usually stewed.
BREAST. Includes what is brisket, plate, and navel in beef.	Whole, or to suit purchaser.	Bony, mixed with fat.	Roasted.
MUTTON AND LAMB			
LOIN. Same as in beef. (Loin chops correspond to porter-house steak, hip chops to sirloin.)	Into chops three-fourths to one inch thick; also, two whole loins sold in one piece as "saddle of mutton."	Contains tenderloin; has less bone than rib chops, therefore more economical.	Chops broiled; saddle roasted.
LEG. Includes rump.	Whole, as in chops.	Fine, solid meat, fatter in mutton than in lamb.	Roasted or boiled whole; chops broiled.

A TABLE OF INFORMATION ABOUT CUTS OF MEAT. — CONCLUDED

NAME AND LOCATION OF CUT.	HOW SOLD.	CHARACTER AND QUALITY OF MEAT.	PREPARED FOR EATING.
RIBS.	Single, as chops. If bone is trimmed, they are called "French chops"; also, rib portion of both forequarters in one piece as "rack of mutton."	Tender.	Broiled. Rack roasted.
SHOULDER. Includes fore leg, and sometimes two or more ribs.	Whole; usually boned. *Note.* — Neck and shoulder are sold together as "chuck."	Considerable refuse.	Stuffed and roasted.
BREAST.	To suit purchaser.	Lean and bone, with a little fat.	Stew or broth.
PORK			
LOIN. Ribs and loin.	Chops and roasting pieces.	Tender, and fairly lean.	Broiled or roasted.

SPARE-RIBS. Ribs freed from fat.	Sold whole or in chops.	Nearly all bone.	Usually roasted or sautéd.
HAM. Hind leg, and parts corresponding to rump and round in beef.	Whole, in halves, or sliced (after being smoked).	Solid, lean, with layer of fat half an inch thick or more, on one side.	Usually cured, salted, and smoked, then boiled, or sliced and fried; sometimes roasted fresh.
BACK. Close to backbone.	Cut into strips.	All fat.	Used for frying, flavoring, larding, etc.
SHOULDER. Includes fore leg.	Cured whole, or sold fresh to suit purchaser.	Similar to ham, but not so good.	Cured, salted, and smoked; cooked like ham. Sometimes roasted fresh.
BACON. Belly.	In rectangular pieces, with the skin (*rind*) left on; sliced thin for purchasers.	Fat, with streaks of lean.	Cured, salted, and smoked; broiled or fried.

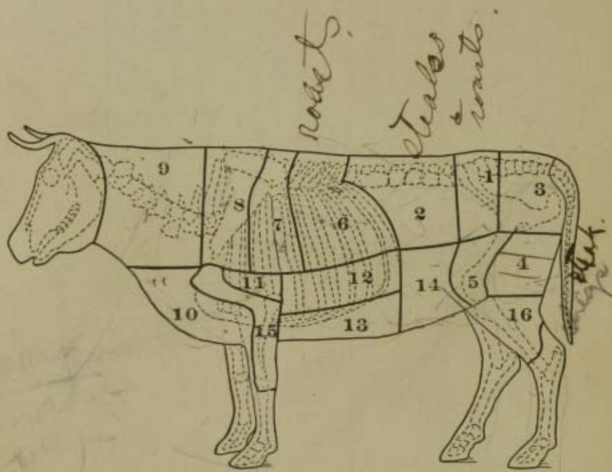


DIAGRAM SHOWING CUTS OF BEEF.

1 and 2 = loin (1 = sirloin).
3 = rump.
4 = round.
5 = top sirloin.
6 = prime ribs.
7 = blade.
8 = chuck.
9 = neck.
10 = brisket.
11 = cross-rib.
12 = plate.
13 = navel.
14 = flank.
15 = shoulder.
16 = leg (shin)

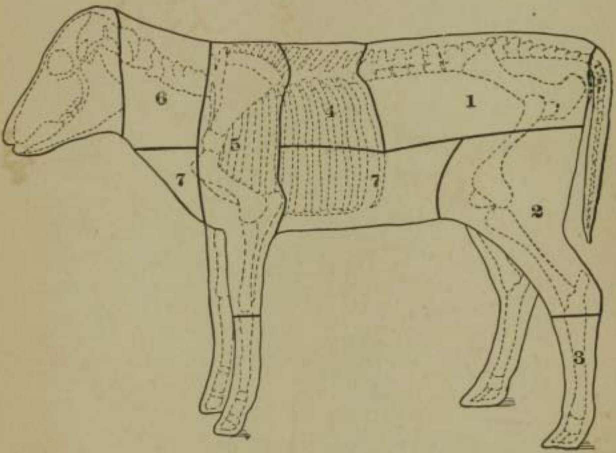


DIAGRAM SHOWING CUTS OF VEAL.

1 = loin.
2 = leg (cutlets, etc.).
3 = knuckle.
4 = rack.
5 = shoulder.
6 = neck.
7, 7 = breast.

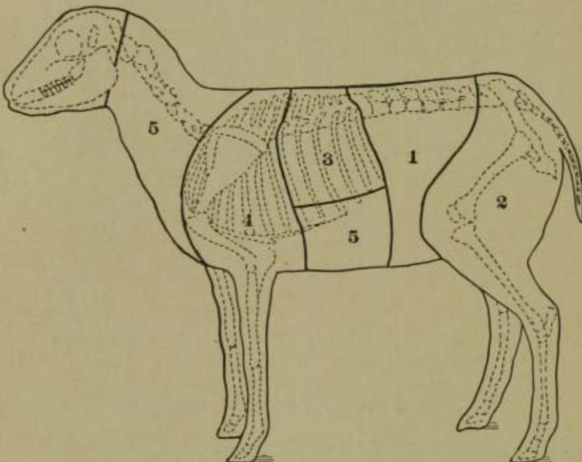


DIAGRAM SHOWING CUTS OF LAMB AND MUTTON.

1 = loin.
2 = leg.
3 = rib-portion.
4 = shoulder.
5, 5 = breast.

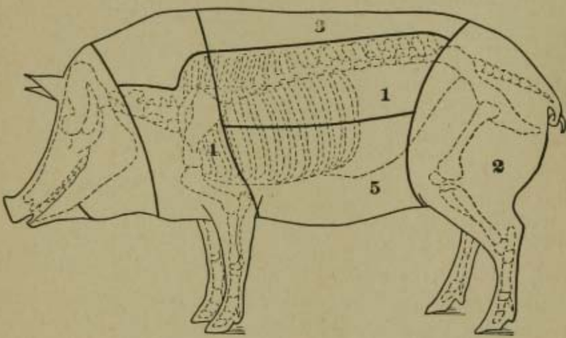


DIAGRAM SHOWING CUTS OF PORK.

1 = loin.
2 = ham.
3 = back.
4 = shoulder.
5 = belly.

Section 3. Poultry and Game

317. Of the birds we use for food, fowls and chickens, turkeys, and tame ducks and geese are classed together as **poultry**; quail, partridges, grouse, wild ducks and geese, and other wild fowl being called **game.**

318. Food value and digestibility of poultry and game. — The flesh of ducks and geese, like pork, is so fat that it is not easily digested. Of what use is fat in the bodies of waterfowl? Game is too expensive to be eaten as commonly as meat, fish, or poultry. Being, except in the case of wild ducks and geese, more readily digestible than other flesh foods, it is especially suitable for the sick.

The light meat from the breasts of poultry is tender, but poorer in flavor, than the less delicate meat from the leg and hip-joint, or "second joint," a difference corresponding to that between the loin of beef and the shin and round. The delicacy of the breast-meat is owing partly to the shortness of its muscle-fibres, and the comparative toughness of the "drumsticks" to strong tendons running through them. Why is the meat on the wings of domestic fowls so much more tender than that on the legs? Wild fowl have dark, rich meat on breast and wings. Can you explain why?

319. Selecting poultry. — In market terms, chicken not more than five months old is "spring chicken"; chicken over a year old, fowl. Full-grown poultry is finer in flavor than young chickens.

Would you choose fowl or spring chicken for broiling? For fricasseeing? What effect would stewing have on the flesh of a young bird? On the tendons of an old one? These tendons should be removed if the fowl is to be roasted, but not if it is to be boiled or fricasseed. What is the reason?

In a chicken or young fowl the scales on the legs are yellow and soft, and the breast-bone yielding. How do the bones of young animals differ in composition from those of older ones? Older fowls have horny scales, a hard breast-bone, thicker and yellower skin, and more fat. Pin-feathers, usually an indication of youth, give place to hairs as the bird grows older. A young cock is best for roasting.

A young turkey is known by the same points as a young fowl. Good turkeys have, besides, plump breasts, black legs, and white flesh. A young cock turkey (gobbler) has small spurs. As a rule, hen turkeys are best; old gobblers are never good.

In a young duck or goose the windpipe is brittle enough to snap readily between the thumb and finger, and the feet are soft and yellow. Neither ducks nor geese are good if more than one year old.

320. How to prepare a fowl for fricassee. — 1. *Cutting off the Meat.* — Do not draw the fowl, but with a small, sharp-pointed knife cut the meat from the skeleton. (*a*) Cut the skin between the legs and body; bend the legs back far enough to snap the hip-joints; then cut through the flesh to these joints, taking off the "second joint" and "drumstick" from each side in one piece. (Separate these after washing them.) (*b*) Break the wing-joints, and cut off the wings. (*c*) Starting with the knife at a right angle to the upper part of the breast-bone, cut back as far as the wing-joint, keeping the knife close to the bone. This cuts out the wish-bone with a large piece of flesh. (*d*) Remove the meat on each side of the breast-bone. (*e*) Cut the neck off short. (*f*) Find on either side of the tail a pointed bone, the "side-bone." Make cuts between these bones and the tail, separating them from the back-bone, and with them two strips of flesh, — the most delicious meat on the fowl. (*g*) Cut off the tail-piece.

2. *Removing Organs.* — Holding the breast-bone firmly with one hand and the back-bone with the other, tear them apart, and take out the entrails. Remove the oil-bag.

3. *Washing.* — Wash the pieces of chicken and the stripped skeleton quickly in cold water.

Recipe for Chicken Fricassee

One fowl.	
Boiling water or white stock, 1 quart.	
One small onion.	
Salt,	2 teaspoonfuls.
Parsley cut fine,	2 teaspoonfuls.
A few sprigs of parsley for garnishing.	

Cut the chicken into thirteen pieces as directed above.

Brown the onion in a little tried-out chicken fat or drippings, and put it with the chicken meat and bones. Add stock or water, and let it simmer about an hour, or till nearly evaporated. Take out the bone, pour off the liquid, and let the meat and sediment brown delicately, stirring and turning the pieces. Then pour back the liquid, with enough water or stock in addition to make two or three cupfuls in all. Add the salt. After simmering for another hour the chicken should be tender. Arrange the pieces on a hot platter, neck and tail in the centre, breast-pieces and wish-bone on top of these, second joints at one end of the dish, legs crossed at the other, and wings and side-pieces on either side. Thicken the gravy with flour wet with cold water, and pour over the chicken; sprinkle and garnish with parsley. The fricassee may be served in a border of rice.

321. Chicken Stew, sometimes called "**White Fricassee of Chicken,**" is prepared like chicken fricassee, except that the chicken is not browned. After removing the chicken, *reduce the liquid to one and one-half cupfuls, add one cupful of milk*, and thicken *with four tablespoonfuls of flour.* Stewed chicken, lacking the flavor of browned meat, is better served on slices of toast than with the comparatively tasteless rice.

Section 4. A Lesson in Digestion, illustrated by the Digestive Organs of a Fowl

We live not upon what we eat, but upon what we digest. — MEINERT.

322. The alimentary canal of a fowl. — When we chop off the head of a fowl we find we have cut through two tubes, one collapsed, the other kept circular by rings of cartilage. The first is the windpipe, the second the "food-pipe," called the esophagus. The latter is part of a long passageway through the body, called the **alimentary canal** (from *aliment*, meaning food). To trace the path of this canal, lay the organs drawn from a fowl, as nearly as you can, in the position they occupied in its body, the lungs folded around the heart; the gizzard in the arched space under the lungs, with the crop close beside the tube leading into the latter; the liver, with gall-bladder attached, at the left of the gizzard,[1] and folded partly around it; the pancreas, a slender, yellow body, in the first loop of the intestine, behind and a little below the gizzard. In the fowl the intestines lie in closely packed coils, making a continuous winding passage from gizzard to vent. See from what a marvellous membrane they are suspended, filmy as gauze, yet strong enough to support them. This is the peritoneum. In life another membrane, the **diaphragm**, is stretched between the lungs

[1] *I.e.* on the right-hand side of the fowl's body, as it is in life.

and the organs beneath them, but, when torn, as it is in drawing the fowl, it contracts to a mere strip, almost impossible to find.

323. Comparison of the alimentary canal of a fowl with that of a human being; why fowls have crops. — If we compare the alimentary canal of a fowl with a diagram of that of a man, we shall find in the latter nothing corresponding to a crop. Why the fowl needs this organ is plain if we examine its mouth and the sac taken from its gizzard. There are no teeth in the former, but in the latter will be found a number of pebbles. These take the place of teeth; but as food swallowed whole goes down much faster than the gizzard can grind it up, the crop receives it, and lets only so much pass at a time as the gizzard has room for. In other respects, however, our own digestive organs are similar to the fowl's. Let us trace the course of a mouthful of food undergoing digestion, recalling what we have already learned about the chemical changes taking place in the process (§§ 129, 161, 178, 237, 238, and 292), and using the organs of the fowl to make each step clear.

324. Food in the mouth and esophagus. — In the mouth food is **masticated** (chewed), and mixed with saliva supplied by three pairs of glands. After being swallowed it is squeezed downward by the contractions of rings of muscle around the esophagus, till it drops into the pouchlike expansion of the alimentary canal called the stomach.

325. Food in the stomach. — The wall of the stomach is of muscular tissue, enclosed in a thin membrane, and lined with another membrane, velvety and moist, that lies, when the stomach is contracted, in soft folds. When it is distended with food, this lining is stretched smooth. Glands in this lining pour out **gastric juice**, composed of **hydrochloric acid** and **pepsin.** Pepsin converts proteids into more soluble substances. It cannot do this, except when working in an acid mixture. Hence the importance of the hydrochloric acid.

A churning motion, kept up by the muscular wall of the stomach, mixes food and gastric juice together. As fast as the stomach contents are reduced to a grayish pulp, called **chyme**, the muscles which close the outlet of the stomach relax, letting the chyme pass into the small intestine. This outlet is called the **pylorus**, which means *gate*.

326. Food in the small intestine. — Two ducts enter the intestine just below the pylorus. Through one flows **bile** which has been secreted by the liver and stored in the gall-bladder till needed; through the other, pancreatic juice from the pancreas. Bile plays no part in digestion. (For function of bile see § 348.) Pancreatic juice contains three ferments (p. 128): *amylopsin*, which acts like ptyalin, changing starch to sugar; *trypsin*, which carries further the digestion of proteids, begun by pepsin; and *steapsin*, which splits fats into simpler compounds.[1] The small intestine itself yields several digestive ferments.

A very powerful one, **erepsin**, changes to still more soluble substances the albumens and similar compounds formed from proteids by the action of pepsin.

Another intestinal ferment, **enterokinase**, acts, not upon the food, but upon the pancreatic ferments, starting them into activity.

Three others complete the digestion of sugars, trans-

[1] For more about the digestion of fat, see p. 215.

forming them to grape-sugar (glucose) in which form they are absorbed.

The products of digestion, when ready for absorption, have become a creamy fluid, termed **chyle**.

327. Absorption of food from the alimentary canal. — The process of absorption is wonderfully interesting, but as the cooking of food has no direct connection with its absorption, that topic lies outside the scope of this text-book. Cooking prepares food for digestion; digestion prepares it for absorption. Some food is absorbed into the blood through the walls of the stomach, but more from the small intestine. It is supposed that the molecules of which foodstuffs are composed, particles far too small to be discerned by the microscope, are, by the digestive ferments, actually split into smaller molecules, so that they may pass through the lining membrane of the alimentary canal. It is to give ample surface for absorption that the small intestine is so long — twenty-six feet — and that its inner surface is thrown into folds and covered with tiny threadlike projections called *villi* (singular *villus*) that suck from the river of chyle all that is nutritious, and send it on into the blood stream, leaving waste matter to pass into the large intestine, and be expelled from the body.

We may think of the alimentary canal as a watercourse, at first straight, then widening into a lake or basin, then narrowing to a winding stream and receiving tributaries, and, at last, having its current diverted into innumerable channels to irrigate the land through which it flows.

SUMMARY OF PROCESS OF DIGESTION (THE LIQUEFYING OF FOOD)

Part of Alimentary Canal.	Mechanical Action.	Organs taking Part in Mechanical Action.	Digestive Fluid.	Secreting Organs.	Active Principles.	Foodstuffs acted upon.	Result of Mechanical Action.	Result of Action of Digestive Fluid.
Mouth.	Chewing, or mastication.	Teeth, tongue, muscles of face.	Saliva.	Salivary glands: 1. Parotid; 2. Sub-maxillary. 3. Sub-lingual.	Ptyalin.	Starch.	Food divided, and moistened with saliva.	Dextrin formed, then maltose.
Esophagus.	Swallowing (deglutition).	Muscular wall of esophagus.					Food carried to stomach.	
Stomach.	Churning motion.	Muscular wall of stomach.	Gastric juice.	Gastric glands.	Pepsin, Rennin. (Hydrochloric acid.)	Proteids.	Food mixed with gastric juice.	Albumoses formed; milk curdled. (Food made acid.) Food leaves stomach as chyme.
					Lipase.	Fats.		
Small intestine.	Peristaltic (wave) motion.	Muscular coat of intestine.	Pancreatic juice.	Pancreas.	Steapsin.	Fats.	Food carried on through intestine.	Fats split into fatty acids. Sugar formed. Albumoses and simpler compounds formed. Inactive pancreatic juice made active.
					Amylopsin.	Starch.		
					Trypsin.	Proteids and products of proteid digestion.		
			Intestinal juice.	Intestinal glands.	Erepsin.	Products of proteid digestion.		
					Maltose. Invertase. Lactase.	Maltose. Corn-sugar. Milk-sugar.		
					Enterokinase.			

Section 5. Fish and Shell-fish

Fruit of the wave! O dainty and delicious! — W. A. Croffut.

328. In fish we have a food similar in general character to meat, yet different from it in some ways. These points of unlikeness in the flesh of the two classes of animals correspond to differences in the natures of the animals themselves.

Fish proper are distinguished from shell-fish by being **vertebrate.**

A Study of the Structure of a Fish

A. How does a fish breathe? Find the gills, — red fringes back of the head. As the water taken into the fish's mouth passes out through the gills, the air dissolved in it gives oxygen to the blood. **B.** What covering has the fish? Are the scales attached at their rear or their front ends? Is there a reason for this? Over the scales lies a thin skin, often containing coloring matter. Mackerel, butterfish, and a few others have no scales. **C.** An air bladder under the spine keeps the fish afloat.

329. How to know a fresh fish. — Fish may be tested for proteid, as meat is. In a fresh fish the gills are a bright red, the flesh along the back-bone firm and elastic, the eyes bulging and bright.

330. How to clean fish. — Wash the fish inside and out with a cloth wet in cold salt water, and dry with a clean towel kept for this purpose. If the fish is to be broiled or fried, cut off head and tail and split it down the back; if to be boiled, cut off the head only; if to be baked, leave whole.

331. Fish suitable for baking whole. — Cod, haddock, cusk, bluefish, small salmon, bass, shad, whitefish.

Recipe for Stuffing for Baked Fish

Stale bread crumbs,	1 cupful.	Pepper,	a few grains.
Melted butter,	1 tablespoonful.	Onion juice,	a few drops.
Salt,	½ teaspoonful.	Parsley cut fine,	1 tablespoonful.

Mix the ingredients in the order given. This recipe makes stuffing for a four-pound fish.

Directions for baking a Fish Whole

Time. — Forty-five to sixty minutes.

Fill the cavity with stuffing, allowing it room to swell slightly. Sew the slit over and over with strong thread, taking stitches deep enough not to tear out. If the fish is a dry one (§ 345), cut gashes crosswise, and put in them strips of fat salt pork about one inch long, or insert the strips with a larding-needle.

Skewer and tie the fish into the shape of the letter S, and set it upright, surrounded by bits of salt fat pork, on a greased fish sheet on a baking-pan. Bake until brown, basting often. Serve with Drawn Butter or Hollandaise Sauce.

If you have no fish sheet, lay two strips of cloth across the pan, and lift the fish, when done, by these.

332. Fish suitable for broiling. *Split.* — Mackerel, young cod, bluefish, whitefish, shad, trout, etc. *Sliced.* — Chicken halibut and salmon. *Whole.* — Smelts, perch, and other small fish.

Directions for broiling Fish

Time. — For small fish, five to ten minutes; for large fish, fifteen to twenty minutes. Use a close-barred double wire broiler. Grease it when hot with salt-pork rind. See that the fish is wiped dry; sprinkle it with salt and pepper, and, if not oily, rub it with melted butter.

Broil split fish flesh side to the heat until browned; then broil the other side till the skin is crisp. Broil small fish close to the heat, turning occasionally. Turn slices of fish often.

When cooked, carefully loosen both sides of the fish from the broiler, and slip off on to a hot platter. Spread with butter, salt, and pepper, with Maître d'Hôtel Butter (for recipe, see p. 151), or with Tartar Sauce, and garnish with parsley and slices of lemon.

333. Fish suitable for boiling. — Thick piece of salmon or halibut, shoulder of cod, whole small cod, haddock, bluefish, etc.

Directions for boiling Fish

Time. —Varies with fish. Thirty to forty-five minutes.

To the water in which the fish is to be boiled add the juice of half a lemon, or one-fourth of a cupful of vinegar. Place the fish on a fish-rack or a plate, or coil it in a wire basket. If on a plate, tie fish and plate in a piece of clean cheese-cloth. Any fish not boiled whole keeps whiter if wrapped in cloth. When the water boils, lower the fish into it, and let it simmer until the flesh separates from the bones. When nearly done, put in one tablespoonful of salt. Garnish with parsley and slices of lemon, and serve on a platter, with Drawn Butter, Egg Sauce, or Tartar Sauce either poured over it or in a sauce-boat.

Recipes for Fish Sauces

Drawn Butter

Butter,	⅓ cupful.	Water,	1½ cupfuls.
Flour,	3 tablespoonfuls.	Salt,	½ teaspoonful.
Pepper,	a few grains.		

Mix flour, salt, and pepper with one-half the butter, pour on the water, and stir over the fire until the sauce boils. Add the rest of the butter in bits, stirring until it is absorbed.

For Egg Sauce, add to Drawn Butter two hard-cooked eggs chopped.

Tartar Sauce

Lemon juice,	1 teaspoonful.	Worcestershire sauce,	1 tablespoonful.
Salt,	¼ teaspoonful.	Vinegar,	1 tablespoonful.

Heat together in a bowl over hot water the vinegar, lemon juice, salt, and Worcestershire. Brown the butter in a frying-pan, and strain it into the mixture.

