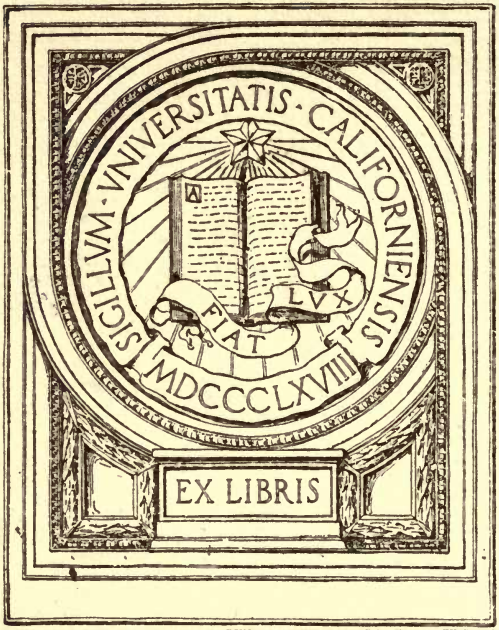
HOUSE SANITATION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HOUSE SANITATION

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A Manual for Housekeepers

By
MARION TALBOT

SECOND PRINTING

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CONTENTS

PREFATORY NOTE

UNDER the wise and inspiring guidance of Mrs. Ellen H. Richards, a group of young college women—Annie E. Allen, Alice Stone Blackwell, Sarah Louise Day, Alla W. Foster, Edith Talbot Jackson, Alice Peloubet Norton, and the undersigned—formed, in 1883, a Sanitary Science Club, one of the first organized activities of the Association of Collegiate Alumnæ. After careful study of sanitary problems, they published a little book, entitled "Home Sanitation," which, in the twenty-five years that have passed, has been widely used and has proved even more helpful than the authors anticipated.

During these years, however, very important and far-reaching changes have taken place in sanitary theory and a considerable number of the practical suggestions in "Home Sanitation" have become out-of-date. Mrs. Richards had been urging a revision of the book for some time prior to her death in 1911. The surviving editor believed, however, that it would be more truly in accord with Mrs. Richards's scientific and progressive spirit to rewrite the book. This she has done, drawing freely from the older text, using the results of studies made by advanced students in the Department of Household Administration of the University of Chicago, and endeavoring to replace out-worn theories and useless practices with such modern views and practical suggestions as will best help the progressive housekeeper in her

efforts to maintain her household in health and physical efficiency with the least expenditure of money, time, and strength.

MARION TALBOT.

Department of Household Administration
The University of Chicago
July, 1912

CHAPTER I

THE NEW SANITATION

THE conservation of national resources is a term which is gradually coming to include human life as well as timber and coal. Needless waste of national vitality is taking its place among the wrongs which are of national concern. Conservation of human life is to be accomplished in large part through the practice of sanitary measures. To be effective in the best sense, this practice must be carried on with the least possible expenditure of time, effort, and money. If, with intelligence and skill, one housekeeper can do the work of ten health officers or one dollar accomplish as much as ten dollars in the hands of a sanitary inspector, the larger expenditure is sheer waste and the net result in conservation is so much the smaller.

It is, therefore, well worth while for those interested in the promotion of public and private health occasionally to survey the field of sanitary practice and to learn whether the methods in use are in accord with the advance of science, or whether modern theory calls for changes in practice in the interests of effective and economical results. This is particularly true of housekeepers, for, on the whole, the sanitation of the home is in their keeping, and as the famous sanitarian, Dr. B. W. Richardson, said, "If in the centers called home the foundations of

the science of health are laid, the rest on a larger scale will necessarily follow."

The idea of considering the house as a unit of health is essentially modern. It was, indeed, an impossible one until the knowledge was available which has been acquired in recent years. The fact that it is so generally accepted today shows that our views have changed materially in respect to two points, viz., the relation of private to public rights and the causation of disease.

In the first place, a man's house is no longer considered his castle, to use as he pleases regardless of the welfare of other people. Modern sanitary law greatly abridges the rights of the householder in recognizing that his possession involves obligations to his neighbors and cannot be used in a way which may prove harmful to them.

In the second place, ideas in regard to disease have undergone radical change. The early Christian view was that disease was caused by the wrath of God or the malice of Satan, or by a combination of both. Since the source of disease was supernatural, it was considered irreligious to use natural means for combating it. Methods of cure were logically based on the two ideas of striving to appease the divine anger which had been aroused because of sin and of eluding the malice of Satan. On the one hand, help was sought by prayer, visits to shrines, pilgrimages, gifts to the church, and similar practices reputed to be effective in renewing divine favor; on the other hand, the malice of Satan was to be thwarted by the persecution and murder of his supposed emissaries, especially Jews and witches. The proof that the Jews were particularly chosen for this office lay in the fact

that they were remarkably free from disease. It is now known that their rigid adherence to the Mosaic code of sanitation, which was to them a religious duty, was the true explanation of their exemption.

In consequence of these views, measures which in modern times would be called sanitary reform were looked upon as impious. Even to the present day, phrases linger in popular speech which express the old view, as, for example, after an epidemic of a contagious disease leading to much loss of life, the explanation is still sometimes offered that the disaster was "due to an inscrutable Providence," "a divine visitation," "the result of natural sin," or "the rebuke of God."

Such influences greatly delayed the progress of scientific thought, for any attempt at another explanation met with opposition and ridicule, reënforced by religious fervor and fanaticism. But the onward march of knowledge could not be permanently stopped. Facts gradually accumulated whose antagonism to the established theory aroused questionings. It became clear, for instance, that pestilence was not limited to heretical countries or to ungodly people.

In time, many forms of disease were seen to be in some way connected with uncleanliness, and that there was some connection between the spread of disease and the water supply became evident. John Wesley's dictum, "Cleanliness next to Godliness," expressed the new idea from which results have already come which have greatly affected society. The impetus to hygienic research came largely through the practical efforts of Sir Edwin Chadwick, properly called "the father of sanitary reform."

The modern science of bacteriology, a marvel in the rapidity of its development, has contributed in an extraordinary measure to men's knowledge of ways in which many kinds of disease are caused, spread, and controlled.

A change of view on the part of the clergy has naturally followed close upon this new knowledge. It is said that after a bishop had issued a call to prayer to ward off cholera, one clergyman refused on the ground that it would be blasphemous to seek help from prayer, considering the