334. Ways of reheating fish. — 1. *Creamed fish.* Remove the skin and bone; pick the fish into flakes with a fork, and heat it in Drawn Butter or White Sauce. 2. *Scalloped fish.* Mix flaked fish with White Sauce and minced parsley, and bake it, covered with buttered crumbs, in a baking-dish, or in clam shells. 3. *Fish hash.* Mix flaked fish with mashed or finely chopped potato, and heat it as you would meat hash. The stuff ing may be used with the fish in any of these dishes.

Why fish needs special care in cooking. — The muscles of fish have large fibres and little connective tissue. It is this that makes fish break so easily.

Except for fish so rich and oily that some loss of flavor and nutriment can be afforded, boiling is a wasteful way of cooking cut fish. Vinegar or lemon juice in the water hardens the fish, thus helping to keep it whole, and saves some of the albumin, by helping to coagulate it; but any fish is better steamed than boiled.

What other precautions do we take to keep fish from cooking to pieces, or from falling apart after being cooked? What effect has cooking on connective tissue? (See Directions for Broiling, Baking, and Boiling Fish.)

335. Food value and digestibility of fish: why good for brain-workers. — In food value and digestibility, fish is much like lean meat. As it is less stimulating, it is especially suited to the needs of brain-workers, who take little exercise.[1] It is more desirable as a means of varying the diet than as a staple food; still, it is the proteid food in many coast towns where sea-food is cheap and meat hard to obtain.

Fish is hurt more than meat by keeping, so that it

[1] There is no truth in the popular notion that fish supplies the brain with phosphorus. As a matter of fact, many kinds of meat contain more phosphorus than fish does.

is nowhere so delicious as near where it is caught. Fish kept too long is watery when cooked.

Fish containing little fat, and that mostly in the liver, are termed "dry"; their flesh is usually white. In most dark-fleshed fish, fat is more abundant, and found throughout the body.

Among fish containing from 6 to 12 per cent of fat, are salmon, shad, Spanish mackerel, and butterfish; whitefish, common mackerel, and halibut have, as a rule, between 2 and 6 per cent; weakfish, black bass, bluefish,[1] cod, and haddock less than 2 per cent.

[1] Bluefish is an exception to the general rule that dark-fleshed fish are oily.

TABLE OF INFORMATION ABOUT FISH

SALT-WATER FISH

Kind.	Appearance.	Length.	Weight.	How Sold.	How Prepared for Eating.
Cod.	Color light green, with narrow white stripe down the side; spotted with darker color. Pointed barbel underneath the mouth.	2 to 6 feet.	2 to 100 pounds.	Small ones whole; large ones by the pound.	Boiled, baked, fried. (Salted.)
Haddock.	Silvery color; similar in shape to cod; one black spot on either side near the head.	2 to 3 feet.	About 5 pounds.	Like cod.	Same as cod. (Smoked.)
Mackerel.	Silvery belly, with blue back; body slender.	About 12 inches.	Average 1¼ pounds.	Whole.	Broiled. (Salted.)
Bluefish.	Back blue, belly light, head larger and back broader than in mackerel.	About 2 feet.	Average 4 pounds.	Whole.	Baked, broiled, fried, boiled.
Striped Bass.	White belly; long parallel black lines on back; checkered between the lines.	Average 2 feet.	About 5 pounds.	Whole.	Broiled, baked, fried.
Halibut.	Flat fish with white belly and brown back. Eyes both on same side of head.	3 to 6 ft.	About 125 pounds.	By the pound.	Boiled, fried. (Smoked.)

Weakfish.	White belly; checkered blue and gray back. Yellow breast-fins.	About 2 feet.	Average 4 pounds.	By the pound.	Broiled, baked.
Smelts.	Back silvery.	6 inches.	1 to 2 ounces.	By the pound.	Fried.
FRESH-WATER FISH					
Whitefish.	White except a narrow stripe along back.	About 2 feet.	About 3 pounds.	By the pound.	Boiled, baked.
Perch.	Silvery, with dark line along the back; yellow fins.	Average 9 inches.	About ¾ pound.	Whole.	Broiled, fried.
Black Bass.	Body broad for its length; back green.	About 18 inches.	About 1¼ pounds.	Whole.	Broiled, baked, fried.
FISH FOUND IN BOTH FRESH AND SALT WATER					
Salmon.	Silvery, dark line along back, spots near head. Flesh pink.	2 to 3 feet.	Average 9 to 10 pounds.	By the pound.	Boiled. (Smoked.)
Shad.	Back dark; scales large and silvery.	About 2 feet.	About 5 pounds.	Whole.	Broiled, baked, planked.

A Study of the Structure of an Oyster

336. Examine an oyster from which the flat shell has been removed. Has it any bones? How is its body protected? Observe the thin membrane (*mantle*) covering the oyster; its fringed edges form the gills. Find on either shell a blue spot showing where the muscle is attached that opens and closes the shell; also the dark spot on the oyster where the liver is.

337. How the oyster lives. — Oysters, clams, mussels, and scallops are salt-water shell-fish belonging to the family of *mollusks*, or soft-bodied animals. Their shells, built up of mineral matter secreted by the mantle, form a sort of outside skeleton. The young oyster floats about, but as its shell grows thicker and heavier, it settles down on the sand or rocks, the half shell, or *valve*, on which it lies becoming rounder and deeper than the one that covers it. The oyster has neither head nor limbs, but has a mouth near the hinge-end of its shell, and two strong muscles, one to open the shell to take in food and water, the other to close it, if a starfish or other enemy comes by. Oysters grow crowded together, forming *oyster-beds*.

Oysters spawn in summer, one individual laying millions of eggs in a season. During this period they are not good food. Like fish, oysters are cultivated, baby-oysters, called "seed-oysters," being planted all along the Atlantic coast.

338. Experiment. — Boil a little oyster liquor. What forms on top? What foodstuff do oysters evidently contain? At what temperature, and for about what length of time, would you cook them?

339. Preparation of oysters. — Oysters are commonly opened by the fish-dealer. **To clean oysters,** drain off the liquor, straining it through a wire strainer if it is to be used. Rinse the oysters on a colander, *using only half a cupful of cold water to one quart of oysters*, to avoid washing away the flavor. With the fingers examine the gills to see that no bits of shell are left clinging to them.

How to serve raw oysters. — Raw oysters are served with lemon juice and red or black pepper as a first course at dinner or luncheon, or for an invalid. Arrange six oysters "on the half shell," on crushed ice on each plate, small ends toward the centre. Place a quarter of a lemon in the middle of the circle.

340. Oysters as food: easily digestible, but not cheap. — Oysters have about the same composition as milk, containing carbohydrate matter[1] which most flesh foods lack. Since they commonly cost at least five times as much as milk, they are clearly not an economical food; but for their flavor and ease of digestibility they are highly prized. Large oysters are, generally speaking, more nutritious than small ones. Oysters are commonly made plump and white by being put into fresh or brackish (half-salt) water for about two days before they are taken to market. During this "fattening" process they gain weight by taking in water, but lose some of the mineral matter that gives them their salty flavor, and probably a small quantity of other foodstuffs.

[1] *Glycogen* (animal starch) in the liver.

Recipes

Oyster Stew

Stewing oysters,	1 pint.	Butter,	2 tablespoonfuls.
Hot milk,	1 cupful.	Salt.	
Pepper, a few grains.			

Drain and rinse the oysters, strain the liquor, and heat the oysters in it till their edges curl,[1] remove the scum, and turn oysters and liquid into the hot milk. Add butter and seasoning. Serve with oyster crackers.

Scalloped Oysters

Oysters,	1 quart, solid.
Melted butter,	½ cupful.
Stale bread crumbs,	2 cupfuls.
Salt,	about 1 teaspoonful.
Pepper,	¼ teaspoonful or more.
Oyster liquor, or oyster liquor and milk,	5 or 6 tablespoonfuls.

Mix the crumbs with the salt, pepper, and butter; spread one-third of them on the bottom of a buttered baking-dish; put in half of the oysters, drained and rinsed, another layer of crumbs and the rest of the oysters, covering the top with the remaining crumbs. Pour over these the liquid. Bake about twenty minutes in an oven hot enough to brown the crumbs in that time.

A grating of nutmeg or a *slight sprinkling of mace* may follow each layer, if you choose.

341. Lobsters, crabs, and **shrimps** are *crustaceans*, that is, animals consisting of jointed sections, each of which

[1] If cooked longer, they will be leathery.

is covered with a hard shell. Their flesh is similar in composition to that of other fish, but tough and hard to digest. It is liked because of its unique and delicate flavor.

A series of good articles about fish begins on p. 120 of *Foods and Beverages*. After examining an oyster, read about the fresh-water mussel in Chapter VI of *Boys and Girls in Biology*.

CHAPTER VII

FUEL FOODS: FAT FROM ANIMALS AND OIL FROM PLANTS

A man too busy to take care of his health is like a mechanic too busy to take care of his tools.

Section 1. Fats and Oils: What they are and What they are Good For

342. What foods have we found to contain fat? What uses have we made of fat in cooking? What are the uses of fat in the body?

Distinction between fats and oils. — We know that **fats** and **oils** are alike greasy, and that fat, by heating it, may be changed to oil. Some fats are soft and oily, others firm and hard. *An oil is a fat that is liquid at ordinary temperatures.*

343. Most fats contain *stearin* and *palmitin*, solid fatty substances, and *olein*, a liquid. Fat having a large proportion of stearin is hard; the less stearin it has the softer it is. Oils consist chiefly of olein, in which some palmitin and stearin are dissolved.

The softer a fat is the less heat it takes to melt it. The fat of some plants is in the form of oil.

Sources of Fats and Oils commonly used in Cooking

344. Olive oil. — This oil is obtained from the fruit of the olive tree. Olives, as we know from seeing unripe ones pickled, are about the size of plums. Some varieties, when ripe, are purple, some green, others yellow. The best oil is obtained from the first pressing of fresh, carefully picked fruit; a poorer grade, from a second pressing; and after treating the mass of pulp with hot water, a third grade, used for soap-making.

Cottonseed oil. — The best grade of cottonseed oil is excellent for table use. Much is exported to Spain, France, and Italy to be bottled, and resold in this country as "pure olive oil," at many times its original value.

Cottonseed oil mixed with suet is sold as "cottolene," "cotosuet," etc.

345. Butterine or **oleomargarine** is made from the olein (oily part) of purified beef and pork fat churned with milk, mixed with butter, and salted and colored as butter is. Good butterine contains about 25 per cent of butter, 30 per cent of "neutral," or lard oil, 25 per cent of olein from beef, and 20 per cent of salt and cream. It is clean, pure, wholesome, and nutritious, and so like good butter that no one eating it can tell the difference. Being cheap to make, it should be sold cheap; but unreasonable laws, designed to prevent its being sold as butter, keep it almost altogether out of the market, while bad butter is openly sold for far more than it is worth.

For an account of butter and butter-making, see pp. 97–99; for lard and other animal fats see section 2 of Chapter VI.

346. Seeds, *particularly nuts and grains, are rich in oil,* some containing 50 per cent or more, stored up, as starch is, to feed the seedling.

Fat as Food

347. Fat as food; no diet well-balanced without it. — Knowing fat to be a heat giver, we can understand why we like, in winter, foods containing more fat than we care for in summer, and why arctic explorers come to like whale-blubber and walrus fat. But when we learn that the natives of even tropic India pour melted butter (*ghee*) over their rice, we perceive that in any climate, and under all conditions, men need to eat some fat. In a body poorly supplied with this, its proper fuel, proteid has to take its place. But proteid is costly, is needed for tissue-building, and, besides, is worth less than half what fat is as a heat giver. So that in burning proteid to keep up our bodily heat, we are like people who, storm-bound on the prairies and out of firewood, feed their stoves with furniture and even with grain; that is, we use for fuel, material intended and needed for other purposes, and which we can ill afford to burn. Girls often dislike fat, particularly the thin, delicate ones who most need it. If possible it should be offered to them in tempting and digestible forms, cream salads dressed with oil, and crisp, fat bacon. But all kinds of fat can be so prepared as to be unobjectionable. Some ways of using it, however, are harmful to health. To see why this is we must understand something about the digestion of fats.

348. How fat is digested. — Fats undergo less change in the alimentary canal than either proteids or carbohydrates. Although their digestion is begun in the stomach by a ferment, **lipase**, they pass into the small intestine in almost the same state that they entered the mouth. Even in the intestine, they are merely split up into fatty acids, chiefly by the steapsin of the pancreatic juice. A portion of these fatty acids is absorbed at once; another portion is dissolved by bile before being absorbed.

By the various processes the fat becomes so finely divided that it can be sucked up by cells in the lining of the intestine. From these cells part of the fat passes at once into the blood, and part into the **lacteals.** The lacteals unite in the thorax to form the **thoracic duct**, which empties into the blood-stream near the heart.

Why fried food and pastry are hard to digest. — It is easy to see that fat finely divided or mixed with other food can be made ready for absorption more quickly than if swallowed in a mass. Perhaps it is for this reason that we instinctively spread butter on bread instead of eating it by itself, and in general prefer to take fat in combination with other food. But what happens if we incorporate it so closely with other food that particles of this are actually coated with grease, as when butter is allowed to melt and soak into toast?

In this case the butter, since it is affected by neither saliva nor gastric juice, acts as a seal, preventing these juices from reaching the starch and other foodstuffs in the bread, which, therefore, remain undigested till the fat is removed from them in the intestine. The juices here do their best to digest the bread, but, as they were never meant to do all the work of digestion, and as the bread is constantly being pushed along past the little cells eager for it, but unable to take it in unprepared, some of it is almost sure to be left unabsorbed. With pastry the case is still worse; for in this, not only is butter rubbed into the flour so as to envelop the starch granules, but so little water is added that the latter cannot swell as they should (§ 117). Food that has soaked up fat in frying is in much the same state.

Section 2. Cooking in Fat: Frying and Sautéing

349. The difficulty of cooking food in fat without having it greasy makes this the least desirable method of cooking. Nevertheless, certain kinds of food are good fried, and, if *properly* fried, need not be unwholesome.

350. Experiments with heated fat. — A. Take the temperature of butter or drippings while it is foaming and bubbling over the fire. Heat it until it no longer bubbles, and take its temperature again. Is it hotter or cooler than before? Does water stop boiling unless it is allowed to cool? Does it grow hotter after it reaches the boiling-point? Do you think the fat was boiling when it bubbled?

351. Why we should not speak of "boiling" fat. — Fats, generally speaking, burn before they boil. It is water contained in the fat that makes it bubble when heated. Until this water has boiled away, the fat cannot be raised to a temperature much above 212°, but after it has all passed off, as is shown by the fat becoming still, the latter grows rapidly hotter, rising to 300° or 400°, some kinds of fat even higher.

352. Experiment. — B. Drop a bit of bread into bubbling-hot lard; after a minute take it out. Continue to heat the lard until it smokes and is perfectly still. Drop in another bit of bread, let it stay a minute, then take it out. Break open both pieces. Which piece has soaked up the most grease? Which has browned? How does a coating of grease affect the digestion of food? How does browning (*caramelization*) affect the digestion of starch? Should food be fried in bubbling or in still fat? What makes the fat bubble when the bread is dropped into it? How does moisture affect the temperature of hot fat?

Experiment. — C. Heat butter, lard, and drippings in separate saucepans. Which burns first? Which can be made hottest without burning? Which is best for frying? Which least desirable?

353. Points about frying: have the fat deep, do not use butter. — These experiments show (1) that unless fat used for frying is hot enough to form a crust on the food cooked in it, it will soak into the food; (2) that so long as it bubbles it is not hot enough to form a crust; (3) that anything that cools the fat tends to make the food greasy; (4) that the best fat to fry in is the one that can be made hottest without burning.

Therefore, *have the fat deep enough to cover the food*, so that it may be crusted over at once; *see that it is smoking hot and still before putting the food in; reheat the fat after each frying;* and *do not fry in butter.*

Of common fats, butter is the worst for frying, suet (hard fat) from beef, veal, and mutton next better, drippings better still, and lard best of all. Olive oil, which may be heated to above 600°, is superior to any of these. In Southern Europe it is commonly employed for frying, but in this country is too expensive for such use.

What reason is there against the use of butter for frying, besides its low burning-point?

How to prepare Fat for Use

354. Fats are "tried out," or *rendered*, to free them from connective tissue, then *clarified* to remove water and impurities. Lard is sold ready for use; other fat is usually tried out at home. Suet may be bought for this purpose, and all scraps of fat, cooked or uncooked, and drippings from beef, veal, fresh pork, and chicken[1] should be carefully saved. Soup fat and drippings need only to be clarified; suet and scraps must first be tried out.

To try out fat. — Cut the fat into bits, put it into a pan in the oven with enough cold water to cover it, and simmer it for several hours. When the fat is melted, and nearly free from water, strain it, pressing to obtain all the fat.

To clarify fat. — Melt drippings or tried-out fat, add to it a few slices of raw potato, and heat slowly in the

[1] The flavor of fat from mutton, lamb, duck, goose, and turkey prevents their being used in cooking. They may be saved for soap-grease. The fat from smoked meats may be used for frying, if you do not object to its taste.

oven until it ceases to bubble. The potato absorbs some of the impurities; most of the rest settle to the bottom. Strain the fat through cheese-cloth, and let it stand undisturbed till solid. If stirred, it absorbs moisture from the air. Since it keeps longer if left unbroken, it is well to strain it into cups or marmalade jars, so that a portion may be used without disturbing the rest.

355. Foods requiring much cooking not suitable for frying. — Foods suitable for frying are those made of cooked material or those that require little cooking; for example, croquettes and oysters. Most raw food, in order that the outside may not become too brown before the inside is cooked, must be put into fat not quite as hot as it should be to prevent absorption of grease. **Exceptions.** — Fish and oysters, being very watery, cool the fat rapidly, — making it therefore as hot for these as for cooked articles.

Articles of food to be fried are usually covered with egg and crumbs, flour, or meal, to protect them from absorbing fat. Why is egg used for this purpose?

356. Testing the temperature of fat for frying. — When the fat begins to smoke, drop into it an inch cube from the crumb of white bread. If this becomes golden brown in forty seconds, the fat is right for croquettes and other articles made of cooked material, and for fish and oysters. If it takes sixty seconds, it is right for fritters, and most other uncooked articles.

357. Directions for frying. — Use a deep frying-pan or kettle. A wire frying-basket to hold the articles to be fried, hung on a long-handled fork, is convenient; but they may be lowered into the fat and taken from it with a spoon-shaped wire egg-beater. Put the fat into a cold kettle, and bring it slowly to the right degree of heat. Have ready several sheets of soft paper laid on a pan, also a pan to hold under the food as it is taken from the fat. Test the fat; if right, dip the basket or wire spoon into the fat to heat and grease it. If a basket is used, lay three or four articles in it, and lower them till the fat covers them. When they are a delicate golden brown, lift the basket, shake it a little, and let the food drain for a moment before removing it to the paper. Reheat the fat, testing again if necessary, and fry another batch of articles. Three croquettes can be fried at once in a three-quart saucepan; more will cool the fat below the "soaking-point." When all grease has been absorbed by the paper, arrange the food on a platter, and garnish it with parsley; in the case of fish or oysters, with parsley and slices of lemon.

Croquettes

358. Materials used. — The usual croquette mixture consists of two parts of chopped cooked meat, or cooked, flaked, well-seasoned fish, to one part of thick white sauce. Cheese, macaroni, and some kinds of vegetables may also be used in croquettes.

Shaping and crumbing. — Put on a board a heap of fine, dried bread crumbs. Break an egg into a plate, add it to a tablespoonful of water, and beat it enough to mix the white and yolk. With two spoons, or with spoon and spatula or broad-bladed knife, shape heaping tablespoonfuls of the croquette mixture into balls, roll them in crumbs, shape them into cylinders, and with the knife lift them one by one into the egg, dipping it over them till every bit of the surface is covered; roll them in crumbs again till all the egg is covered, and lay them carefully on the board.

Recipes

Chicken Croquettes

Cooked chicken, chopped fine, 2 cupfuls.
Thick white sauce, 1 cupful.
Onion juice, 1 teaspoonful.
Grated nutmeg, a few grains (about three strokes on the grater).
Additional salt and pepper according to taste.

Make white sauce for croquettes from

Butter, 2 tablespoonfuls. Milk or thick cream, 1 cupful.
Flour, ¼ cupful. Salt, 1 teaspoonful.
White pepper, ⅛ teaspoonful.

Add seasonings to the chicken, mix with the hot white sauce, and turn on to a platter to cool. When cold, form into cylinders or cones, roll in egg and bread crumbs, and fry in deep fat. Stick a small sprig of parsley into each croquette; serve on a folded napkin, or pour around them a white sauce.

Croquettes may be made of any cooked meat. Veal may be mixed with chicken. With beef or lamb croquettes omit nutmeg, and serve with Tomato Sauce instead of White Sauce.

Savory Rice Croquettes

Boiled rice,	2 cupfuls.	Salt,	½ teaspoonful.
Eggs,	1, beaten.	Pepper,	⅛ teaspoonful.
Butter	2 tablespoonfuls.	Cayenne, or paprika,	a few grains.

Minced parsley, 2 or 3 tablespoonfuls.

If the rice is cold, warm it with two or three tablespoonfuls of milk. Mix the ingredients, and shape and fry like chicken croquettes.

Potato Croquettes

Mashed or riced potato,	2 cupfuls.
Butter,	2 tablespoonfuls.
Salt,	½ to ¾ teaspoonful.
Pepper,	⅛ teaspoonful.
Celery salt,	¼ teaspoonful.
Onion juice,	10 drops.

Beat the yolk, mix it with the potato, and add the other ingredients. Heat the mixture in a saucepan, stirring ; when it cleaves from the side of the pan, turn it on to a flat dish ; when cold, shape it into cylinders about three inches long. Roll these in egg and crumbs and fry them.

Codfish Cakes (Fishballs)

Salt codfish,	½ pound.
Potatoes, in inch-thick pieces,	2 heaping cupfuls.
Eggs,	1.
Butter,	½ tablespoonful.

Boil and mash the potatoes. While they are cooking, cover the codfish with boiling water; when this is cool enough to allow your hands in it, pick the fish into shreds. Drain off the water, mix fish, potatoes, butter, and eggs together, and beat the mixture well. Fry it by heaping tablespoonfuls in deep fat, or shape it into balls or cylinders and fry in deep fat.

Directions for frying Oysters

359. Prepare large oysters as directed in § 339; lay them on one end of a soft cloth, and with the other pat them dry. Take them one at a time by the gills, cover them first with seasoned cracker crumbs, then with egg, and last with crumbs grated from loaf. Fry in fat hot enough to brown white bread in forty seconds.

360. **Sautéing**, often incorrectly called "frying," is cooking in a small quantity of fat. It is a slower method than "deep frying," less healthful, because the food cannot be kept from absorbing grease, and more wasteful, on account of the fat taken up in this way. But, as it is sometimes convenient to sauté potatoes, liver, small dry fish, and a few other kinds of food, it is important to know how to do it in the best way.

Directions for sautéing. — Have the pan hot enough to hiss when the fat is put into it, and the fat hot enough to hiss when the food is put in. Cook the food first on one side, then on the other. Use very little fat, adding from time to time just enough to keep the food from burning.

The very worst way of cooking food is to put it into a cold or half-warm pan with grease enough to half cover it, and to let it sizzle and soak till it is wanted. Much of the sickness and death laid to other causes is really the result of eating food thus cooked.

Suggestions about using Fat in Cooking

361. 1. Beef fat, clarified by itself, is a good substitute for butter in shortening bread, biscuits, and gingerbread. (See footnote to p. 107.) It can also be used to grease tins.

2. Suet mixed with lard for frying improves its flavor, but not its frying qualities. It should not be used alone, as it hardens quickly, leaving a greasy coating on articles fried in it.

3. Have articles to be fried as dry as possible, and not very cold. Why?

4. **Cautions.** — *Always lower food gently into hot fat;* if dropped in, the fat, splashing up, will burn your hand, and may fall on to the stove and catch fire. If this happens, or if the fat in the kettle takes fire, throw sand or ashes on it. With care about spattering the fat, or spilling water into it, which causes a sudden burst of steam, there need be no accidents.

5. When the frying is done, set the fat in a cooler place at once. Do not strain it immediately, as it may be hot enough to melt the strainer.

6. When fat has become dark from repeated using,

reclarify it with potato, or pour into it, when cold, three or four times its bulk of boiling water, stir well, and let it cool. Remove the cake of fat, and scrape off the sediment that will be found on its under side. Fat too dark for croquettes may be used for fish. From overheating, or many times reheating, it becomes unfit for cooking purposes. When you find it does not brown the food well, use it for soap-grease, or throw it away.

Suggestions for reading. — In *Foods and Beverages* read "Fat from Trees," p. 87; in *Food Products of the World*, Chapter XIV, "Butter"; Chapter XVII, "Vegetable Fats and Oils" (includes cocoanut oil and others not mentioned in this text-book), pp. 233–237 on nuts.

CHAPTER VIII

ACID AND SALT SUPPLYING FOODS: FRUITS AND VEGETABLES

Section 1. Fruits

Purple grapes with autumn sunshine hot,
The fragrant peach, the juicy bergamot.

— LONGFELLOW.

A STUDY OF AN APPLE

362. Apples may be said to be to other fruits what potatoes are to other vegetables. But what do we know about apples? For instance, what makes them hard? Grate and squeeze one as you did the potato, and you will know. So much juice must mean that the apple is full of water. Test it for starch (§ 121 **D**). Taste it. It tastes both sour and sweet. What two substances must it contain? In talking of the pulp of the apple, as the mass of juice-filled cells is called, we must not forget that this grows simply as a covering for the seeds. Some fruits have stones enclosing their seeds. How many stone fruits can you name? In some others the seeds are scattered through the pulp. This is true of some foods not commonly called fruits — for example, the tomato, the squash, the cocoa bean.

363. Definition of fruit; popular use of the term. — In the broad sense, all seed-vessels are fruits. This definition covers nuts, grains, and many vegetables; but we commonly class as fruits those seed-vessels eaten with sugar, or as a dessert; and as vegetables, those served with meat or in salads. Fifty years ago, when it was the custom to eat tomatoes with cream and sugar, they were doubtless considered fruit.

364. Composition and food value of fruits; fresh fruits. — Most fresh fruits contain from 80 to 90 per cent of water, and considerable cellulose. They have almost no proteid or fat, and, when ripe, little or no starch. Ripening changes their starch to sugars and gums. One of these gums is **pectin**, a sort of "plant gelatin." We shall learn more about it when we make jelly. Sugar is the only foodstuff found in any considerable quantity in fruit. Apples, cherries, pears, peaches, and oranges contain, on an average, about the same amount of sugar (7 to 14 per cent); lemons, cranberries, and currants, less; grapes, bananas, and dried fruits, more.

Excepting bananas, fresh fruits have little food value. We eat them for their delicious taste, their refreshing, thirst-quenching juices, their organic salts, and mineral compounds. These last supply sodium, calcium, phosphorus, and other elements essential to pure blood and sound tissues.

365. Bananas contain more carbohydrates than other fruits do. In ripe bananas these are mostly in the form of sugar and gum, but the bananas in our markets, like all fruits sold far from where they are grown, are picked green, and never ripen as perfectly as they would on the tree. In this condition they contain considerable starch, and, therefore, need cooking to develop all their food value and flavor. **Pineapples** contain a proteid-digesting ferment. **Huckleberries** are indigestible and irritating unless cooked. If eaten raw, they must be well chewed.

366. Dried fruits. — Dates, raisins, figs, and **prunes** contain 50 to 75 per cent of grape and other fruit sugars. This makes them really nutritious. Prunes are dried plums; raisins, dried grapes; the **black currants** used in cake are dried currants from Greece and Asia Minor. **Citrons** belong to the same family as lemons, oranges, grape-fruit, and limes. Citron and currants are believed to be quite indigestible.

Rules for eating Fruit

367. 1. Eat only sound, ripe fruit. Unripe fruit is dangerously indigestible. Over-ripe or partly spoiled fruit is poisonous from the bacteria it contains. The cheap fruit hawked about the street, after it is too far gone for reliable storekeepers to sell, is fit only to be thrown away.

2. As a rule, cooked fruit is less likely to cause sickness than raw fruit. Fruit not quite ripe and fruit kept a *little* too long may be made safe to eat by thorough cooking.

3. Fruit is most wholesome eaten by itself, at the beginning of a meal, or as dessert; least wholesome in pudding or pie, or after a hearty dinner that has included a dessert besides the fruit.

4. Sweet fruits, such as dates, bananas, figs, are best with breakfast cereals and other starchy foods; acid fruits sometimes interfere with the digestion of the starch. Explain this. Dates, figs, or prunes supply all the sweetening needed with mush.

5. Do not eat peach, plum, or any other tough fruit-skins raw. It is safer not to eat grape seeds.

6. Eat moderately of raw fruit, especially in hot weather. Do not imagine, because it is watery and comparatively innutritious, that you can safely eat it in unlimited quantities.

7. Avoid taking milk or cream at the same time with acid fruits, particularly with oranges or cherries. What is the effect of acids on milk?

HOW TO PREPARE AND SERVE FRESH FRUIT

368. Fresh fruit must be clean. — Fruit and vegetables exposed for sale on the streets and sidewalks gather dirt, besides decaying quicker than they would if kept protected and cool. A law requiring dealers to keep these foods indoors and covered would greatly benefit the public. If you find a dealer that does this, make it a rule to buy of him. Till we have such a law, fruit bought in the market must be rinsed or wiped clean. Rinse berries quickly in cold water and drain them at once. Soaking hurts their flavor and softens them.[1] Rinse grapes and other small fruits. Wipe larger fruits with a damp cloth. If you like apples polished, rub them with soft paper. Wipe the down from peaches.

Use silver or wooden spoons, silver knives, and earthen or enamelled cooking dishes for fruit. What class of substances in fruit may form bad-tasting, and perhaps poisonous, compounds with iron, steel, or copper? (§ 105.)

369. Serving fruit. — Fruit, except when warm from tree or vine, should be served as cold as possible. Never leave fruit in the dining-room between meals; keep it cool and out of the dust.

Arrange it tastefully, grouping the colors harmoniously, if several kinds are placed on one dish. In arranging one kind by itself, lay on the plate the leaves belonging to it, peach leaves under peaches, grape leaves under grapes, or use grape leaves with any fruit. Place finger bowls on the table when fruit is served. Fruit juice stains white napkins.

370. Sugaring fruits. — Cut and sugar sliced peaches just before serving, as they discolor quickly. Let sliced oranges, bananas, and pineapples stand sugared for half an hour. Sugar currants, crush them slightly, and let them stand till the sugar dissolves. Serve berries unsweetened, and pass powdered sugar, or sugar and cream, with them.

[1] Strawberries are never so good after washing. If free from sand and clean-looking, they need not be rinsed.

371. Oranges. — For breakfast, oranges are served whole. Each person cuts his orange in halves across the sections, and eats the pulp from these with a spoon. To prepare sliced oranges, peel them, pick off the bitter, indigestible white skin, thrust a fork into the centre of the orange, and, with a sharp steel knife, slice off the pulp, leaving the pith on the fork. Sprinkle with sugar.

372. Bananas. — Bananas peeled, scraped, and sliced may be served mixed with sliced oranges. Or serve them by themselves with sugar and a little lemon juice, or with sugar, a few grains of salt, and cream.

373. Muskmelons and grape-fruit, or **shaddocks**, are served as a first course at breakfast or lunch. Cut grape-fruit in two, loosen the pulp from the skin of the sections with a knife, sprinkle with sugar, and eat from the peel with a spoon. Cut melons in two, remove the seeds, and put a piece of ice in each.

374. Pineapple. — To prepare pineapple for the table, cut off the skin and dig out the eyes; then, holding the pineapple on one fork, with another tear the pulp into shreds, and cut or scrape the shreds off with a knife, leaving the woody core untouched. Sprinkle with sugar.

HOW TO COOK FRUIT

375. What effect will cooking have upon the cellulose in fruit? Upon the starch, if there is any? Upon germs of disease or decay?

Fruit loses some of its sweetness in cooking. All fruits, except the sweetest, require, when stewed, the addition of sugar. Figs and prunes are so sweet that a little lemon juice improves them.

Directions for stewing fruit. — Cut pears, apples, or quinces in pieces. Slice or shred pineapples. Cook small fruits whole. Put into a saucepan half as much water as you have fruit. Add for each pint of fruit one-fourth to one-half cupful of sugar, according to the acidity of the fruit. When the sugar and water boil, put in the fruit. If enough juice does not flow to make the syrup cover the fruit, add boiling water until it does. When the fruit is soft, but not mushy, taste it; add more sugar if needed; stir until this dissolves; then take out the fruit. If the syrup is watery, boil it down before pouring it over the fruit. Fruit not quite ripe, or hard fruit, such as quince, should be cooked in clear water till soft, and then sweetened.

Recipes

Apple Sauce

Prepare sour apples, as for stewing. Put them into a saucepan with enough water to keep them from burning, and one cupful of sugar to six or eight apples. Cook till the apple is very soft, stirring or beating to make it smooth. If the apples lack flavor, cook an inch of stick cinnamon or five or six cloves with them.

Baked Apples

Wash and core large, sound, sweet apples; put them into an earthen or enamelled ware baking-dish. Put one tablespoonful of brown sugar into each cavity, and pour boiling water into the dish, one-half cupful for each eight apples. Bake until soft, frequently dipping over the apples the syrup that forms in the pan. Serve cold with cream or milk. If the apples are thick-skinned, pare them (after coring, that they may not be broken by knife or corer). If they lack flavor add a little lemon juice and cinnamon to the sugar — one teaspoonful of lemon juice and one-fourth teaspoonful of cinnamon to one-fourth cupful of sugar.

Pears, quartered, are baked or stewed like apples.

Baked Bananas

1. Choose sound, ripe bananas; cut about three-fourths of an inch off of each end, and bake in an earthen or enamelled ware baking-dish for thirty minutes. Slit open the skin, and eat the banana, which should be sweet and juicy, with a fork or spoon.

2. Remove bananas from skins, lay in a baking-dish, sprinkle with granulated sugar, and pour a little cold water into the dish. Bake in a hot oven until tender. Serve for breakfast, or with Lemon Sauce for dessert. (For recipe for Lemon Sauce, see p. 271.)

Cranberry Jelly

Cranberries, 1 quart. Water, 1 cupful.

Sugar, 1 pound.

Pick over and wash the cranberries, cook them slowly with the water for about fifteen minutes, and press through a strainer. Return to the fire, and add the sugar, stirring until it is dissolved. Boil without stirring five minutes longer, pour into a mold, and let it stand until firm enough to turn out. Serve with poultry, mutton, or game.

Lemonade

Lemon juice, ½ cupful. Water, 1 quart.
Sugar, 1 cupful.

One way. — Mix lemon juice and sugar, add the water, and stir until the sugar dissolves, strain, and ice.

The best way. — Have the water boiling, pour it on to the lemon juice and sugar, strain, and, when cold, ice.

376. **Rhubarb**, though not strictly a fruit, is so like fruit in composition that it may be classed with it. It can be had in the spring before fruit is plentiful, yet when we crave vegetable juice and acid.

Rhubarb Sauce

Steamed. — Cut off the leaves. Wash the stalks, and cut them into one-inch lengths. To each pint of rhubarb add one cupful of sugar, and cook it in a double boiler till soft. Add more sugar if it tastes too sour. Do not stir it. The pieces of rhubarb should be unbroken.

Baked. — Prepare and sweeten the rhubarb as for steaming. Cook it in a deep dish in a moderate oven until tender and deep-red in color.

377. Imported dried fruits are usually dirty. Dates and figs need rinsing with boiling water, and are better if steamed or stewed in a little water till tender. Stewed figs with cream are delicious. Select shrivelled, dry-looking prunes; plumper ones have been soaked to make them look well, and the purchaser pays for the water they have absorbed.

Dried apples, peaches, and **apricots,** after soaking for several hours in water, are cooked like fresh fruit.

Stewed Prunes

Prunes, 1 pound. Sugar, 2 tablespoonfuls.
Lemon, 1, sliced.

Wash the prunes, and soak them for several hours, or over night, in cold water enough to cover them. Add sugar and lemon, and cook them thirty minutes, or until soft. Or omit the sugar, and cook by moderate heat one hour or longer to develop the natural sweetness in the fruit.

Reading. — "The Cape Cod Cranberry" (illustrated), in *Harper's Weekly*, Vol. XLI, p. 1012, October 9, 1897; "The Grape Industry," in the *Chautauquan*, Vol. XXIV, December, 1896; *Foods and Beverages*, pp. 169–214; *Food Products of the World*, Chapter XXIV, pp. 217–233.

Section 2. Vegetables

The common growth of mother earth suffices me. — Wordsworth.

The secret of the cooking of vegetables is the judicious production of flavor. — Ellen H. Richards.

378. We eat as vegetables the fruits, or seed-vessels, of some plants; of others the root, the leaves, or some other part.

Vegetables, like fruits, contain mineral salts important to health. What salts are found in potatoes? Vegetables valued chiefly for these salts are frequently eaten raw; to this class belong lettuce, celery, cucumbers, and all "salad plants." Many vegetables, however, require cooking. If we analyze one, we shall see why.

Study of a Carrot

379. Examine and analyze a carrot just as you did the potato, and make a table showing its structure and composition. Is it a root or a tuber?[1] Where is it most woody? In the spring you may be able to get both young and old carrots. Compare them. Which has the thicker skin? The more cellulose? The centres of very old carrots may be too hard to eat. Do carrots contain starch? Do you know or can you tell from their structure and composition which will take longer to cook, a potato, or a carrot of the same size?

Carrots contain more water than potatoes do; why are they not good baked?

380. **Foodstuffs in carrots**. — Carrots contain sugar, gum, and about one-fourth as much starch as potatoes do; of the mineral compounds in them the most important are potash salts. (For percentage composition of carrots and other vegetables, see table on pp. 319–326.)

[1] Roots of certain plants sometimes bud and sprout. Scoop out a carrot or a sweet potato for half its length; hang up this carrot or sweet-potato cup by a string, and keep it full of water. Sprouts will appear, but not from regularly placed eyes or *bud-scales*, as on potatoes or other *plant-stems*.

381. How plants and animals make food ready for man. — Roots are the feeding organs of plants. They suck up water and food from the earth. We have seen that cattle turn grass into beef and milk for our use; grass, grain, and every edible plant that grows, work the mineral matter of the earth into cellulose, starch, sugar, for animals or men.

382. Analysis of Peas. — **A.** Rub some cooked green or dried peas through a sieve, washing the pulp through with water. What is left on the sieve? **B.** Test for starch the pulp that passes through. **C.** Analyze beans in the same way.

383. Vegetables that supply proteid: peas, beans, lentils. — We see that peas and beans may be considered starchy vegetables. But they also contain much proteid matter, as is proven by their turning yellow if treated with nitric acid. In China a kind of cheese is made from them. This fact makes the name "vegetable casein," sometimes given to one of the proteids in peas and beans, seem appropriate. **Legumin** is, however, a better name for this substance. Although there are greater quantities of other proteids in peas and beans, they, together with lentils, another of the *pulses*, or pod-forming plants, are classed as **legumes.**

Studies of Growing Vegetables

384. — 1. Make drawings of a pea-plant or a bean-plant at different stages of growth, noting how the cotyledons shrivel as the seedling grows. Explain this. (§§ 146 and 147.)

2. **A.** — Cover half an onion split lengthwise, with warm water, renewing this several times a day to hasten the experiment.

What takes place in the centre of the onion, and at the base of the leaves? What becomes of the leaves as the shoot grows? Where does the onion store its food? **B.** Test the onion for starch.

An onion is a **bulb**, that is, an underground stem surrounded by overlapping leaves, thickened by stored-up food material.

385. Food value of vegetables; selecting vegetables with regard to food to be served at the same meal. — All vegetables are valuable for their mineral salts, some furnish a considerable amount of carbohydrates, a few are rich in both carbohydrates and proteids. All, however, contain a large proportion of water and comparatively indigestible material. This makes them suitable to eat with concentrated foods, such as eggs and meat; for this indigestible stuff, consisting largely of cellulose, helps to fill the stomach and keep the mass of food loose, so that as this turns, every part of it comes in contact with the gastric juice. The rough bits of cellulose are useful, besides, in stimulating the intestines to action, so that their contents are kept constantly moving.

On the other hand, it is probably because of the cellulose walls surrounding plant proteids, that these proteids are not so completely digested as animal proteids; so that three ounces of green peas cannot be counted on to build as much tissue as one ounce of beefsteak, although the quantity of tissue-building material supplied is in each case the same. Peas and beans may to some extent, however, take the place of animal proteid food. Lentils, which are much used in Europe, are more digestible than either peas or beans.

Experiments show that part of the cellulose of carrots, celery, and lettuce is slowly digested and absorbed. If tender, it is more digestible raw and crisp than cooked. Thus cooked cabbage is less readily digestible than raw, and most indigestible when boiled till sodden and stringy.

If you were to have both meat and fish for dinner, would you serve tomato, or split-pea soup? What vegetables are suitable with roast beef? Which are suitable for a meal at which little or no meat is served? Pork is fat, a fuel food; what vegetable goes well with it? What sort of vegetables should be served with lean meat? Tomato, or a vegetable dressed with acid — pickled beets or cole-slaw — is appetizing with fish. With delicately flavored meat, such as chicken or veal, do not serve a strong vegetable like cabbage. Custom prescribes peas with lamb, apple sauce with pork and goose, cranberry sauce with turkey.

386. Selecting vegetables in the market. — Choose vegetables that are in season. Those forced in hot-beds or brought from a distance are seldom equal to native produce, garden grown, — besides being too expensive for most purses. Know what each is worth when plentiful, and you will not be tempted to pay four or five times that sum for it out of season.

Choose medium-sized or small vegetables. Large vegetables are usually old and woody; they require more fuel to cook them than younger ones do, and are less nutritious. A measure holds a greater weight of small vegetables than of large ones — one reason why they ought to be sold by the pound. Large squashes and cucumbers are seedy; corn with large kernels is tough.

The signs of freshness and good quality in particular vegetables are given in the table on pp. 244–247. Stale or wilted vegetables are never economical, and are likely to be unwholesome.

If you get your vegetables from the garden, gather them while the dew is on them.

387. Care of vegetables. — Keep winter vegetables, except squashes, in a cool, dark, dry place, piled up to exclude air. Squashes keep better spread out in a rather warm, dry place. What grows on food in the damp? Keep green vegetables in the refrigerator or other cold place till used.

388. Preparation of vegetables. — 1. *Fresh.* Wash all fresh vegetables. Even if they look clean, they may be spoiled by impure water used in watering, by insect poison, or in other ways. Eggs of insects swallowed raw may produce worms in the human body. Soak in cold water vegetables not fresh from the garden. How does water affect wilted flowers? In the same way it makes vegetables firm and crisp.

389. 2. *Dried.* Dried peas and beans must be soaked to restore the water lost by evaporation. Weigh a pint of beans before and after soaking. What do they gain in weight? 3. *Canned.* As soon as the can is opened, turn out all the contents. Why? Drain off the liquid from peas and beans and rinse them. Let all canned food stand awhile to regain the oxygen lost by canning. Heat, season, and serve like fresh vegetables.

HOW TO COOK VEGETABLES

390. People are not agreed on what are the best ways of cooking vegetables. Too many cooks think only of getting them soft, without regard to retaining their juices and salts. Vegetables cooked in water lose a large proportion of their foodstuffs. In carrots this loss may amount to 20 per cent of their whole value when they are cut into large pieces, to 30 per cent when they are cut small. Cabbage loses about one-third of its food value. Until we have more accurate knowledge, we can only try to make each vegetable palatable, endeavoring at the same time to keep it as nutritious as possible. The directions for cooking vegetables given in the table on pp. 244–247 are based upon the following general rules: —

General Rules for cooking Vegetables

391. 1. Cook vegetables whole when practicable. When not practicable, cut them into as large pieces as are convenient. If the cooking water is to be served with the vegetable, the pieces may be smaller than would otherwise be desirable.

2. Use only as much water as is necessary to cover the vegetable. For small or cut-up vegetables that can be stirred, use just enough to keep them from burning, adding more as this cooks away.

3. Use the cooking water, if palatable, in sauces, soup-stock, cream-of-vegetable soups, etc. It contains much nutritive matter dissolved from the vegetables.

4. For vegetables cooked whole or in large pieces, keep the water boiling, that they may cook in the shortest possible time. Peas, beans, and any vegetables served in the cooking water are better simmered.

5. Green vegetables keep their color better if cooked uncovered. The reason for this is not known. Cook onions and cabbage uncovered; their odor is less noticeable when allowed to pass off continually than when escaping occasionally in bursts of steam.

6. The time required to cook any given vegetable depends upon its size, age, and freshness. Old beets may be so woody that they cannot be cooked tender. Dried or wilted vegetables cook more quickly if first soaked in cold water. Think of the part water plays in cooking starch, and explain why this is so.

392. Seasoning vegetables. — Use two teaspoonfuls of salt to one quart of water. To one pint of small, cooked vegetables, — beans, peas, onions, etc., — or to one pint of mashed or cubed turnips, potatoes, etc., use two tablespoonfuls of butter, one-half teaspoonful of salt, and one-eighth teaspoonful of white pepper.

393. Scalloped vegetables. — Many kinds of cooked vegetables may be scalloped, — potatoes, onions, cabbage, and cauliflower being excellent so prepared.

For scalloping, cut potatoes into cubes, quarter or tear apart onions, separate the flowerets of cauliflower. Cabbage leaves, if not separated before cooking, must be pulled apart. Season the vegetable as directed above, put it into a baking-dish, pour over it Thin White Sauce, allowing one cupful and a half of sauce to each pint of vegetables. Cover with buttered crumbs, and bake till the crumbs are brown.

Ingredients for Thin White Sauce

Butter, 2 tablespoonfuls.	Milk, 1 cupful.
Flour, 1½ tablespoonfuls.	Salt, ½ teaspoonful, or more.

Pepper, ⅛ teaspoonful.

394. Vegetables served raw. Celery. Use only the inner stalks. Wash these, scraping them if not perfectly white, cut off all but a little of the tops, and soak in cold water till crisp. Serve them laid in a glass dish. **Cucumbers.** The seeds and coarse fibres of cucumbers make them one of the most indigestible of foods. Soaking in salt water wilts them, increasing their indigestibility. Pare them, cut thick slices from the ends to remove medicinal salts, and slice *thin*. **Radishes.** Wash and cut off the tops, make cuts across the tops of the roots through the skin, and turn this back in points. **Tomatoes.** Peel and slice in half-inch slices. (See Preparation of Tomatoes in table.) Serve very cold.

TABLE OF INFORMATION ABOUT VEGETABLES

Vegetable.	Selection; Care after Buying.	Preparation for Cooking.	Method of Cooking.	Time.	Serving.	Remarks.
Asparagus.	Stalks should be green; the ends should show that they have been recently cut. Keep standing in cold water.	Cut stalks off as far down as they are brittle. Untie the bunches, wash stalks, and retie them in bunches right to serve to one person. Tie these into one bunch again, and stand it in cold water till put on to cook.	Stand the asparagus in a deep kettle, and pour in boiling water to cover all but the tips. Let it boil tightly covered till the stalks are tender. The steam cooks the heads. Salt when nearly tender.	About 45 min.	Drain, and butter. Serve on strips of toast moistened with the cooking water and buttered.	Keep the rest of the water to use in making Cream-of-Asparagus Soup.
Beans (Lima).	Buy green, juicy pods with small veined beans.	Wash and shell.	Cook uncovered in barely enough boiling water to cover them. Let this boil down toward the last. Salt when nearly done.	1 to 1½ hrs.	Serve without draining; season with butter and pepper.	
Corn.	Silk should be brown. Tear husk open, and see that ear is filled with well-developed kernels. Try a kernel with your nail,—sweet milky juice should flow. Remove outer husks as soon as it comes from market. Cook as soon as possible. Corn is injured by keeping.	Take off outer husks; remove silk; fold inner husks back over the ear.	Cook in boiling water until, when a kernel is pressed, no juice flows.	5 to 15 min.	Remove husks and serve ears whole, in a napkin. Or shave off the top of the kernels, scrape out the pulp with the back of a knife, season with butter, pepper, and salt, and reheat with a little milk.	Cooking in *salted* water wrinkles and hardens corn.

STRING BEANS.	Break a pod; it should be brittle. Strings should be delicate, and beans very small.	Wash, pull off the strings, and snap or cut the pods into inch pieces.	Cook in barely enough boiling water to cover them, letting this boil down when beans are nearly cooked. Salt when nearly done.	For young beans, 1 hr. For old ones, 2 to 3 hrs.	Serve without draining; season with butter and pepper.	
BEETS.	Choose those with dirty roots and fresh, green leaves. If roots are clean, beets have probably wilted and been freshened by soaking.	Wash, taking care not to break the skin. Cut tops off about two inches above the root. If cut *short*, the beet will lose color and sweetness.	Cook in boiling water till tender. Salt half an hour before taking from fire.	For young beets, about 1 hr. For old beets, 4 or 5 hrs.	Rub off the skins with a dry cloth. Slice large beets, quarter small ones. Season with butter, pepper, and salt.	Tops of summer beets may be cooked with roots, and served separately as "greens." Avoid trying beets till you think they are really done.
CABBAGE.	Choose a hard, heavy one, with crisp white leaves, and stalk cut close to the head. Keep in cool, dark place.	Remove outer leaves. Cut out stalk, and separate inner leaves, removing any insects found.	Cook inner leaves, uncovered, in boiling salted water till tender, but not *sodden*.	About 20 min.	Drain, and season with butter, salt, and pepper, or mix with white sauce.	

TABLE OF INFORMATION ABOUT VEGETABLES. — CONCLUDED

VEGETABLE.	SELECTION; CARE AFTER BUYING.	PREPARATION FOR COOKING.	METHOD OF COOKING.	TIME.	SERVING.	REMARKS.
CARROTS. Young (summer).	See that leaves are green and fresh.	Wash and scrape; drop into cold water.	Cook in boiling water.	30 min. to 1 hr.	Serve in thin white sauce, or with green peas.	Peas and carrot cubes are a good garnish for meat.
Old (winter).	Choose the smaller ones.	Wash and scrape; cut into half-inch cubes.	Cook in a small quantity of boiling water.	20 to 30 min.	Serve in thin white sauce.	
CELERY.	Buy only when white, crisp, and fresh.	Cut off root; wash and scrape outer stalks; cut them into one-inch pieces.	Simmer them till tender in water to cover them.	5 to 15 min.	Drain, and serve covered, with white sauce.	Save root for soup stock, water for Cream-of-Celery Soup. Serve inner stalks raw.
PEAS.	See that pods are green and brittle, peas green. Young peas are small. Cook as soon as possible. Peas are injured by keeping.	Wash the pods before shelling.	Cook in barely enough water to cover, adding salt 15 minutes before taking from fire. Let water boil down when peas are nearly cooked.	30 to 40 min.	Serve without draining; season with butter and pepper.	Should the peas lack sweetness, add ½ to 1 teaspoonful of sugar to each half-peck of peas while cooling.

SPINACH.	Choose that with leaves fresh and ***dirty.*** If clean, they have wilted and been soaked to revive them.	Cut off roots, stems, and poor leaves; wash by lifting from one pan of cold water to another, till water is free from sand.	Cook in its own juices, heating it gradually till these are drawn out.	About 15 min.	Season with butter, salt, and pepper, and reheat.	Rather old spinach may be better cooked in water and drained.
SQUASH. Crookneck or Summer.	Good ones are light yellow, the shell tender enough to be broken with the finger-nail.	Wash, cut into pieces, and pare.	Cook in a steamer or a strainer placed over boiling water.	About 30 min.	Mash, and season with butter, salt, and pepper.	If very watery, press out part of the juice by squeezing the pieces of squash between the colander and a plate.
Hubbard or Winter.	Choose sound ones with no soft spots. If you buy a quantity, keep them spread out in a dry place.	Break into pieces with hatchet; take out shreds and seeds.	Steam like summer squash.	About 40 min.	Scoop out inner part. Rub through a colander; season with butter, pepper, and salt.	
TOMATOES.	Best ones are firm, smooth, and evenly red, with no decayed, bruised, or green spots.	Let them stand covered with boiling water for one minute to loosen the skins; peel and cut into pieces.	Simmer them.	About 20 min.	Add for each pint of tomatoes 1 tb. butter, ¼ t. salt, a few grains of pepper, and 1 or 2 t. of sugar. To thicken, stir in 2 tb. of pounded and sifted cracker crumbs; or omit crumbs and serve on buttered toast.	Pink tomatoes are usually less acid than red ones.

Suggestions about cooking and serving Vegetables

395. 1. Strong-flavored vegetables may have to be cooked in a generous supply of water to make them palatable. As this wastes them, it is better to buy mild-flavored ones.

2. Avoid piercing vegetables to see if they are cooked. A knitting-needle breaks them less than a fork.

3. As one object in using vegetables is to give variety to our diet, take pains to vary the vegetables served from day to day; if you can get but few kinds, vary the ways of cooking these.

4. Take particular pains to make winter vegetables attractive to sight and taste.

Suggestions for home work and reading. — Make a list of the parts of plants used as vegetable, and write each under its proper head, — beet under root, celery under stalk, etc. As you become familiar with other plant foods add them to the list, — cinnamon under bark, maple syrup under sap, etc. Write in tabular form directions for selecting, keeping, preparing, cooking, and serving potatoes, or any other vegetable not included in the table on pp. 244–247. Some common vegetables are treated of in Chapter XXII of *Food Products of the World*, p. 193.

Section 3. Cream-of-Vegetable Soups (Purées)

396. A **purée** is the pulp of a cooked vegetable, strained and thinned slightly with milk or cream. A **cream-of-vegetable soup** is a very thin purée. Vegetables too old or too tough to be served whole should be made into soup or purée, as straining removes the hull and coarse fibre, leaving the digestible part of the vegetable. Flour or cornstarch is added to these soups to keep the vegetable from settling. This flour or cornstarch and the butter usually mixed with it are called "binding material," because they bind together the solid and liquid parts of the soup.

Recipe for Green Pea Soup

Green peas,	1 pint, or 1 can.	Salt,	1 teaspoonful.
Boiling water,	1 quart.	Pepper,	⅛ teaspoonful.
Milk,	1 pint.	Sugar,	½ to 1 teaspoonful (more for old peas than for young).
Butter,	2 tablespoonfuls.		

Flour, 2 tablespoonfuls.

Cook the onion with the peas in the water. Scald the milk. When the peas are very soft, remove the onion and mash the peas through a strainer, add to them the milk, and reheat. Rub the flour and butter together, stir into them a little of the soup, and turn this mixture back into the rest of the soup. Stir till smooth, add seasoning and sugar, and serve with croûtons.

397. **To prepare croûtons**, cut buttered slices of bread one-half inch thick into half-inch squares. Heat these on a pan in the oven, stirring occasionally, till they are crisp and golden-brown. Pass them with soup. They may be kept and reheated.

Recipe for Tomato Soup without Stock

Note. — This soup, although it contains no milk or cream, is given here because in other respects it is made like cream-of-vegetable soups.

Tomatoes,	1 can, or	Celery salt,	1 teaspoonful, or
Fresh-cooked tomatoes,	1 quart.	Salt, 1 teaspoonful, and a sprig of celery cooked in the soup.	
Hot water,	1 pint.	Pepper,	a few grains.
Butter,	¼ cupful.	Onion,	1 slice.
Cornstarch,	3 tablespoonfuls.	Sugar,	1 tablespoonful.
Cloves,	4.		

Cook water, tomatoes, onions, and cloves together for twenty minutes; add the butter, stir in the cornstarch wet to a smooth paste with cold water; boil the soup till clear, and season.

Cornstarch is used in this recipe because it gives a clearer soup than flour does. Why is it mixed with water instead of with butter? Which lumps most easily, pure starch or flour? Why? Why is more thickening required for tomato than for pea soup?

398. General proportions of ingredients for cream-of-vegetable soups. — To *one quart of liquid* (water, milk, stock) use *one to two cupfuls of vegetable pulp*, *two tablespoonfuls of butter*, *one to three tablespoonfuls of flour*, *one teaspoonful of salt*, and from *a few grains to one-eighth of a teaspoonful of pepper*.

General directions for making cream-of-vegetable soups. — A cream-of-vegetable soup is practically white sauce, with the addition of vegetable pulp. Cook the vegetable in water till very soft. Press it through a sieve,

TABLE OF CREAM-OF-VEGETABLE SOUPS

Name of Soup.	Vegetables.	Liquid.		Binding or Thickening.		Seasoning.	Other Ingredients.	Special Directions for preparing the Soups. For General Directions, see § 398.
		Water.	Milk.	Butter.	Flour.			
Cream of tomato.	Tomatoes, ½ can.		1 qt.	2 tb.	3 tb.	Salt, 1 t. Pepper, ⅛ t.	Soda, a few grains.	Scald the milk, and thicken it with the flour and butter. Cook the tomatoes ten minutes, or till soft, add the soda, and strain. Stir the tomato slowly into the thickened milk, taking care that it does not cook after being mixed, and serve at once.
Cream of asparagus.	Asparagus, 1 bunch.	1 qt. (Boil down to 1 pt.)	1 pt.	2 tb.	2 tb.	Salt, 1 t. Pepper, a few grains.		Break off the heads, and cook them with the stalks in the water. Take out the heads as soon as they are tender, and either serve them on toast, or put them in the tureen before turning in the soup.
Cream of celery.	Celery, 3 roots, or 3 outside pieces of 3 stalks with leaves.	1 pt. hot, or enough to cover the celery.	1 qt.	2 tb.	2 tb.	Salt, 1½ t. Celery salt, ⅛ t. Pepper, ⅛ t.		Wash the celery, cut it into short pieces, and simmer it in the water till soft.
Cream of turnip, carrot, etc.	Mashed vegetable, 1 to 2 c.	1 pt. of the water the vegetable was cooked in.	1 pt.	2 tb.	2 tb.	Salt and pepper, according to quantity of seasoning already added to the vegetable.		If a "left-over" mashed vegetable is used, heat the milk and water together, and pour them on to it. Strain and bind as usual.
Potato.	3 large potatoes.		1 qt.	2 tb.	2 tb.	Salt, 1 t. Pepper, ⅛ t.	Parsley, 2 t. Bit of bay-leaf. Onion, 1 slice. Celery-root (if on hand).	Boil the potatoes, and mash them through a strainer into a saucepan. Cook the onion in the milk. When the latter reaches the scalding-point, take out the onion, and stir the milk into the potato. Bind with the flour and butter; season; strain into a tureen, and sprinkle with parsley.
Split pea.	Dried split peas, 1 c.	3 pts. cold.	Enough to thin the soup properly.	2 tb.	2 tb.	Salt, 1 t. Pepper, ⅛ t.	Ham-bone, slice of onion, or both, may be cooked with the peas.	Soak the peas over night. In the morning drain them and simmer them in the water two hours or more, adding more water as the first boils away. When very soft rub peas and water through a strainer.

vegetable press, or strainer, using the cooking water to help wash the pulp through. Heat milk and pulp together, stir into them the binding material (cornstarch mixed with water, or flour mixed with butter), boil till smooth, and season. If too thick, add more milk. The coarser the vegetable, the coarser should be the strainer used. Onions, herbs, and whole spices may be cooked in the water or milk used in the soup; other seasonings are added at the last. **To make the soup richer**, part cream may be used instead of all milk, white stock instead of water, or a beaten egg or a few spoonfuls of whipped cream may be put into the tureen before turning in the soup.

Study the table opp. p. 250, noting in what respects the soups are alike, in what different. Think out, if you can, the reasons for variations in quantity of water used, time of cooking, etc.

Caution. — Cream-of-tomato soup must be made with great care to prevent the acid in the tomatoes from curdling the milk. Adding a bit of soda helps to neutralize the acid. Draw the saucepan away from the heat before adding the soda; otherwise the tomato may foam over. Explain this. What gas is formed? (§§ 193 and 194.) Pour the tomato slowly into the milk; if the milk be poured into the tomato, it will curdle. Take care not to combine milk and tomato till just before the soup is served, as milk heated with acid is almost sure to curdle.

Bean Purée

Beans, 1 quart.	Baking-soda, ¼ teaspoonful.
Onion, 1 small one.	Butter, 2 tablespoonfuls.
Carrot, 2 slices.	Milk or cream.
A bit of bay-leaf.	Salt, ¾ teaspoonful.

Pepper, a few grains.

Wash the beans, and soak in cold water over night. In the morning drain, cover them with cold water, and when this boils, drain them again. Add soda, onion, bay-leaf, and carrot. Boil gently until the beans are soft; then press them through a colander, add butter, salt, pepper, and milk or cream enough to thin the purée to your taste. Serve as a vegetable.

Section 4. Salads

A cheap but wholesome salad from the brook. — Cowper.

399. The salad, or "salet," of olden times was always a dish of green herbs dressed with vinegar and other condiments. Now eggs, many kinds of meat, fish, and fruit, and almost all kinds of vegetables, cooked as well as raw, are used in salads, singly, or combined with a dressing containing oil, butter, or cream.

Salad-making

400. Four things essential in salad-making. — A salad must be *cold*, the greens in it *crisp*, the ingredients in the dressing *carefully proportioned and blended* so that it shall be neither oily nor acid, and the whole *well-mixed*. With these conditions fulfilled, a handful of lettuce leaves dressed with salt, pepper, oil, and vinegar is in its way to a perfect dish. Because of the judgment and deftness required to produce this perfection, the master or mistress of the house frequently prefers to dress such a salad rather than to have it brought to the table dressed.

401. Preparing the ingredients. — Lettuce is used as a bed for any salad. As soon as it comes into the house, sprinkle it, and put it in a covered tin pail in the icebox. To prepare it for use, cut off the stem, separate the leaves, and let them lie for at least fifteen minutes in the coldest water you can provide. Wash them clean, taking care not to break them ; look sharply to see that no insects cling to them, shake lightly or swing them in a wire basket or a salad-net [1] to partially dry them, and wipe them carefully with a soft cloth. If left wet, the dressing runs off of them. Freshen and dry other salad leaves in the same way. **Other vegetables.** — (For **tomatoes** and **cucumbers**, see p. 243.) Remove the strings from **string beans**, and cook them without breaking or cutting. Keep **parsley** in a glass of water, with only the roots wet. Cut **cooked vegetables** except potatoes into half-inch cubes, or small irregular bits. Put remnants of cooked vegetables into a colander and pour hot water over them to rinse off any butter.

[1] Bags made of coarse netting are sold for this purpose.

Plain French Dressing

Salt,	½ teaspoonful.	Olive oil,	3 tablespoonfuls.
Pepper,	¼ teaspoonful.	Vinegar, (malt, wine, or tarragon,)	1 tablespoonful.

Onion juice (if desired), or rub the salad bowl with a clove of garlic.

Stir the seasonings into the oil, add the vinegar, and stir vigorously until the dressing thickens slightly. A larger quantity made in the same proportions may be passed in a bowl.

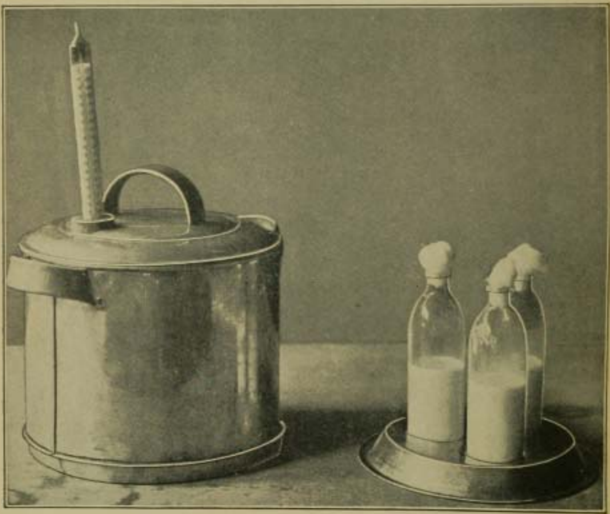
French dressing may be served with any green salad.

Mayonnaise or cooked salad dressing are appropriate with string beans, tomatoes, celery, or cauliflower. Cooked dressing is used with cabbage; Mayonnaise usually with meat or fish.

402. Arranging the salad. — If only lettuce is to be served, put it in a pretty bowl, either glass, or of some color that looks well with the green of the leaves. Arrange these to form a frill above the edge of the dish, and let the centre be a nest of cool, shadowy green. The arranging of salads gives a girl a chance to display artistic skill no less than does the embroidering of a doily, or the making of a sketch. How satisfactory to be able to combine those few spoonfuls of peas, beets, potatoes, and what not, left from two or three dinners, into a pyramid of pretty colors, wreathed with green and blossoming with radish "rose-buds"! (Macédoine Salad.) Or, starting with fresh materials, what pleasure may be found in bringing out the

PLATE XI.

MACÉDOINE SALAD.



HOME-MADE PASTEURIZER.

For description, see p. 292.

beauty of glowing tomatoes nestled in palest green, and crowned with golden Mayonnaise! (Stuffed Tomato Salad.) Nor do thrift and taste and judgment alone come into play in salad-making; use your originality and invention, and you can produce many a salad not described in cook-books, but delightful to eye and taste.

403. To dress lettuce at the table, mix oil and seasonings in the salad spoon, pour them over the lettuce, and toss and turn this till every leaf is coated. Then add the vinegar, and toss again. To vary the flavor, have the salad bowl rubbed with a "clove of garlic," or have a piece of bread rubbed with garlic at the bottom of the bowl.

404. Reasons why salads should be eaten more than they are. — While the food value of a green salad is not large, the salts it supplies and its refreshing, appetizing qualities make it a most wholesome food. The oil or butter used in dressing it furnishes fat in a digestible form. The acid vinegar is believed to help digest the cellulose. Salads are prepared with little trouble and with no expense for fuel. Some vegetable suitable for salad can be obtained all the year round, even canned ones making, with fresh greens, an acceptable dish. If you cannot have salad every day, have it as often as you can. Some people now have salad instead of dessert, and if you cannot have both at the same dinner, it is well to substitute salad for pudding two or three times a week, at least.

Recipes

Mixed Vegetable or Macédoine Salad (Plate XI)

Cold cooked peas, carrots, beets, string beans, almost any cold vegetables may be combined in this salad.

Cut beets and carrots in half-inch cubes, string beans and celery in short lengths, mix each vegetable separately with French dressing, and arrange them in sections, forming a circular mound. Let vegetables of contrasting colors come next each other. Garnish with radishes, celery tips, lettuce leaves, etc.

Potato Salad

Hot boiled potatoes cut into ½-inch cubes, 3 cupfuls.

Salad oil,	9 tablespoonfuls.	Pepper,	¼ teaspoonful.
Vinegar,	3 teaspoonfuls.	Onion, chopped fine,	¼ cupful.
Salt,	1 teaspoonful.	Parsley, cut fine,	1 tablespoonful.

Mix these ingredients thoroughly, heap the salad on a dish, and garnish with radishes, sliced, or cut in rose form (§ 394), and sprigs of parsley.

Cooked Salad Dressing (without oil)

Mustard,	½ teaspoonful.	Sugar,	1 teaspoonful
Salt,	½ teaspoonful.	Yolk of 1 egg.	
Cayenne,	a few grains.	Milk,	¾ cupful.
Flour,	2 teaspoonfuls.	Butter, melted,	2 teaspoonfuls.

Hot vinegar, ¼ cupful.

Mix the dry ingredients in a saucepan, stir into them the yolk of egg, butter, and milk. Stir the mixture over hot water until it begins to thicken, then stir in the vinegar, a few drops at a time. When as thick as thick cream, strain and cool.

Cole-slaw

One-half of a small hard cabbage.
Cooked salad dressing, hot, 1 cupful.

Soak the cabbage in cold salt water for thirty minutes, shred it fine with a sharp knife or vegetable shredder, and mix the dressing with it. Serve cold.

Mayonnaise Dressing

Yolk of 1 egg.
Olive oil, 1 cupful.
Salt, ½ teaspoonful.
Cayenne pepper, a few grains, or paprika, ¼ teaspoonful. Mustard, if liked, ½ teaspoonful. Lemon juice or strong malt or tarragon vinegar, about 2 tablespoonfuls.

Mix in a bowl or soup-plate with a silver fork. To insure success, have bowl, oil, and egg very cold; and add oil very slowly. In summer set the bowl in a pan of cracked ice while mixing the dressing.

Break and separate the egg, taking care that no white remains with the yolk. Beat the yolk slightly, and stir into it the seasonings mixed. Now begin to add the oil, a drop at a time at first, beating hard. As it thickens, add more rapidly, but never add more until that in the bowl has become thoroughly mixed with the egg. When too stiff to beat easily, add a little vinegar or lemon juice, and continue adding oil and vinegar alternately, until all is in. The dressing should hold its shape. More oil and seasonings can be added to one yolk to make a larger quantity of dressing.

Stuffed Tomato Salad

Medium-sized tomatoes, 8.	Mayonnaise dressing, 1 cupful.
Celery cut in small pieces, or	Lettuce.
Cucumber cut in cubes, 2 cupfuls.	Salt.

Scald and peel the tomatoes; slice off their tops. Scrape out the seeds and a little of the pulp, and fill the cavities heaping full with celery or cucumber mixed with Mayonnaise dressing. Make on a platter, or on separate plates, nests of tender lettuce leaves, and put a tomato in each nest.

Chapter XXIII in *Food Products of the World* tells about salad plants.

CHAPTER IX

SUGAR AND SWEETS

Section 1. Sugar — Candies

405. Sugar a valuable food. — Sugar is not only a food pleasing to the taste, but is one of the best of heat givers and force producers. This is why children, naturally more active than grown people, are more eager for sugar.

406. Common sense in the use of sugar. — Because sugar dissolves readily, small quantities of it are easily digested; but if more than a little is taken at once, some of it is likely to ferment in the stomach, causing distress, and interfering with the digestion of other foods. It may ferment in the mouth and make the teeth decay.

Do not eat sweets just before meals; they will take away your appetite for more substantial food. Use sugar sparingly on oatmeal and in beverages; a little tastes as sweet as more to one who has not blunted his taste by using too much. Do not be tempted by sweets in the bakeshop; they are bad for teeth, complexion, and health.

407. Where sugar comes from. — There are many kinds of sugar, but the kind we usually mean when we speak of sugar is made from the juice of the sugar-cane. This juice also contains gluten, which makes it a better food than manufactured sugar is.

408. The sugar-cane. — The sugar-cane is a tropical plant belonging to the family of grasses. It looks like corn, but grows sometimes twenty feet high. The stalk contains a loose, spongy substance, filled, in the growing plant, with sap. About the time that the blossoms appear, the sap becomes sweet and rises in the stalks to feed the ripening plant. The stickiness of the stalks is the sign that the cane is ready to be cut down.

Sugar Making and Refining

409. Raw sugar. — The sweet juice obtained by crushing the cane-stalks between rollers is boiled to a thick syrup in large copper vessels. As it slowly cools, part of it separates into crystals. The liquid that will not crystallize is called **molasses**. After draining this off, **raw sugar**, a coarse, impure brown product, is left.

410. Experiment to illustrate crystallization. — Dissolve in hot water as much sugar as it will take up. This makes what is called a **concentrated solution**. Boil this till syrupy. Then hang in it several pieces of worsted, and let it cool slowly. What forms on the worsted? This is the method used in making rock candy.

411. Experiment with molasses. — Test molasses with red and with blue litmus paper. Is it acid or alkaline? Add to a little of the molasses in a test-tube a pinch of baking-soda, and test again. What does this test show? What does the foaming of the molasses show? (§§ 193 and 197.)

Soda is used with molasses as it is with sour milk to raise batters. — If only a little molasses is called for by the recipe, enough soda must be used to neutralize this, and as much baking-powder added as is required to make the batter light.

412. Experiments to illustrate the refining of raw sugar. — A. Dissolve some raw sugar in water, and pour it through a fine strainer lined with flannel. Which is clearer, the original liquid or the filtrate?

B. Plug the bottom of a flower pot with a sponge, fill it half full of charcoal, and pour through this the filtrate from the strainer. What has become of the brown coloring matter? Taste the filtrate. Where is the sugar?

413. How sugar is refined. — In the sugar refineries of the United States raw sugar is mixed with hot water, treated with lime to neutralize any acid present, and then filtered, first through flannel, afterward through a bed of charcoal. Next it is boiled in vacuum pans. These are covered vessels from which part of the air is exhausted. Under this reduced air pressure the sugar solution can be evaporated to a thick syrup without danger of burning it. (§ 42.)

414. Trade names of sugars. — Granulated sugar is obtained from this syrup by putting it into centrifugal machines, rapidly revolving cylinders which throw out the uncrystallizable part of the syrup, leaving a mass of white crystals.

Cut or **block sugar**, the purest kind, is made by running the syrup into molds, where it hardens. The glistening crystalline cones are then sawed into cubes. An inferior kind of block sugar is made by pressing granulated sugar into cubes. These are more regular in shape than the blocks of sawed sugar, and lack their rough surface. **Powdered sugar** is made by grinding the fragments broken off in sawing block sugar. **Brown sugars** are less refined grades.

415. Other kinds of sugar. — Honey is the purest natural form of sugar. **Beet sugar** is made from the juice of the sugar beet. **Maple sugar** is obtained by simply boiling down the sap of the sugar maple until it thickens, and then cooling it in molds. **Grape sugar**, or **glucose**, appears as a yellowish, grainy substance on raisins and other dried fruits. **Commercial glucose** is manufactured from starch by boiling it with an acid. It is not so sweet as cane sugar, but wholesome, and even more readily digestible. It is too moist to be convenient for household use, but is used largely by candy makers. What other kinds of sugar do you know of?

CANDY

416. Pure candy can be made at home more cheaply than it can be bought. Much of the candy sold is made of impure sugar and contains coloring matter that is unwholesome, and, in some cases, poisonous.

417. The effect of heat on sugar; experiment. — Heat a little sugar in a test-tube, noting the changes in its appearance. Continue heating till there is no further change.

Sugar becomes at 365° F. a clear, colorless liquid, **barley sugar**. At 420°, the sugar turns brown. It is now **caramel**. If heated still further, its oxygen and hydrogen gradually pass off as steam, leaving only a lump of black carbon, one-fourth the weight of the original sugar.

418. Boiling sugar to the thread, soft ball, hard ball, and crack. — Sugar is heated to different degrees for different kinds of candy. For some, it is boiled till a drop let fall from the spoon spins itself into a fine thread; for some, to the "soft ball" stage, when a little dropped into water can be rolled into a soft ball between your fingers; for others, till it makes a "hard ball" in cold water. When it becomes brittle upon being dropped in water, it is said to be boiled to "the crack."

Candy Recipes

Molasses Candy

Cook two cupfuls of molasses in a *buttered* iron kettle until it forms a hard ball in cold water. Turn out on a buttered plate. This may be pulled just before it hardens. *One tablespoonful of vinegar* may be used in this candy.

Butter Taffy

Brown sugar,	2 cupfuls.
Water,	6 tablespoonfuls.
Butter,	2 tablespoonfuls.
Grated cocoanut or chopped nuts,	¾ cupful.

Cook the sugar and water together, stirring, till the sugar dissolves. Let this syrup come to the boiling-point, then add the butter and cook to the "soft ball" stage (about ten minutes). Add cocoanut or chopped nuts. Stir until it thickens, and pour quickly into buttered pans.

PEANUT BRITTLE

Sugar,	1 cupful.
Peanuts (shelled and pounded),	1 cupful.

Put the peanuts on a buttered tin plate and set on the back of the stove. Make a caramel of the sugar. Stir in the peanuts very quickly, pour it into the pans, and spread it thin by slightly tilting them.

You can read more about sugars in *Foods and Beverages*, pp. 215–231, and about preserves and candy, pp. 232–235. For an experiment in crystallization to try at home, see p. 236 of *Early Chapters in Science*. For directions for making other kinds of candy, see *The Century Cook-book*.

Section 2. Cakes and Desserts

Few things are impossible to diligence and skill. — SAMUEL JOHNSON.

419. Under the head of "Cakes and Desserts" come most of the dishes that contain enough sugar to make sweetness their predominant taste. With the sugar other ingredients are combined in various ways.

Cakes and desserts; new applications of familiar principles. — Compare the recipe for Egg Muffins with the recipe for Standard Cake in the table below. For convenience the former is repeated at the head of the table. Cake, you see, is only rich bread, some cakes being richer than others, — that is, having more butter, sugar, and eggs in proportion to the flour. Which is the richest cake in the table? Which is the plainest?

420. Two classes of cakes: butter and sponge cakes. — All cakes belong to one of two classes, **butter cakes** and cakes without butter, or **sponge cakes**. Several kinds of cake can easily be made from one recipe, by varying the flavorings, spices, and fruits, by baking the same mixture in pans of different shapes, by frosting the cake or leaving it plain.

421. Every one that cooks should understand the principles of mixing and raising batters sufficiently to know when she reads a new recipe whether or not it will turn out well, and whether it is extravagant or reasonable.

422. **General rules for the proportions of ingredients in cakes.** — In general, a cake should contain not more than one-third to one-half as much butter as sugar, and about half as much liquid as flour. Remember that butter, or other shortening, counts as liquid, since it melts in the oven. Sour milk and molasses do not thin a mixture as much as sweet milk or water. A cake with fruit should be a little stiffer than one without. **One cupful of molasses requires one teaspoonful of soda**. How much soda is required for one pint of sour milk? (§ 197.) How much baking-powder for one cup of flour? (§ 201.) The more eggs there are in a cake, the less baking-powder is needed.

423. Compare Standard Cake with 1, 2, 3, 4 Cake. How do you account for their having the same quantity of milk while the flour in the latter recipe is double that in the former? Why is there less sugar in Spice Cake than in 1, 2, 3, 4 cake? Account for the absence of baking-powder in Spice Cake and Gingerbread. Why does Sponge Cake require no baking-powder? Notice some of the other ways in which recipes differ, and account for these in as many cases as you can.

Directions for mixing Cake

(See Breaking and Beating Eggs, p. 89.)

Note. — Read "Hints on How to Work," p. 56, "Batters and Doughs," p. 106, and "Helpful Hints about Mixing and Baking Quick Breads," p. 110. What is said about quick breads applies equally to cakes.

424. How to mix butter cakes. — Cream the butter and sugar thoroughly; unless they become partially liquefied before the other ingredients are added, the cake will be coarse grained, perhaps heavy. Add the yolks of the eggs, beaten slightly, then a little of the milk, then part of the flour with the other dry ingredients sifted with it, a little more milk, and so on till all the flour and milk are stirred in, taking care to keep the mixture always of about the same degree of stiffness. Fold in the whites beaten very stiff. Add the flavoring and beat the mixture well. If fruit is to be added, fold it in, well floured, last of all.

Compare these directions with those for mixing Egg Muffins. What difference do you observe? For Cottage Pudding the butter is melted. Note the proportion of butter to sugar, and think why this is done.

425. How to mix sponge cake. — Beat the yolks till thick and lemon colored. Beat the sugar into them, add the flavoring (and other liquid, if the recipe calls for any). Beat the whites till stiff and dry; slip them into the mixing-bowl; sift the flour over them, and fold all together. Sponge cake beaten after adding the flour will be close and tough.

426. Mixing molasses cakes. — Mix milk and molasses and stir them into the flour. Add soda last, sifted with a little of the flour reserved for this purpose.

427. Fruit must be well floured and added last, or it will sink to the bottom of the loaf. To **stone raisins,** cover them with boiling water. When they become soft, squeeze out the seeds. Cut citron in thin strips.

(For the preparation of currants, see § 235.)

428. Directions for baking. — The baking is the most important part of cake making. No matter how skilfully cake is mixed, it will be spoiled if not properly baked.

429. Greasing cake pans. — Grease cake pans well with melted butter (§ 189). Sponge-cake tins need not be greased; line them with ungreased paper.

430. The oven. — The oven should be less hot for cake than for bread. It is right for butter cakes baked in loaves, if it turns a piece of writing paper light brown in five minutes. For small cakes it should be hotter. Sponge cake may be baked either in a hot oven or in a moderate one, allowing it forty to fifty minutes in the latter case. Loaf cake requires about one hour. Small cakes and layer cakes, about twenty minutes. When cake is done it shrinks from the pan, and a broom straw run into it comes out clean. Take it at once from the pan, and set it on a clean towel to cool.

431. The points of good cake. — A good butter cake is smooth on top and an even golden-brown all over. It should round up slightly in the middle, but not sink from the edges and rise sharply with a crack on the top. Such a cake either contains too much flour or has baked too fast. The inside of the loaf should be slightly moist, but not sticky, and of a fine, even grain, with no heavy streaks. Coarse-grained cake is usually caused by lack of beating or by too slow an oven. Sponge cake should rise in the oven, and settle to a *level*, not lower, after being taken out. The top crust should be slightly sugary, the texture looser than that of butter cake, but tender and velvety. Too much flour makes sponge cake tough.

432. Remarks on the table of cake recipes. — While, for convenience, the ingredients for each cake and pudding are given separately in the table, it can readily be seen that Cottage Pudding is merely a sweet muffin mixture, that Suet Pudding is Standard Cake, made with suet instead of butter, and molasses instead of sugar; that Spice, Gold, and Silver Cakes are modifications of Cup Cake; and that Whole-wheat Gingersnaps are made by varying slightly the recipe for Sugar Cookies.

Butter or **drippings** may be used instead of suet; in this case, especially if the pudding is made with water, add a little extra flour.

Light Fruit Cake is made by adding to either Standard

TABLE GIVING PROPORTIONS OF INGREDIENTS FOR CAKES AND BATTER PUDDINGS

Name.	Shortening.		Sweetening.		Eggs.		Liquid.		Leavening Material.		Flour.	Flavoring. Seasoning. Spice.	Fruit.	Special Directions.
	Butter.	Suet.	Sugar.	Molasses.	Whites.	Yolks.	Milk.	Water.	Baking-powder.	Baking-soda.				
Egg Muffins.	1 tb.				1	1	¾ c.		2 t.		1½ c.	Salt, ⅜ t.		Mix and sift flour, baking-powder, and salt. Stir into them the milk, beaten egg, and the butter, melted. Last, fold in the beaten white.
Cottage pudding.	2 tb.		½ c.		1	1	¾ c.		2 t.		1½ c.	Salt, ¼ t.		Beat the yolk; beat into it the sugar; stir in the milk, and the flour, sifted with the salt and baking-powder. Last, fold in the white, beaten stiff.
Standard Cake.	¼ c.		¾ c.		2	2	½ c.		1½ t		1½ c.	Vanilla, ½ t.		
Suet pudding.		Suet ½ c.		½ c.			½ c. or	½ c.		½ t.	1½ c.	Cinnamon, ½ t. Allspice, ¼ t. Salt, ¼ t.	Stoned and chopped raisins and currants, mixed, ½ c.	Free the suet from membrane, chop it fine, and mix it with the milk and molasses before stirring them into the dry ingredients. Steam in a greased pudding mold for 3 hours. Fruit may be omitted. Serve with Hard Sauce.
Gingerbread.	2 tb. melted.			¾ c.	1	1	½ c. sour.			1 t.	2 c.	Ginger, 1 tb.		
Cup Cake, or 1, 2, 3, 4 Cake.	1 c. sc.		2 c.		4	4	½ c.		3 t.		3 c.	Vanilla, 1 t., or grated nutmeg, ½ t.		This recipe makes two loaves.
Spice cake.	1 c. sc.		1 c. brown.	¼ c.	3	3		¾ c.		¼ t.	3 c.	Cinnamon, 1 t. Allspice, clove, and nutmeg, mixed, 1 t.	Raisins, ½ c. Currants, ¼ c. Citron, ¼ c.	Mix like any butter cake, adding the molasses to the butter and sugar. Remember to add soda last.
Gold cake.	½ c. sc.		1¼ c.			4	½ c.		2 t.		2 c.	Grated nutmeg, ¼ t.		Make Gold and Silver cake at the same time, to use both parts of the eggs.
Silver cake.	½ c. sc.		1¼ c.		4		½ c.		2 t.		2 c.	Almond extract, ½ t.		
Sponge Cake.			1¼ c. powd. or gran.		5	5					1¼ c.	Juice and grated rind of half a lemon. Salt, ¼ t.		
Baking-powder sponge cake.			1½ c.		3	3		½ c.	2 t.		1¾ c.	Salt, ¼ t. Lemon extract, ½ t.		
Sugar Cookies.	½ c.		1 c.		1	1	¼ c.		2 t.		Enough to roll out, about 3 c.	A sprinkling of nutmeg after cookies are cut.		Mix like butter cakes. When stiff enough to roll, turn out on a floured board, and roll out, part at a time, one-fourth of an inch thick. Keep board and pin well floured. Bake 15 minutes on shallow pans.
Whole-wheat ginger snaps.	½ c.		1 c.	2 tb.	1	1	¼ c.		1 t.	¼ t.	Whole-wheat Flour, about 3 c.	Ginger, 1 tb.		Roll as thin as possible.

or Cup Cake *half a cup of raisins* and *one-fourth cup each of currants and citron.*

Chocolate Layer Cake. — Bake Standard Cake in three jelly-cake tins, and spread chocolate frosting on top and between the layers.

Plain Spice Cake is made by omitting ginger from the gingerbread recipe, and adding spice as in Spice Cake.

Coffee Cake. — Use coffee instead of water in Spice Cake.

Points to be Remembered in Cake-making

433. 1. Use only the best materials, — fresh eggs, *fine* granulated sugar, good butter. Otherwise the cake will not pay for the trouble of making it.[1]

2. If you cannot get fine sugar, sift what you have. Sponge cake is better for having both flour and sugar sifted separately several times.

3. See that the fire is so arranged that the oven will be ready when the cake is mixed.

4. If very little butter is used, melt it and add it to the sugar, or to the sugar and eggs. In cold weather warm the bowl slightly with hot water before creaming butter. A teaspoonful or two of milk may be added to the butter and sugar, if they are very slow to cream.

5. Cake containing molasses burns easily. Bake such cake and any thick loaves requiring long baking in tins lined with greased paper.

[1] Pastry flour makes the tenderest cake, but bread flour gives satisfactory results. If you substitute bread flour for pastry flour in a recipe calling for the latter, use but seven-eighths of the measure given.

6. If cake browns within fifteen minutes after it is put into the oven, the heat is too great. Reduce it, or make a tent of brown paper over the pan, shaped like this _|‾|_. A pan of water put into the oven will reduce the heat. Explain why.

Recipes for Cake Frostings and Fillings

Quick Frosting (*Boston School Kitchen Text-book*)

Powdered sugar,	1 cupful.
Boiling water,	1 tablespoonful.
Lemon juice,	1 tablespoonful.

Mix these ingredients, and add more boiling water, a few drops at a time, till the sugar settles when you cease stirring. Spread on cake while the latter is hot.

Soft Frosting

Granulated sugar,	½ cupful.	Water,	¼ cupful.
White of 1 egg.		Lemon juice,	1½ teaspoonfuls.
Lemon extract,	½ teaspoonful.		

Stir the sugar and water in a saucepan till the syrup boils, then boil it *without stirring* till it threads (§ 418). A little before it reaches this point, beat the white-of-egg stiff. When the syrup threads, turn it into the egg in a fine stream, beating till smooth, but not thick enough to drop. Flavor, and pour over cake, spreading with a knife. If beaten too long, thin with a few drops of lemon juice or boiling water, and wet the knife in cold water.

Chocolate Icing or Filling

Granulated sugar, 1 cupful. Unsweetened chocolate, 2 ounces.
Water, 2 tablespoonfuls.

Scrape the chocolate fine, mix it with the sugar and water, and simmer about twenty minutes, or till thick enough to spread. Spread while hot on the cake.

Recipes for Pudding Sauces

Lemon Sauce

Sugar (brown or white),	½ cupful.
Boiling water,	1 cupful.
Cornstarch,	1 tablespoonful.
Butter,	2 tablespoonfuls.
Lemon juice,	1 tablespoonful.

Mix the sugar and cornstarch, stir into them the boiling water, and boil five minutes. Take from the fire, and add butter and lemon juice.

Variations

1. Boil the thinly shaved rind of half a lemon in the water, straining it out before adding the water to the sugar and cornstarch.

2. Add one well-beaten egg after taking the sauce from the fire.

A fruit sauce may be made by thickening the syrup from canned fruit with cornstarch. If no more sugar is required, how will you keep the cornstarch from lumping?

Hard Sauce

Butter,	¼ cupful.	White of 1 egg.
Powdered sugar,	1 cupful.	Vanilla extract, 1 teaspoonful.

Grated nutmeg, ⅛ teaspoonful, or ⅛ of a nutmeg.

Cream butter and sugar, add the white-of-egg unbeaten, and the vanilla, and beat together thoroughly. Heap roughly in a small, glass dish, grate nutmeg over the top, and keep cool until served.

DESSERTS

434. The making of elaborate desserts, except for special occasions, is a waste of time. A rich pudding is unsuitable after a hearty dinner; fruit is the best dessert after such a meal. Jellies, custards, creams, and combinations of these with fruit, when a part of the meal and not eaten to please the taste after hunger is satisfied, are desirable and wholesome.

435. Remarks about the desserts for which recipes are given. — Some dessert dishes have been given under other headings. Caramel Custard is a variation of Cup Custards (p. 91). Bread Puddings are baked custards thickened with bread crumbs. They should be soft, like custard. In making soft custard, use the same care that you have in making sauces thickened with eggs. In using tapioca[1] or cornstarch, see that the starch is thoroughly swollen and cooked. What other reason is there for cooking it thoroughly? Starch

[1] Tapioca is manufactured from the root of *manioc*, a tropical tree. It is almost pure starch.

mixtures stiffen in cooking; if to be molded, take care not to have them more than just stiff enough to hold their shape when cold.

Caramel Custard

Eggs, 3.	Extract of vanilla, ½ teaspoonful.
Sugar, 1½ tablespoonfuls.	Scalded milk, 1 pint.
Sugar for caramel, 1 cupful.	Water, 1 tablespoonful.

Melt sugar for caramel, stirring it constantly until light brown in color. Reserve one-half of it. Butter custard cups and pour a little caramel into each; tip the cups so as to coat them with it.

After beating the eggs slightly, beat in the sugar, stir in the milk and vanilla, and fill the cups nearly full. Bake like cup custards, and when cold turn them out, one on each serving plate. Serve with cold Caramel Sauce.

To make caramel sauce, add to the caramel reserved half a cup of *boiling*[1] water, and keep it hot till the caramel dissolves.

Bread-pudding Recipes

Plain Bread Pudding

Scalded milk,	1 quart.	Stale bread crumbs without crust,
Sugar,	½ cupful.	grated or rubbed, 2 cupfuls,
Eggs,	2.	or
Salt,	¼ teaspoonful.	Dried crumbs, 1 cupful.

Beat the eggs slightly; beat into them the sugar and add the milk, spice, and salt. When the crumbs

[1] If the water is not very hot when poured in, the caramel will spatter.

T

become soft, turn into a buttered dish, and bake until a knife inserted in the pudding comes out clean.

Variations of Bread Pudding. — 1. Add *one cupful of boiled raisins, citron, and currants mixed.*

2. Separate the eggs, add only the yolks to the pudding. Beat the whites stiff; beat into them *two and a half tablespoonfuls of powdered sugar*, spread them roughly over the pudding, and return it to the oven for two minutes, or till a delicate brown.

3. **Queen of puddings.** — Like variation 2, except omit spice, flavor with *one and a half tablespoonfuls of lemon juice* and spread it over with *jam* or *jelly* before covering it with meringue.

Plain Soft Custard

Scalded milk, 2 cupfuls.	Sugar, 6 tablespoonfuls.
Egg-yolks,[1] 3.	Salt, ⅛ teaspoonful.
Vanilla, ½ teaspoonful.	

Beat the eggs slightly, beat into them the sugar, and salt, and stir in slowly the hot milk. Pour into a double boiler, and cook, stirring constantly, until the custard is thick enough to coat the spoon. Strain at once through a fine strainer into a cold pitcher. When cool stir in the vanilla, and pour into a glass dish or glass custard cups for serving.

If the custard cooks a moment too long, it will curdle.

[1] Whole eggs may be used, but they do not make so smooth a custard. When eggs are expensive, two yolks may be used instead of three, half a tablespoonful of cornstarch mixed with a tablespoonful of cold milk being stirred into the rest of the milk, and scalded with it.

It is safer to take it from the fire before you think it *quite* done, as the heat of the boiler cooks it even while it is being turned out. If it begins to curdle, set the upper part of the boiler immediately into a pan of cold water, and beat the custard energetically with a Dover egg-beater till smooth.

Apple Tapioca

Pearl or granulated tapioca,	4 tablespoonfuls.
Tart apples,	6.
Boiling water,	1 pint.
Sugar,	½ cupful.
Cinnamon or nutmeg,	¼ teaspoonful.
Salt,	a few grains.

Soak the tapioca over night in one cupful of cold water. Core and pare the apples, slice one of them, and cook it with the tapioca in the boiling water till the latter is translucent. Place the rest of the apples upright in a buttered baking-dish, sprinkle over them the sugar and spice, pour over them the tapioca mixture, and bake till they are tender. Serve with sugar and cream.

Cornstarch Meringue

Milk,	1 quart.	Granulated sugar,	¼ cupful.
Cornstarch,	¼ cupful.	Vanilla extract,	1 teaspoonful.
Eggs,	3.	Powdered sugar,	6 tablespoonfuls.

Scald the milk in a double boiler, and stir into it the cornstarch just moistened with cold water. Cook directly over the heat till it comes to the boiling-point; then remove at once. Separate the eggs; beat the yolks slightly by themselves, then with the granulated sugar; stir these into the thickened milk, cook all together for one minute, add the vanilla, and pour into a baking-dish.

For the meringue. — Beat the whites till frothy, add the powdered sugar, and beat again. When stiff enough to hold its shape, spread the meringue over the pudding, heaping it in the middle, sprinkle with powdered sugar, and brown slightly in a warm oven. Serve cold.

Creamy Rice Pudding

Milk, 1 quart.	Sugar, ½ cupful.
Rice, ½ cupful.	Grated nutmeg, a few grains.

Salt, ¼ teaspoonful.

Wash the rice. (§ 138.) Mix the ingredients in a pudding-dish and bake for three or four hours, stirring in the brown crust as it forms. Or cook slowly for a shorter time in a saucepan on the stove, stirring often. Serve cold.

Half a cupful of raisins may be added to this recipe.

Section 3. Ice-cream and Water-ices

The daintiest last to make the end most sweet.— Shakespeare.

436. In summer no other dessert is so welcome as ice-cream. With bread and butter, it is a sufficient lunch on a hot day.

437. Ice and salt form a freezing mixture. — When ice and salt are mixed, a double action takes place: the salt makes the ice melt, and the melting ice dissolves the salt. We have already observed that heat is used up in changing matter from the solid to the liquid form (§§ 48 and 100). Melting ice and salt reach a temperature below the freezing-point of water. If we pack them around some other liquid, they draw the heat from it so fast that it freezes. This is why we use a mixture of salt and ice to freeze ice-cream.

Experiment. — Fill a cup with cracked ice; take the temperature of the ice with a thermometer. How cold is the ice? Mix four tablespoonfuls of rock-salt with the ice, and watch the thermometer. When the mercury stops falling, see what degree of cold it registers.

Directions for freezing Cream

438. Making ready. — Put the ice into a strong canvas bag, or wrap it in a piece of stout cloth, and pound it fine. Use rock-salt; fine salt will not do. Scald can, dasher, and cover. Fit the can into the socket in the pail, pour in the mixture to be frozen, put on the cover, adjust the cover to the cross-piece, and turn the crank to make sure that all is in working order.

439. Packing. — Fill the space between the can and the pail with alternate layers of ice and salt, putting in three measures of ice, then one of salt. The ice and salt should come a little above the height at which the cream will stand in the can. As the mixture expands in freezing, fill the can not more than three-fourths full. Pack ice and salt solidly, turning the crank a few times to let the mixture settle.

440. Freezing. — Turn the crank slowly and steadily until the cream is rather stiff, then turn more rapidly. Do not draw off the water unless it stands so high that there is danger of its getting into the can. The cream should take about twenty minutes to freeze; cream frozen too rapidly, or not well stirred, is coarse-grained.

When the dasher turns very hard, the cream is sufficiently frozen. Remove the dasher, wipe the outside of the cover and the upper part of the can (to avoid letting in any salt water), and take off the cover. Scrape the cream from the sides of the can, and pack it down level. Put a cork into the hole in the cover, and replace it. Draw off the salt water through the hole near the bottom of the pail, repack with ice and salt, and cover with an old blanket or a piece of carpet. Let the cream stand in the freezer at least one hour, two, if possible, to "ripen" before serving. This greatly improves its flavor.

441. Water-ices. — Freeze water-ices like cream, except that the crank need not be turned constantly. A few turns every five minutes is enough.

442. How to make ice-cream without a freezer. — Ice-cream can be made in a tin pail packed in a wooden pail. Whirl the pail round by its handle, taking off the cover occasionally to scrape down and beat the cream. A small quantity can be made in a baking-powder can set into a pail or saucepan. Before using the can, fill it with water to see if it leaks. Most cans require soldering. A tinman will do it cheaply, or you can get a stick of solder and do it yourself.

Recipes

Plain Ice-cream

By varying the flavor this cream may be used as the foundation for any kind of ice-cream. It may be made with three eggs and no cream, but even half a cupful of cream is a great improvement.

Milk, 1 pint.	Flour, 2 tablespoonfuls.
Sugar, 1 cupful.	Cream, 1 pint.
Eggs, 2.	

Scald the milk, mix the sugar, flour, and eggs together, and make a custard according to the directions for making Soft Custard (p. 274). When cold, stir the cream into it, and freeze.

Flavorings.—Vanilla Cream. Add one tablespoonful of vanilla, just before freezing. **Chocolate Ice-cream.**—Add four ounces of unsweetened chocolate, melted. **Strawberry Ice-cream.**—Add one box of berries, crushed. **Peach Ice-cream.**—Add one quart of peaches, pared and mashed.

Lemon Ice

Lemons, 4 large ones.	Sugar, 1¼ pounds.
Oranges, 1.	Water, 1 quart.

Make a syrup of the sugar and water by boiling them together five minutes. Add the grated rind of the orange and of one lemon. Add the juice of the orange and lemons. When the syrup is cool, strain and freeze.

CHAPTER X

THE PRESERVATION OF FOOD

Section 1. The Spoiling of Food: What Bacteria have to do with it

Vast hordes of tiny toilers are working in our service night and day to keep the world wholesome and all the races of beings supplied with life-stuff. — T. M. Prudden.

443. Microscopic plants. — We have learned that mold is a tiny plant, and that yeast and bacteria belong to plant families related to it (pp. 32, 33). Bacteria, we have found, may do us harm. What precautions have we used to keep them, so far as is possible, out of our houses, and particularly, out of our food and drinking-water?

It is a mistake, however, to think all bacteria harmful.

A Study of Bacteria

444. Experiment in growing bacteria. — Expose a little clear, cool soup-stock to the air for a few minutes; then cover it with a piece of clean glass, set it aside in a rather warm place, and look at it every day. What happens to it? How does it smell after a few days? What do we say has happened to it?

445. Microscopic examination. — **A.** Examine under a microscope a speck from one of the cloudy spots on the soup-stock, or any other spoiled food. What is it made up of?

B. Examine from time to time a drop from a glass of water allowed to stand undisturbed. The drop is crowded with little living things. Can you pick out some shaped like lead-pencils, others like eggs or billiard-balls, and still others like corkscrews? Make sketches of them.

446. Bacteria compared with yeast. — Bacteria are single-celled forms of plant-life, like yeast; and, like it, they multiply when they have warmth and food and moisture. They exist in far greater numbers than yeasts do, however, swarming in the air, in water, in the ground under our feet. One kind is so small that fifteen hundred in a row would hardly reach across the head of a pin.

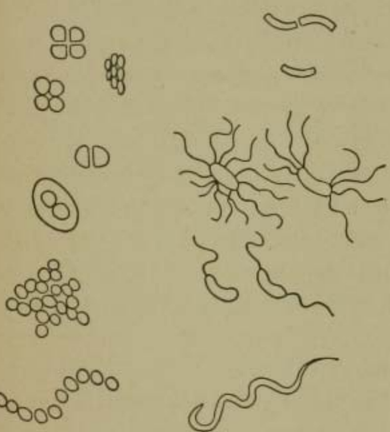


FIG. 15. — Shapes and groupings of different kinds of bacteria (much enlarged).

FIG. 16. — Bacteria causing typhoid fever, as seen under the microscope.

447. The life-history of bacteria. — Bacteria multiply by dividing themselves in two, repeating this process so frequently that were there food and room enough for them all, the world would soon be crowded with bacteria. But there is no danger of this coming to pass; for they die by millions constantly, one kind preying upon another, while all kinds are destroyed by the occurrence of conditions unfavorable to life. Cold checks their activity and growth; the temperature of boiling water, sometimes a lower temperature, kills them. Dry heat is not so fatal to them as moist heat. They have a way, when food and water are scarce, of entering upon a "resting-stage." This corresponds, in a way, to the "going to seed" of bigger plants when winter comes on. The lively, growing bacteria disappear, but not till after they have produced spores, as yeast does when it gets old (§ 225). These little spores are hard to kill; they seem able to last forever, ready to spring into life when right conditions return.

448. Fermentation and putrefaction. — The life-history of bacteria closely resembles that of yeast. Let us compare the action of yeast upon sugar with the action of bacteria upon soup-stock. The first is fermentation, the second **putrefaction**. In both cases organic matter is split into something simpler, but fermentation improves the flavor of the dough, and produces carbon dioxide to make it porous, while putrefaction spoils good food, and generates unpleasant-smelling gases. Some bacteria cause undesirable fermentation; for example, that which takes place in fruit improperly canned.

449. Death and decay are necessary to life. — On first thoughts the work of bacteria, particularly the bacteria of putrefaction, does not compare favorably with the work done by yeast. But if there were no decay, the surface of the earth would become loaded with dead matter in useless form, and after a time no plants would grow because the earth would have no food for them. You see now that we could not live without bacteria. These "tiny toilers" feed upon what has been called the "broken-down remnants of things once alive," reducing them, finally, to inorganic substances suitable to be taken up by plants and again made into living matter. Thus bacteria form an invisible link between us and the dust; a link essential to the continuance of life on the globe.

450. Ways of preserving food; preservatives. — Conditions favorable to the growth of yeast being, in general, favorable to the growth of bacteria, a simple rule to keep the latter from troubling us is to treat them in just the opposite way from that we took to make yeast thrive and grow. That is to say, keep food cold, or dry it, or cook it. Cooking is effective for a time only, unless the food cooked be immediately sealed up so that no other bacteria can reach it. A fourth way of preserving food is to add a disinfectant (§ 59) to it if it is liquid, or to coat it with a disinfectant if it is solid.

Disinfectants used on food are called **preservatives.** Preservatives injurious to health are often used in canning factories and by dealers in meat, milk, and other food.

The process of destroying bacterial life is called **sterilization**, and anything that has undergone this process is said to be **sterilized**.

Salt has a preservative effect on food, as has sugar, when used in large quantities.

Dr. T. Mitchell Prudden has written three interesting little books about bacteria: *The Story of the Bacteria*, *Dust and Its Dangers*, and *Drinking-water and Ice Supplies*. The last is perhaps the simplest.

"The Bacteriology of Household Preserving," *American Kitchen Magazine*, September, 1898, is practical and helpful.

Section 2. Canning and Jelly-making

451. We do well to take a lesson from the bees, and in the long summer days to store up food for the winter. If we can kill the bacteria in food, and then seal it up so that no more can get in, it will keep indefinitely. This we do in canning.

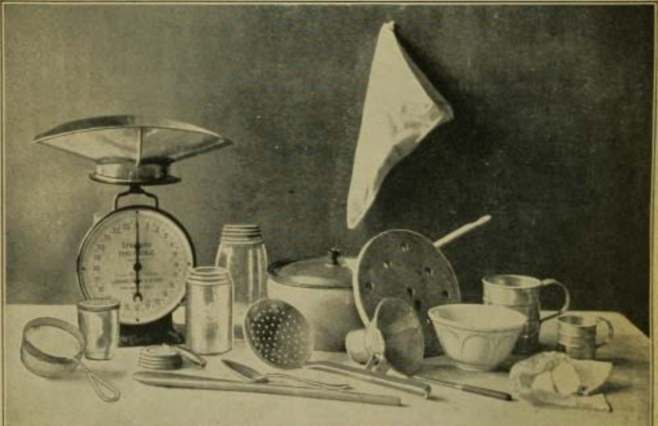
CANNING

452. Can each kind of fruit in its season, when it is best and cheapest. Select it under-ripe rather than over-ripe. To insure success in preserving it observe carefully the following directions:—

453. Preparing the jars.—For a small family use pint jars. Buy jars with tight-fitting covers, and fit them each year with new rubber rings. Old rubber

PLATE XII.

FILLING FRUIT-JARS.



Scales Jars Jelly-bag Measures
Jelly-tumbler Saucepan, with perforate i wooden mat to stand jars upon
Cover and ring
Strainer Skimmer Funnel Paraffin
Silver spoon
Wooden spoon

UTENSILS USED IN CANNING AND JELLY-MAKING.

becomes porous, and lets in air. Fit each jar with a ring and a cover; pour water into them, and invert them to see if they are air-tight. If not, do not use them. Sterilize jars and covers by placing them in a dishpan of cold water and letting this slowly come to the boiling-point, and boil fifteen minutes.

454. Preparing and cooking the fruit; strawberries. — Wash and hull the berries; weigh them, and add one-third of a pound of sugar for every pound of fruit. Let them stand for forty-five minutes or longer. Cook the berries slowly until the juice is thick and syrupy, and the berries soft. Remove scum as it rises.

455. Peaches. — Pare the peaches, dropping them into cold water. Why not leave them in the air? Make a syrup, allowing two cups of water and one pound of sugar to three pounds of peaches; boil it fifteen minutes. Cut peaches in two, stone them, and put peaches and stones into the syrup. The flavor of peaches is improved by cooking the stones with them. Cook the fruit until, when tried with a knitting needle, it is found to be soft.

Pears, cherries, apples, and **plums** may be canned like peaches.

456. General directions for filling jars. — Remove the jars from the boiling water, and stand them on a cloth wet in boiling water. What would happen to the jar if set while hot on a cold table? Place a silver spoon in the jar to be filled first. Silver, being a good conductor of heat, absorbs heat from the fruit, thus further lessening the risk of the jar's breaking. Dip a rubber ring into boiling water (to sterilize it), and place it on the jar. Dip a silver spoon into boiling water, and with it fill the jar with fruit; then fill the jar to overflowing with syrup. With the handle of the spoon press the fruit away from the side of the jar, that any air-bubbles between may escape. Put on the cover, and screw it tight. Turn the jar upside down; if syrup oozes out, remove cover and rubber, put on another rubber, refill with boiling syrup, and again screw down the cover. The jars must be sealed air-tight.

Directions for Canning Tomatoes

Select small, round, smooth tomatoes: scald and peel them. Pack them in sterilized jars and fill the jars with boiling water. Sterilize the covers and put them on without screwing down. Set the jars on small blocks of wood in a kettle of cold water, and let the water heat slowly for fifteen minutes. Remove the covers, fill the jars to overflowing with boiling water, put on the rubber rings, and screw the covers down.

JELLY-MAKING

457. Before the principles of sterilizing were understood, fruit was preserved by cooking it with its weight of sugar. Only jellies are commonly done in this way now.

458. Pectin. — The juice of fruits that contain considerable **pectin** can be made into jelly. Pectin, although a carbohydrate, in some ways resembles gelatin. It dissolves in boiling water, and stiffens on cooling. It is most abundant in the harder parts of the fruit, the core and skin. From what animal tissues is gelatin obtained?

Apples, quinces, crab apples, currants, and **grapes** *make the best jellies.*

General Directions for making Jelly

459. Wash the fruit, and remove stems and imperfections. Cut large fruit into pieces. With watery fruits, such as grapes and currants, use no water. With apples and quinces use enough water to cover them. Cook the fruit until the juice flows, crushing it with a spoon. Remove it from the fire and strain it through a pointed bag hung from the ceiling or between two chairs. Do not squeeze the bag at first; when nearly all has strained through, the bag may be squeezed. Keep this last juice by itself; the jelly made from it will not be clear, but can be used for jelly-cake, etc. Measure the juice, and measure out an equal quantity of sugar. Reheat the juice, add the sugar, and let boil. As scum forms remove it. When a little of the jelly dropped on a cold plate thickens slightly, pour into jelly glasses and set aside till firm.

For **quince jelly,** cut quinces into quarters without paring or coring, cover with water, and cook until soft. Strain, and proceed according to General Directions for Making Jelly.

460. Jelly must be covered to protect it from mold. Paraffin is convenient for this purpose.

To cover jelly with paraffin. — Melt the paraffin in a saucepan and pour it over the jelly to the depth of about one-eighth of an inch. If, on cooling, any bubbles form, exposing the surface of the jelly, add another coat of paraffin.

Helpful Hints about Canning and Jelly-making

461. 1. Use an enamelled-ware saucepan, and a wooden spoon. Why?

2. Use the best granulated sugar obtainable; avoid any on which a bluish scum forms in boiling.

3. After filling fruit-jars, let them stand upside down over night. In the morning, screw the tops down as tightly as possible, wipe the jars carefully, label them, and put them away in a cool, dark place.

4. Fruit that is unusually watery, as it is likely to be just after a rain, may not make good jelly. In order to evaporate the surplus water, the juice has to be cooked so long that the pectin becomes sticky.

5. Before using the jelly-bag sterilize it by dipping it in boiling water.

CHAPTER XI

SPECIAL DIETS

Section 1. Diet for Babies — Special Preparations of Milk

Child-building is an art. — ANNA VIRGINIA MILLER.

462. Nature's food for a baby, its mother's milk, is the best food it can have. It is as perfectly adapted for the baby as cow's milk is for the calf, the egg for the unhatched chick, and the seed for the seedling.

463. Difference between cow's milk and "mother's" milk. — The food next best to this is that most nearly like it. Cow's milk has about the same percentage of water as woman's milk; but it has more proteid and mineral matter, a little less fat, and not nearly so much sugar.[1] It is also thicker than the latter, and

[1] AVERAGE COMPOSITION OF COW'S MILK AND WOMAN'S MILK

	WATER	FAT	SUGAR	PROTEIDS	MINERAL MATTER
Cow's milk . .	87.50	3.50	4.30	4.00	.70
Woman's milk	87.30	4.00	7.00	1.50	.20

slightly acid when delivered, while a woman's milk is always alkaline.

464. Modified milk. — By diluting cow's milk with water to reduce the proportion of proteids, and adding cream and milk sugar, a compound similar to the baby's natural food is produced. There seem to be properties in the latter that cannot be produced by mixing one lot of milk with cream from another lot, and sugar prepared from a third. This **modified milk** is, nevertheless, the best food for bottle feeding. It is prepared according to exact recipes, or formulas, different formulas being used for babies of different ages. The following table[1] gives the three most commonly used. The first is intended for a baby from three to seven days old, the second for one between one and three months old, the third for one six to nine months old.

Ingredients.	Quantities.		
	1	2	3
Milk	1½ oz.	2 oz.	8 oz.
Cream	2½ oz.	4 oz.	4 oz.
Water	20 oz.	18 oz.	12 oz.
Milk sugar . . .	1⅕ oz. or 3 tb.	1⅕ oz. or 3 tb.	1⅕ oz. or 3 tb.

[1] These formulas are from *The Diseases of Infancy and Childhood*, by L. Emmett Holt, M.D.

Usually lime-water or baking-soda is added. Each recipe makes about twenty-five ounces. As all babies, even of the same age, do not require exactly the same food, the physician usually directs its preparation.

465. **Directions for preparing modified milk.** — Dissolve the milk sugar in the water, which should be boiling hot. Filter this through cotton, add the milk and cream, and the lime-water or baking-soda. A measuring-glass on which the ounces are marked is used for measuring. Mix in a pitcher, and if the milk does not require heating, divide it into as many bottles as the baby has meals in a day.

466. **Pasteurizing.** — Most milk requires heating to render harmless the germs it contains. To sterilize it completely, it would have to be boiled for one hour and a half. But milk treated in this way does not agree with or nourish children as well as fresh milk. Pasteurizing, a process named after the famous French bacteriologist, Pasteur, is preferable. Pasteurizing consists in keeping the milk for fifteen or twenty minutes at a temperature of 160° to 170° F. This kills all active bacteria, and destroys the spores of tuberculosis (consumption), typhoid fever, diphtheria, cholera, and all fever-producing germs. Pasteurized milk may keep sweet and good for several days, but it is best to prepare every morning the quantity needed for the day.

Home-made pasteurizers. — A convenient pasteurizing apparatus can be bought, but a large kettle, one dish-pan covered by another, or even a wash-boiler will do.

There must be some sort of a frame or rack to hold the bottles. A home-made pasteurizer is shown in the illustration (Plate XI, facing p. 254). This consists of a covered pail and a tin plate with holes cut in it to fit the bottles. The plate is placed bottom up on blocks in the pail.

467. Right and wrong sorts of bottles. — A feeding-bottle should have a rounded bottom and a rubber tip fitted to its neck. Cylindrical bottles holding eight ounces and having the ounces marked in the glass are best. If bottles with flat bottoms are used, there is danger that they will be allowed to stand with milk in them. **Tips** should be so made that they will not collapse. The hole should be large enough to let the milk drop rapidly, but not run in a stream when the bottle is held upside down. Never use a tube. It cannot be kept clean, and the sour milk that collects in it is poison to a baby. (Fig. 17.)

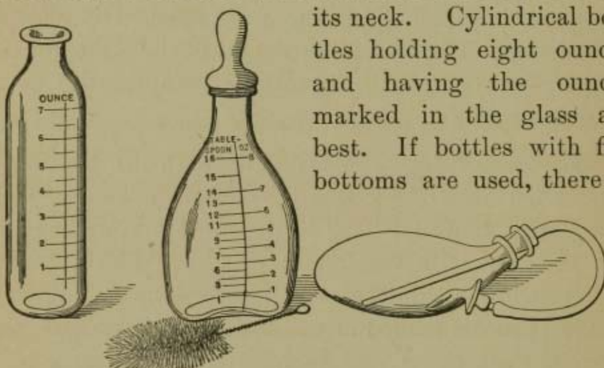


Fig. 17.

Feeding-bottles, correct shapes; bottle-cleaner. Improper style of feeding-bottle, showing tip collapsed.

468. Care of bottles and tips. — Before using new bottles, wash them thoroughly with cold water and fill them with a solution of baking-soda (one teaspoonful of soda to one pint of water). Let them stand awhile, then rinse them with boiling water, and boil them for fifteen minutes to sterilize them. Let them cool slowly in the water. On taking them out plug them tightly with wads of cotton that have been sterilized by baking in the oven for an hour. Do not take out the cotton till milk is to be put in. Clean, sterilize, and plug the bottles after every feeding.

469. Directions for pasteurizing milk. — Pour water into the bottom of the can or pail holding the bottles. It must not be deep enough to touch them. The steam surrounding the bottles heats them. Let the water boil for twenty minutes, then take the bottles out, and cool them quickly by setting them into a pail of cold water.

470. Cleanliness of milk and milk utensils. — Milk for a baby should be of the best quality, and as fresh as possible. Observe carefully the directions for the care of milk, on p. 94. Scald all pitchers, spoons, measuring-glasses, and other utensils before letting them touch the milk. Never remove the cotton from a bottle of pasteurized milk until ready to put the rubber tip on. The cotton serves as a strainer to filter bacteria out of air passing through it; if removed, bacteria from the air will fall into the milk.

471. How much and how often to give food. — A common error in feeding babies is to give too much at a time

You will probably be surprised to learn how small a baby's stomach is. A new-born baby's stomach holds only a little more than two tablespoonfuls, that of a six-months-old baby about three-fourths of a cupful. For this reason it can take but little food at a time, and so must be fed often. A graduated bottle makes it easy to regulate the quantity given. Give milk at regular intervals ; it is a great mistake to feed a baby whenever you happen to think of it, or whenever it cries.

Giving the bottle. — Heat the milk lukewarm by letting the bottle stand in warm water for a few minutes. When giving the bottle, hold it so that the neck is kept full of milk. Otherwise the baby will swallow air. Take the bottle from the child's mouth occasionally to let the child rest. *Any milk left in the bottle must be thrown away ; never give it to the child a second time.*

A baby needs water. This should be boiled, cooled, and kept covered. Give even a little baby a teaspoonful or two occasionally.

472. Food other than milk given to babies. — **Barley water** or **oatmeal water** are sometimes added to milk, not to increase its nutritive value, but because they seem to aid the digestion of the milk.[1]

To make **barley water,** wash *one teaspoonful of pearl*

[1] A baby under one year old cannot digest any appreciable quantity of starch, neither the ptyalin nor the amylopsin being fully developed till later. If nature meant a baby to have starch, there would be starch in milk. **Patent baby foods** *should never be used unless*

barley, and put it into *one pint of cold water*. Let it come to the boiling-point, and boil till reduced to two-thirds the original quantity. Or cook *one level teaspoonful of barley flour* in *one and one-half cupfuls of cold water* for fifteen minutes. Use barley water instead of clear water to dilute the milk.

Peptonized milk. — Peptonized milk has been wholly or partially digested by pepsin. "Pancreatized milk" would be a better name, as **pancreatin**, an extract of the pancreas, is now generally used instead of pepsin.

For directions for peptonizing milk, see p. 302.

If the child is not well the doctor may prescribe *beef juice* or some kind of *broth* to be given besides milk or, for a few days, instead of milk.

473. Condensed milk is poor food for a baby. Its being sterilized makes it difficult of digestion, and the quantity of cane-sugar in it is much too large in proportion to its other foodstuffs. This sugar makes fat, but not healthy flesh. Babies fed on it are plump and white-fleshed, but rarely grow up strong. It may be used for a little while if fresh milk is not obtainable.

474. Food during the second year. — Milk should be the basis of the diet all through the second year. At about twelve months of age gruel and beef juice may be given; after the eighteenth month, scraped beef (not more than one or two tablespoonfuls at a time),

ordered by a doctor. Most of them contain starch, many of those advertised as having their starch already digested by some ferment, containing large quantities of starch unchanged. Certain patent cereal foods are desirable for a baby old enough to digest starch.

soft-cooked eggs once or twice a week, bread dried in the oven, and the pulp of a baked apple or of stewed prunes. After two years, milk toast, mush, rennet custard, and plain starchy puddings may be given.

475. What the baby must not have. — Give neither solid nor starchy food to a baby under one year old. Of course, a baby must not have a drop of tea, coffee, beer, or any alcoholic liquor. No child under three years of age should taste pork, veal, pastry, cakes, candy, fried food, highly seasoned dishes, or any "indigestible" food.

Reading. — Three articles in the *American Kitchen Magazine:* "The Souring of Milk," December, 1895; "Milk Fermentation," January, 1896; and "Bacteria affecting Butter and Cheese," February, 1897. *Facts about Milk*, Farmers' Bulletin 42.

Section 2. Diet for the Sick

Taste the food that stands before you;
It is blessed and enchanted.
It has magic virtues in it.
— LONGFELLOW.

476. Importance of proper diet in cases of sickness. — Preparing and administering the patient's food is an important part of a nurse's work. Recovery, in many cases, depends more upon proper food than upon medicine. The doctor will tell you what to give the patient; but the more you know about food, cooking, and digestion, the more intelligently you will be able to carry out his orders.

477. Three kinds of diet. — Diets for the sick are classified as liquid, light, and convalescent. **Liquid diet** consists entirely of liquid food. In typhoid fever, and sometimes in other cases of severe illness, nothing but milk is given for a long time. But usually beef juice or beef tea, broths, gruels, and, in fevers, cooling drinks are included in liquid diet. Hot milk or cocoa, given at night, induces sleep; tea and coffee are usually forbidden at all times, as too stimulating. Wine or liquor should never be given unless prescribed by the physician.

Light diet is used in less severe illnesses, or when a patient that has been very sick begins to improve. It includes everything belonging to liquid diet, and, in addition, soft-cooked eggs, soup, gelatine jellies, soft puddings, custards, fruit, and a little game, poultry, or tender meat.

Convalescent diet includes all ordinary dishes except those particularly difficult of digestion. The change from one diet to another should be made gradually. Below are given examples of each of these three kinds of diet.

LIQUID DIET FOR ONE DAY

8 A.M.	Hot milk, ¾ cupful.
10 A.M.	Chicken broth, ¾ cupful.
12 A.M.	Eggnog.
2 P.M.	Hot milk, ½ cupful.
4 P.M.	Milk punch, or Kumiss, a glassful.
6 P.M.	Chicken broth, ¼ cupful.
8 P.M.	Cocoa, ¾ cupful.

Light Diet for One Day

BREAKFAST

Poached egg on toast. Coffee.

LUNCH

Soft custard.

DINNER

Broiled mutton chop. Dry toast.

LUNCH

Irish-moss jelly.

SUPPER

Milk toast. Cocoa.

Convalescent Diet for One Day

BREAKFAST

Mush with cream and sugar.
Minced chicken on toast. Whole-wheat muffins.
Coffee.

DINNER

Soup with rice.
Broiled beefsteak. Baked potatoes.
Peas. Bread and butter.
Snow pudding.
Tea or coffee.

SUPPER

Coddled eggs. Toast.
Lemon jelly. Sponge cake.
Cocoa.

478. Sick people fed like children. — You see that invalids have the same sort of food that children do, given, as it is to children, frequently and in small quantities

An alimentary canal weakened by illness may be compared to an immature one ; so there is sense in reducing the diet of a moderately sick patient to that of a little child, and the diet of a very sick person to that of a baby. Never give a patient anything the doctor has forbidden him to eat, no matter how much he wants it.

479. General rules; special cases. — Everything you know about food and cooking can be made of service to the patient. Keep in mind the properties of different foods. What proportion of carbohydrate food to proteid does a well person need? (§ 251.) Why is a diet rich in tissue-building foods usually prescribed for a convalescent? Would you give an invalid pork and beans? Pastry? Fried food? If not, why not? In general, give no foods about the wholesomeness of which there is any doubt. A safe rule to follow is that what is not particularly good for healthy people will be dangerous to sick ones. How long should gruels be cooked? (pp. 77 and 79.) In what form is albumin most easily digestible? (p. 87.) What is the function of gelatin? (§ 244.) What foods would you think good for a person wasted by fever? Consumptives need an abundance of proteids and fat. What food should they have? Is beef juice nourishing? Beef extract? (§§ 257 and 288.) Sometimes a patient is restricted to one class of foods. For a patient on *farinaceous* (starchy) diet, what dishes would you prepare? What dishes for a patient on nitrogenous diet, *i.e.* one containing neither sugar nor starch?

480. Pre-digested foods are used for invalids as for babies. Such are peptonized milk, malted milk, and all foods in which the starch has been digested by malt, or by some other ferment.

Recipes for Gruels

(See Chapter II, sect. 3.)

481. Serve gruel hot in a cup on a small plate or small tray covered with a doily.

Oatmeal Gruel

Oatmeal, ¼ cupful. Cold water, 1 quart.
Salt, 2 teaspoonfuls.

Cook these together in a double boiler for two hours. Press through a strainer, dilute with milk or cream, reheat, and serve. *The well-beaten white of one egg* stirred into the gruel makes it more nutritious.

Cornmeal Gruel

(Adapted from Miss Farmer's *Boston Cooking School Cook-book.*)

Cornmeal, 2 tablespoonfuls. Salt, ½ teaspoonful.
Flour, 1 tablespoonful. Cold water, about ¼ cupful.
Boiling water or hot milk, 3 cupfuls.

Mix meal, flour, and salt; stir into them enough cold milk or water to make a thin paste, and pour this into the hot milk or water. If water is used, cook one hour in a saucepan; if milk, three hours in a double boiler. Serve hot, diluted with milk or cream.

Shredded-wheat Gruel

Shredded-wheat biscuit, 1.	Boiling water, 1 pint.
Salt, 1 teaspoonful.	Milk, 1 cupful.

Cook biscuit, salt, and water together for twenty minutes, stirring occasionally. After adding the milk, strain.

Egg Preparations

(See Chapter III, sect. 1.)

482. **Raw eggs** are often prescribed. Break the egg into a glass, season it with pepper, salt, and vinegar, and let the patient swallow it whole.

Egg Gruel

(Adapted from Mrs. Lincoln's *Boston Cook-book*)

Egg, 1.	Hot milk (not scalded), 1 cupful.
Sugar, 1 teaspoonful.	Nutmeg or lemon juice to flavor.

While the milk heats, beat the yolk of the egg till thick and light colored, the white till stiff. Stir into the yolk the other ingredients in the following order: Sugar, milk, beaten white, flavoring. Serve hot in a glass placed on a plate covered with a doily.

Eggnog

Eggs, 1.	Wine, 1 or 2 tablespoonfuls,
Sugar, 2 teaspoonfuls.	or
Lemon juice, 1½ tablespoonfuls,	Brandy, 1 teaspoonful.
or	Nutmeg.

Beat the yolk till thoroughly foamy; stir in the other ingredients. Nutmeg may be omitted.

Shirred Egg

Break an egg into a buttered cup or egg shirrer; let this stand in a pan of hot water in the oven till the white jellies. Season and serve in the same dish placed on a plate.

Milk Preparations

(See sect. 2 of Chapter III, and paragraph relating to Yeast in Chapter IV, sect. 4.)

483. Milk diet *may be varied* by giving the milk in various forms, *e.g.* kumiss, milk punch; if permitted, in milk jellies and ice-cream; and by serving it sometimes hot, sometimes cold, and sometimes flavored with coffee.

When plain milk does not agree with the patient, add a little lime-water or a few grains of salt.

Albuminized Milk

Put the white of one egg and half a cupful of milk into a glass jar, cover tightly, and shake until well mixed.

Peptonized Milk

Fairchild's peptonizing powder,	1 tubeful.
Cold water,	¼ cupful.
Fresh cold milk,	1 pint.

Shake the water and powder together in a quart glass jar or bottle, add the milk, and shake again. Set the jar into warm water, and keep it as near 130° F. as you can for twenty minutes. Then put it at once on ice.

Serve with grated nutmeg, sugar, or mineral water, as the patient may prefer or the doctor prescribe.

For a baby, milk is sometimes *completely* peptonized by keeping it at a temperature of 120° for two hours.

Kumiss

Milk, 1 quart.	Lukewarm water, 1 tablespoonful.
Sugar, 1 tablespoonful.	Hot water, 1 tablespoonful.
Yeast, 1/8 cake.	

Have ready beer bottles, cleaned, sterilized, and cooled. Scald the milk and cool till lukewarm. Boil the sugar with the hot water till dissolved. Mix the yeast with the lukewarm water. When the syrup is cool, stir it and the yeast into the milk. Pour at once into bottles, filling them to within one and one-half inches of the top. Cork and shake well. Stand in a warm room ten hours. Lay them down in the ice-box for from three to five days. Slow fermentation produces the best kumiss, but if needed for use the day after making, the bottles may be allowed to stand in the room for six hours in summer, twelve in winter, and then laid in the ice-box for twelve hours. If ordinary bottles are used, tie the corks down as shown in Fig. 18.

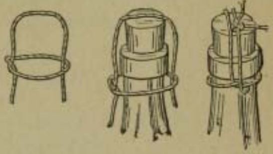


Fig. 18. — Method of tying corks into kumiss bottles.

Irish Moss Jelly (or *Blanc Mange*[1])

Irish moss, 1/4 cupful.	Salt, a few grains.
Milk, 2 cupfuls.	Sugar, to suit patient's taste.

[1] French for "white food."

After washing the moss, let it soak in the milk in a double boiler one hour; then cook until the milk steams, sweeten, and strain into molds. When cold, turn out on a colored plate, and serve with cream and sugar. Vanilla may be used to flavor either jelly or cream, if the doctor approves.

Gluten Wafers

(See Chapter IV, sect. 2.)

Cream, ½ cupful. Gluten flour, enough to make a stiff dough. Salt.

Mix cream and flour, roll out very thin, prick with a fork, and sprinkle lightly with salt. Bake the wafers till crisp and brown.

Meat Preparations

484. (See sects. 1 and 2 of Chapter VI, particularly §§ 258, 262, 269, 281–286, and 289–292.)

Nourishing Beef Tea

Lean beef chopped fine, 1 pound. Cold water, 1 pint.

Flavoring: bit of bay-leaf, sprig of parsley, slice of onion, stalk of celery, two or three cloves. (Any or all of these may be used if approved by the patient's physician.) Salt and pepper to patient's taste.

Let the beef stand in the cold water for two hours; then heat slowly, stirring, in a double boiler, until it steams. Strain through doubled cheese-cloth wrung out of cold water, and season. This beef tea should be bright red, showing that it contains albumin in liquid form. The loss of this color shows that it has been overheated. *Use great care in reheating;* if the albumin coagulates, strain it out. Serve it in a warm glass, *red* glass if the patient objects to the color of the beef tea.

Beef Juice

Directions for preparing beef juice are given on pp. 144 and 147. Reheat, season, and serve like beef tea.

Mutton Broth

Neck of mutton,	2 pounds.	Bit of bay-leaf.
Cold water,	1 quart.	Small sprig of parsley.
	Salt.	

Cut the meat into small pieces, soak it with the herbs one hour, then simmer three hours. Strain, cool, and remove fat. Reheat and salt a portion when required. *Three tablespoonfuls of rice* may be boiled and served in the strained broth.

Raw Beef Sandwiches

(See p. 146.)

Broiled Beef Tenderloin

Over a carefully broiled slice of tenderloin, squeeze, with a meat-press or lemon-squeezer, the juice of half a pound of beef-round. Season with salt, and with pepper and lemon juice, if the doctor approves. Use no butter.

Chop broiled in Paper

Lay the chop between slices of glazed writing paper. Trim these to within one inch of the chop, and fold their edges together, enclosing the chop. Broil over hot coals, turning often. The paper holds all the juices. When the chop is cooked, hold it over the dish it is to be served on and remove the paper. Season it and serve on toast.

Clam broth can often be taken by a patient who can take no other food.

Clam Broth (one cupful).

Large clams, 6 or 8. Water, ¼ cupful.

Scrub the clams well with a brush and cold water.

Heat them with the one-fourth cupful of water in a covered saucepan till their shells open. Boil for one minute after this, and strain through fine wire. Serve undiluted, or add a little hot water.

Wine Jelly

Granulated gelatine,	1¼ tablespoonfuls.
Cold water,	¼ cupful.
Boiling water,	1 cupful.
Lemon juice,	1½ tablespoonfuls.
Sugar,	½ cupful.
Wine (sherry or Madeira),	½ cupful.

Make like Lemon Jelly, recipe on p. 164.

Irish Moss Lemonade

Irish moss, ¼ cupful. Cold water, 2 cupfuls.
Lemon juice and sugar to suit patient's taste.

Soak the moss in cold water till soft. Pick out dark bits and foreign matter. Cook it in the two cupfuls of water in a double boiler for twenty minutes. Strain, flavor, and sweeten. Use hot or cold for patients with throat or bronchial inflammation.

Lemon Whey

Hot (not scalded) milk, 1 pint.
Juice of 2 lemons (or 6 tablespoonfuls).

Add the lemon juice to the milk; when the latter has curdled, strain it through cloth. Serve the whey hot or cold in a glass.

485. The invalid's tray. — Use a tray just large enough for the dishes it is to hold. Cover it with a spotlessly clean napkin. Arrange it as if you were setting a place at the table. Use the prettiest dishes you have.

Except in making jellies, gruels, and other foods that are not injured by keeping or reheating, prepare no more food than the patient is likely to eat. No food left by the patient should be served a second time; nor should food that has been in the sick-room be eaten by others.

Begin

CHAPTER XII

BEVERAGES: TEA, COFFEE, COCOA

486. The primary service of **beverages**, or drinks, is the quenching of thirst. Thirst being the body's demand for water, water is the best of beverages, other drinks satisfying thirst simply by means of the water they contain (§ 55).

A **decoction** is extracted by boiling; an **infusion**, by treatment with boiling-hot water.

Section 1. Tea

A Study of Tea

487. A. Put a teaspoonful of tea in each of two enamelled-ware saucepans, and pour on to one a cupful of boiling water; on to the other a cupful of water not quite boiling hot. Let them stand five minutes. Which is darker in color? Which stronger in taste? What action has the water had on the tea? Which is the best solvent of tea, boiling, or merely hot, water? (Observe that in water below the boiling-point the leaves float.)

B. Pour off half the tea made with boiling water, and let the rest stand ten or fifteen minutes longer. Meanwhile, pour another cupful of boiling water on to a spoonful of fresh tea, and boil it five minutes. What is its color? Taste? Add to this, to the tea standing on the leaves, and to the tea poured off, a few drops of *copper sulphate.* Does it act on all alike? At what temperature should water be for making tea? How long should it steep? Should it boil? Give your reasons.

C. Take out a few of the wet tea leaves and unroll them; find, if possible, an unbroken one; note its pointed shape and notched edges. Do you find any other kinds of leaves? Any sticks or other foreign matter? If the tea is Young Hyson, Pekoe, or other high-grade tea, look for buds.

488. Two substances in tea. — Tea is valued chiefly for its **theine**, a principle pleasantly stimulating, although injurious if taken in excess. Tea also contains **tannin**, a bitter substance used in making ink and in tanning leather. In the body it interferes with digestion, and tends, if taken in large quantities, to toughen the lining of the stomach, as tan-bark toughens leather.

489. Effect of water on tea. — Boiling hot water poured over tea dissolves its theine and flavoring matter, making a delicate, refreshing drink; water below the boiling-point draws these out imperfectly, and, in consequence, the tea is insipid. Boiling the tea, or letting it stand long on the leaves, extracts the tannin. Tea made by adding fresh water to old leaves in a pot that stands on the stove all day is actual poison.

490. How to have good tea. — 1. Buy good tea; cheap tea is likely to be adulterated with used tea leaves and leaves of other plants. 2. Keep it in a closely covered glass jar or tin canister; if exposed to the air it loses flavor. 3. Use a china, or silver, or earthen teapot; never a tin one. 4. Have the water freshly drawn, and bring it quickly to the boiling-point; water deprived of its air by standing or by boiling gives tea a flat taste. 5. Have the teapot *hot* and the water *boiling* at the moment the tea is made. 6. Steep it not over five minutes; *never let it boil.*

Directions for making Tea

491. Allow from one to three teaspoonfuls of tea to two cupfuls of water, using less of close-rolled than of coarse, loose teas. When the water boils, scald the pot, put in the tea, and pour in the boiling water, and let it stand covered from three to five minutes on the side of the stove or under a cosy on the table.[1] Serve with sugar and milk, or cream, or with sugar and thin slices of lemon. For weakening it, use water as nearly as possible boiling hot.

Iced tea, made weak, is a wholesome summer drink. Serve it strained, with lemon and powdered sugar.

492. How tea is grown and made ready for market. — Tea consists of the dried leaves of an evergreen shrub native to China. In what other countries is it cultivated? Tea-plants, left to themselves, would grow tall, but in a tea-garden they are trimmed to keep them bushy. Only young leaves and buds are picked for market, the smallest making the finest grades of tea, such as Pekoe and Souchong. Tea leaves have to be wilted, rolled, "fired" — that is, dried by artificial heat,

[1] Color does not show the strength of an infusion, the finest teas giving a light color even after long steeping; it is tannin that makes tea dark.

to develop their flavor and stimulating properties — and graded by sifting before they are ready for market. Freshly picked leaves carried rapidly through these processes keep their natural color, and are sold as **green tea**; **black tea** is produced from leaves left in heaps on the ground, to darken and develop a different flavor before being rolled.

India teas are cleaner than other black teas, being prepared by machinery instead of by hand; but they are said to contain more tannin. Green tea contains more tannin than black tea does, and so is more likely to cause nervousness. Among green teas are Gunpowder, Hyson, Pekoe, and all Japan teas; among black, Formosa and Oolong.

493. Value of tea. — While not nutritious, tea is a useful food adjunct, because it prevents tissue from wearing out. For this reason it is excellent for elderly people, but bad for children, whose health depends on the constant renewal of all parts of their bodies. Nor is its stimulating effect good for young nerves. You will be wise not to drink tea until you are grown up, and then in moderate quantities only. Much of the benefit thought to be derived from tea is doubtless caused by its heat and the action of swallowing it; a cup of hot water would be equally effective.

Section 2. Coffee

494. A study of coffee. — **A.** Compare roasted with unroasted coffee beans, observing differences in color, odor, and taste. Brown a few unroasted beans on a pan or shovel over the fire, and compare them with the roasted ones. What changes does roasting produce in coffee?

B. Boil together for ten minutes one rounded table-spoonful of coffee and one cupful of water; compare taste with that of coffee made by either of the methods given below. In what respect is long-boiled coffee like boiled tea?

495. Coffee — on the plantation and in the market. — The coffee "bean," or berry, is the seed of the red cherrylike fruit of a tropical evergreen, each fruit usually containing two berries. When the fruit begins to shrivel, it is shaken to the ground and dried until the seeds can be easily separated from the pulp. The seeds are run between wooden rollers to crack off the husk enclosing them, after which they are roasted in a revolving cylinder, great care being taken to have the degree of heat that will best develop their characteristic flavor and odor, or *aroma*.

The coffee grown at Mocha is so fine in quality that, although none of it is exported, it has given its name to a certain kind of high-grade coffee the world over, — any small, dark-yellow, roundish bean being termed "Mocha." Java and East India coffees are pale yellow before being roasted; Ceylon, West Indian, and Brazilian coffees, greenish gray. A good mixture is one part of Mocha coffee to two parts of Java. Ground coffee is in many cases mixed with other cheaper materials.

496. Test for adulteration in coffee. — Pour on to about a tablespoonful of ground coffee a cupful of cold water.

If the coffee floats and colors the water very slowly, it is pure; but if any of the "coffee" sinks to the bottom or stains the water quickly, chicory or some other adulterant is present.

497. Value of coffee. — Coffee, like tea, contains tannin and theine (generally called *caffeine* in coffee); it acts, therefore, much as tea does upon the body, and requires similar preparation. The difference in flavor and odor between coffee and tea is caused by a difference in the aromatic oils they contain. Moderately strong coffee in moderate quantities seems to be not harmful to grown persons in good health, but it is unsuitable for boys and girls for the same reasons that tea is. It relieves fatigue, and enables a person to work for a short time harder than his natural strength would permit; but habitually to stimulate the nerves in this way is both unwise and wrong. A woman or girl who cannot "get along" without tea or coffee is as much the slave of a drug as a boy with the "cigarette habit" or a man who drinks liquor to excess. Much ill-health among Americans is caused by drinking too much or too strong tea and coffee. Substitutes for coffee, made of roasted grains, if not adulterated with cheap coffee, are harmless to children and wholesome for any one.

498. How to have good coffee. — 1. Buy freshly roasted, unground coffee, and grind it at home as needed; or buy it freshly ground every two or three days. The longer it is kept after roasting, particularly if ground, the more of its aroma does it lose. 2. Keep in an air-tight can or jar. 3. Use an enamelled or earthen coffee-pot that is scoured clean, not omitting the spout, after each using. 4. Either filter the coffee, or boil it not longer than three minutes. 5. Have coffee powdered for filtering, finely ground for boiling. 6. Serve with hot, but not scalded, milk.

Directions for making Coffee

499. 1. **Boiled Coffee.** — Use *two heaping tablespoonfuls of coffee* to *one pint of boiling water.* Put the coffee into the pot, pour on the water, and let it come again to the boiling-point. Set it away from the heat, and stir in *two tablespoonfuls of slightly beaten egg.* Let it boil for one minute to clear it; then keep it hot, where it will not boil, for five minutes before serving.

2. **Filtered Coffee.** — Use a French coffee-pot. Put *two heaping tablespoonfuls of powdered coffee* into the bag. Pour over it *one pint of boiling water.* Cover the pot and let it stand in hot water till the water poured in has filtered through. Pour it out, and turn it through the filter again. This makes **black coffee**, suitable for serving in small cups after dinner. Make breakfast coffee less strong.

Section 3. Cocoa and Chocolate

500. The cocoa bean; growing and making it ready for market. — **Cracked** and **powdered cocoa**,[1] all **chocolate**[1]

[1] A confusing use of terms has resulted from retaining both the name *chocolate*, by which plant and beverage were known to the

preparations, and **cocoa shells** are products of the seeds of the chocolate tree, a native of the tropic countries of America. These seeds, called *cocoa beans*, which are about the size of almonds, lie surrounded by fibrous pulp, in a brownish yellow pod about a foot long. When fresh, they are whitish in color, and very bitter. The pods as they ripen are cut off with knives fastened on poles, and left on the ground to dry for twenty-four hours. The seeds are then taken out and thrown into heaps to ferment for from two to five days. During this process they darken in color, and become milder in taste. After this they are roasted, further to improve their flavor; but, instead of being ready for use, as coffee then is, cocoa must go through the hands of the manufacturer before reaching the cook.

501. How chocolate and cocoa are manufactured. — In the factory the beans are cracked into the irregular bits we know as *cocoa nibs* or cracked cocoa. The papery shells are winnowed out to be sold by themselves, while the nibs are either put up for market, or undergo further preparation. Cocoa beans contain so much fat that when ground they become not powder, but paste. The cocoa paste, run into molds and cooled, forms cakes of plain chocolate; if flavored and sweetened before being molded, it forms **sweet chocolate**.

Breakfast cocoa is made by extracting from cracked

natives of Mexico, and *cacao*, the name given them by the Spanish. The chocolate tree belongs to a different family from the cocoanut palm.

cocoa, by means of powerful presses, a large proportion of its fat, and grinding to powder the dry substance left. The fat is sold as cocoa-butter, for making perfumes and ointments, and for other purposes. Dutch manufacturers, instead of removing the fat, emulsify it (§ 179) by the addition of alkalies. Their method is not, however, altogether desirable, and it is probable that no imported cocoa or chocolate excels that made by leading American firms.

502. Composition and food value. — Linnæus, the great botanist, named cocoa *theobroma*, "food of the gods." Roasted cocoa contains about 50 per cent of fat, 15 to 18 per cent of nitrogenous compounds, and 10 to 13 per cent of starch. Note fat globules on the surface of chocolate that has been standing. Boil one teaspoonful of breakfast cocoa with one-quarter cupful of water, and test it with iodine for starch. It has also a small amount of **theobromine**, a substance similar to caffeine, but so much less powerful that neither cocoa nor chocolate has the stimulating effect of tea and coffee on the nerves. Unlike tea and coffee, cocoa preparations are food, whether eaten or taken in the form of a drink, since, even in the latter case, the cocoa itself, not merely an infusion of it, is swallowed. For children and young people it is the best of hot drinks. People who do not like prepared cocoas often like cracked cocoa; while even cocoa shells alone makes an economical beverage, recommended particularly for the sick.

Cocoa is insoluble, but when boiled with water the starch thickens sufficiently to keep the other solid particles suspended.

Recipes

Cocoa made from Cracked Cocoa

Cracked cocoa (or cocoa and cocoa shells),	½ cupful.
Boiling water,	3 pints.

Boil cocoa and water together for two hours or more, strain and serve with milk and sugar. Since cocoa made in this way improves by cooking, do not throw away what is left in the pot, but add each day more water and a little fresh cocoa, and boil again. Once a week empty and clean the pot.

Breakfast Cocoa

Scalded milk,	1 pint.	Prepared cocoa,[1]	2 tablespoonfuls.
Boiling water,	1 pint.	Sugar,	2 to 4 tablespoonfuls.

Mix the cocoa and sugar in a saucepan; stir in the water gradually, and boil five minutes; add the milk and cook five minutes longer, or until smooth and free from any raw taste. Beat well with a Dover egg-beater to prevent albuminous skin from forming.

Chocolate

Chocolate,[1]	2 squares.	Boiling water,	1 cupful.
Sugar,	4 tablespoonfuls.	Scalded milk,	3 cupfuls.

[1] The proportions of cocoa and chocolate in these recipes are for the preparations made by Walter Baker and Company. They may have to be varied for other kinds.

Put the chocolate cut in bits into a saucepan set into hot water; when melted, add the sugar and water, stirring till smooth. Pour into this part of the milk, then pour the chocolate back into the rest of the milk, and stir till it comes to the boiling-point. Beat till frothy with an egg-whisk or a Dover beater.

For a **luncheon** or for **afternoon tea** serve in tall cups with a spoonful of whipped cream on the top of each cup. (p. 99.)

Where to find descriptions and pictures of tea, coffee, and cocoa. — *Foods and Beverages:* Tea, p. 252; Coffee, p. 256; Cocoa, p. 261. *The Chocolate Plant*, published by Walter Baker and Company, Dorchester, Massachusetts (many pictures).

APPENDIX A

TABLE SHOWING

CHEMICAL COMPOSITION OF AMERICAN FOODS AND FOOD MATERIALS

Prepared from data given in Bulletin 28, published by the U.S. Dept. of Agriculture, Office of Experiment Stations.

Note in Explanation of Table showing Composition of Food. — The food value of any food or food material is estimated by finding out how much energy it yields in the form of heat when burned. Heat is measured by *calories*. One calorie is the amount of heat required to raise one pound of water four degrees Fahrenheit. The figures in the right-hand column thus show what the food value of a pound of each food or food material would be *if every bit of it were perfectly digested and assimilated.*

Foods and Food Materials.	Refuse.	Water.	Proteids and Other Nitrogenous Matter.	Fat.	Total Carbohydrates.	Starch.	Fibre.	Sugar.	Dextrin, Gum, etc.	Mineral Matter.	Fuel Value per Pound, indicating Food Value.
Beef.	per ct.	per ct.	per ct.	per ct.	per ct.[1]	per ct.	per ct.	per ct.	per ct.	per ct.	calories.
Chuck (including shoulder).											
As purchased	17.3	54.0	15.5	12.5	—	—	—	—	—	.7	820
Edible portion	—	65.0	18.7	15.4	—	—	—	—	—	.9	1005

[1] "Total carbohydrates" includes starch, fibre, sugar, dextrin, and gum. When the percentages of these are known, they are given separately besides.

CHEMICAL COMPOSITION OF AMERICAN FOODS. — CONTINUED

Foods and Food Materials.	Refuse.	Water.	Proteids and Other Nitrogenous Matter.	Fat.	Total Carbohydrates.	Starch.	Fibre.	Sugar.	Dextrin, Gum, etc.	Mineral Matter.	Fuel Value per Pound, indicating Food Value.
Beef (*concluded*).	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	calories.
Flank.											
As purchased	5.5	56.1	17.7	19.9	—	—	—	—	—	.8	1185
Edible portion	—	59.3	18.7	21.1	—	—	—	—	—	.9	1255
Porter-house Steak.											
As purchased	12.7	52.4	19.1	17.9	—	—	—	—	—	.8	1110
Edible portion	—	60.0	21.9	20.4	—	—	—	—	—	1.0	1270
Ribs.											
As purchased	20.1	45.3	14.4	20.0	—	—	—	—	—	.7	1110
Edible portion	—	57.0	17.8	24.6	—	—	—	—	—	.9	1370
Round.											
As purchased	8.5	62.5	19.2	9.2	—	—	—	—	—	1.0	754
Edible portion	—	67.8	20.9	10.6	—	—	—	—	—	1.1	835
Plate (corned).											
As purchased	14.5	34.3	11.7	35.8	—	—	—	—	—	4.0	1730[1]
Edible portion	—	40.1	13.7	41.9	—	—	—	—	—	4.7	2025

Veal.											
Cutlets (leg).											
As purchased	3.4	68.3	20.1	7.5	—	—	—	—	—	1.0	690
Edible portion	—	70.7	20.3	7.7	—	—	—	—	—	1.1	750
Lamb.											
Loin.											
As purchased	14.8	45.3	16.0	24.1	—	—	—	—	—	.8	1315
Edible portion	—	53.1	18.7	28.3	—	—	—	—	—	1.0	1540
Lamb, cooked.											
Chops, broiled.											
As purchased											
Edible portion	13.5	40.1	18.4	26.7	—	—	—	—	—	1.2	1470
Leg roast.	—	47.6	21.7	29.9	—	—	—	—	—	1.3	1665
Edible portion											
	—	67.1	19.7	12.7	—	—	—	—	—	.8	900
Mutton.											
Hind leg.											
As purchased	17.7	51.9	15.4	14.5	—	—	—	—	—	.8	900
Edible portion	—	63.2	18.7	17.5	—	—	—	—	—	1.0	1085
Shoulder.											
As purchased	22.1	46.8	13.7	17.1	—	—	—	—	—	.7	975
Edible portion	—	60.2	17.5	21.8	—	—	—	—	—	.9	1245
Mutton, cooked.											
Leg, roast.											
Edible portion	—	50.9	25.0	22.6	—	—	—	—	—	1.2	1420

[1] Fat meat has high fuel value, but in estimating its real food value we must take into account how much of the fat will be eaten, and how much left on the plates.

CHEMICAL COMPOSITION OF AMERICAN FOODS. — CONTINUED

Foods and Food Materials.	Refuse.	Water.	Proteids and Other Nitrogenous Matter.	Fat.	Total Carbohydrates.	Starch.	Fibre.	Sugar.	Dextrin, Gum, etc.	Mineral Matter.	Fuel Value per Pound, indicating Food Value.
Pork.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	calories.
Loin chops.											
As purchased	19.3	40.8	13.2	26.0	—	—	—	—	—	.8	1340
Edible portion	—	50.7	16.4	32.0	—	—	—	—	—	.9	1655
Ham, smoked.											
As purchased	12.2	35.8	14.5	33.2	—	—	—	—	—	4.2	1670
Edible portion	—	39.8	16.5	38.8	—	—	—	—	—	4.7	1945[1]
Ham, smoked, fried.											
As purchased	—	36.6	22.2	33.2	—	—	—	—	—	5.8	1815
Salt pork, clear fat.											
As purchased	—	7.9	1.9	86.2	—	—	—	—	—	3.9	3670[1]
Poultry.											
Chickens.											
As purchased	41.6	43.7	12.8	1.4	—	—	—	—	—	.7	295
Edible portion	—	74.8	21.5	2.5	—	—	—	—	—	1.1	505
Fowl.											
As purchased	25.9	47.1	13.7	12.3	—	—	—	—	—	.7	775
Edible portion	—	63.7	19.3	16.3	—	—	—	—	—	1.0	1045

Fish.											
Striped bass.											
Whole, as purchased . .	55.0	35.1	8.4	1.1	—	—	—	—	—	.5	200
Edible portion	—	77.7	18.6	2.8	—	—	—	—	—	1.2	465
Bluefish.											
As purchased, entrails removed	48.6	40.3	10.0	.6	—	—	—	—	—	.7	210
Edible portion	—	78.5	19.4	1.2	—	—	—	—	—	1.3	410
Cooked	—	68.2	25.9	4.5	—	—	—	—	—	1.2	670
Cod.											
Dressed, as purchased . .	29.9	58.5	11.1	.2	—	—	—	—	—	.8	215
Edible portion	—	82.5	16.7	.3	—	—	—	—	—	.9	325
Mackerel.											
As purchased, entrails removed	40.7	43.7	11.6	3.5	—	—	—	—	—	.7	365
Edible portion	—	73.4	18.7	7.1	—	—	—	—	—	1.2	645
Salmon.											
As purchased, entrails removed	29.5	48.1	13.8	8.1	—	—	—	—	—	.8	600
Edible portion	—	64.6	22.0	12.8	—	—	—	—	—	1.4	950
Shad.											
As purchased	50.1	35.2	9.4	4.8	—	—	—	—	—	.7	380
Edible portion	—	70.6	18.8	9.5	—	—	—	—	—	1.3	750

[1] See footnote, p. 321.

CHEMICAL COMPOSITION OF AMERICAN FOODS. — CONTINUED

Foods and Food Materials.	Refuse.	Water.	Proteids and Other Nitrogenous Matter.	Fat.	Total Carbohydrates.	Starch.	Fibre.	Sugar.	Dextrin, Gum, etc.	Mineral Matter.	Fuel Value per Pound, indicating Food Value.
Fish (*concluded*).	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	calories.
Salt Cod.											
As purchased	24.9	40.2	16.0	.4	—	—	—	—	—	18.5	315
Edible portion	—	53.5	21.5	.3	—	—	—	—	—	24.7	410
Oysters.[1]											
Solid, as purchased . .	—	88.3	6.0	1.3	—	—	—	—	—	1.1	230
Eggs.											
Edible portion	—	73.7	14.8	10.5	—	—	—	—	—	1.0	720
Butter	—	11.0	1.0	85.0	—	—	—	—	—	3.0	3605
Cheese.											
Full cream	—	34.2	25.9	33.7	2.4	—	—	—	—	3.8	1950
Partly skimmed milk . .	—	38.2	25.4	29.5	3.6	—	—	—	—	3.3	1785
Milk.											
Whole	—	87.0	3.3	4.0	5.0	—	—	—	—	.7	325
Skimmed	—	90.5	3.4	.3	5.1	—	—	—	—	.7	170
Condensed	—	26.9	8.8	8.3	54.1[2]	—	—	—	—	1.9	1520

Meal, flour, and bread.											
Corn meal	—	12.5	9.2	1.9	75.4	—	1.0	—	—	1.0	1655
Hominy	—	11.8	8.3	.6	79.0	—	.9	—	—	.3	1650
Hominy, cooked	—	79.3	2.2	.2	17.8	—	—	—	—	.5	380
Oatmeal	—	7.3	16.1	7.2	67.5	—	.9	—	—	1.9	1860
Oatmeal, cooked	—	84.5	2.8	.5	11.5	—	—	—	—	.7	285
Rice	—	12.3	8.0	.3	79.0	—	.2	—	—	.4	1630
Rice, boiled	—	72.5	2.8	.4	24.4	—	—	—	—	.3	535
Wheat flour.											
Entire wheat	—	11.4	13.8	1.9	71.9	—	.9	—	—	1.0	1675
High grade spring wheat	—	12.3	11.7	1.1	74.5	—	.1	—	—	.4	1650
Macaroni, cooked	—	78.4	3.0	1.5	15.8	—	—	—	—	1.3	415
Graham bread	—	35.7	8.9	1.8	52.1	40.7	1.1	3.2	5.5	1.5	1210
Biscuit	—	32.9	8.7	2.6	55.3	41.5	.7	2.7	5.5	.5	1300
White bread	—	35.3	9.2	1.3	53.1	—	.5	—	—	1.1	1215
Crackers	—	6.8	10.7	8.8	71.9	—	.5	—	—	1.8	1905
Vegetables and fruits.[3]											
Beets, cooked	—	88.6	2.3	.1	7.4	—	—	—	—	1.6	185
Cabbage	15.0	77.7	1.4	.2	4.8	—	-	—	—	.9	125
Carrots	20.0	70.6	.9	.2	7.4	—	-	—	—	.9	160
Lettuce	15.0	80.5	1.0	.2	2.5	—	—	—	—	.8	75
Onions	10.0	78.9	1.4	.3	8.9	—	—	—	—	.5	205
Onions, cooked	—	91.2	1.2	1.8	4.9	—	—	—	—	.9	190

[1] Oysters contain 3.3 per cent of carbohydrates (in the liver).
[2] Condensed milk contains on an average about 43 per cent of cane sugar.
[3] Unless otherwise indicated the composition is given of fresh vegetables and fruits *as purchased*; of cooked ones, the *edible portion* only.

CHEMICAL COMPOSITION OF AMERICAN FOODS. — CONCLUDED

Foods and Food Materials.	Refuse.	Water.	Proteids and Other Nitrogenous Matter.	Fat.	Total Carbohydrates.	Starch.	Fibre.	Sugar.	Dextrin, Gum, etc.	Mineral Matter.	Fuel Value per Pound, indicating Food Value.
	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	per ct.	calories.
Vegetables and fruits (*concluded*).											
Peas, dried	—	9.5	24.6	1.0	62.0	—	4.5	—	—	2.9	1655
Peas, green, cooked	—	73.8	6.7	3.4	14.6	—	—	—	—	1.5	540
Potatoes, raw, edible portion	—	78.3	2.2	.1	18.4	—	.4	—	—	1.0	385
Potatoes, boiled	—	75.5	2.5	.1	20.9	17.4	.6	.4	—	1.0	440
Tomatoes	—	94.3	.9	.4	3.9	—	.6	—	—	.5	105
Apples, edible portion	—	84.6	.4	.5	14.2	—	1.2	12.4	—	.3	290
Bananas, edible portion	—	75.3	1.3	.6	22.0	—	1.0	—	—	.8	460
Dates, dried	10.0	13.8	1.9	2.5	70.6	—	—	—	—	1.2	1450
Chocolate	—	5.9	12.9	48.7	30.3	—	—	—	—	2.2	2860
Cocoa	—	4.6	21.6	28.9	37.7	—	—	—	—	7.2	2320

APPENDIX B.

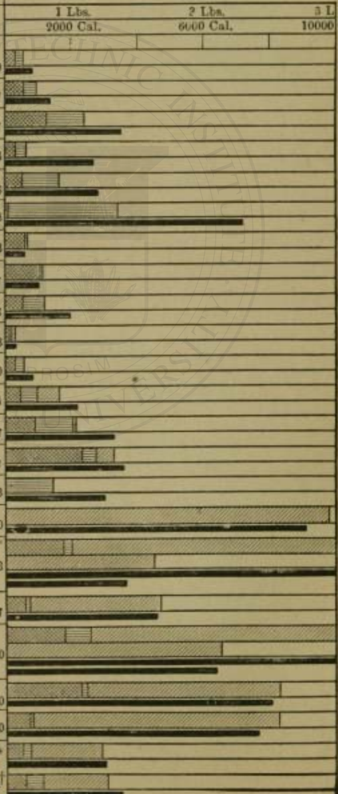
TABLE SHOWING QUANTITY OF FOODSTUFFS OBTAINED IN DIFFERENT FOOD MATERIALS FOR 25 CENTS.

Taken from Farmers' Bulletin, No. 23. Foods: "Nutritive Value and Cost," by W. O. Atwater, Ph.D. Published by U.S. Department of Agriculture.

[Quantities of foodstuffs in pounds. Fuel value in calories.]

Protein. Fats. Carbohydrates. Fuel value.

	Price per pound.	Food materials for 25 cents.	Weights of nutrients and calories of energy in 25 cents' worth
	Cts.	*Lbs.*	
Beef, sirloin	25.0	1.00	
Beef, round	15.0	1.67	
Beef, neck	6.0	4.17	
Mutton, leg	22.0	1.14	
Ham, smoked	16.0	1.56	
Salt pork, very fat	12.0	2.08	
Codfish, fresh	8.0	3.13	
Codfish, salt	7.0	3.57	
Mackerel, salt	12.0	2.08	
Oysters, 35 cents quart	18.0	1.43	
Eggs, 25 cents dozen	14.7	1.70	
Milk, 7 cents quart	3.5	7.14	
Cheese, whole milk	15.0	1.67	
Cheese, skim milk	8.0	3.13	
Butter	30.0	0.83	
Sugar	5.0	5.00	
Wheat flour	3.0	8.33	
Wheat bread	7.0	3.57	
Corn meal	2.5	10.00	
Beans	5.0	5.00	
Potatoes	1.2	20.00	
Standard for daily diet for man at moderate work	German*		
	American†		



† Atwater.

INDEX

Dear Mother

Emil Jones,
8-2
How far does it go

8					
7					
6					
5					
4					
3					
2					
1					

Live foods
Protuds
Carbohydrates
water
minerals

1. Protein – build tissue.

2. Fat – heat, stores fatty tissue

3. Sugar – energy & heat

4. Starch – energy

5. Water – supplies blood carry

6. Mineral – bone, blood,

7. Cellulose – assists in digestion.

Edna Jones

Domestic Science

food thru of system:
nerve tissue,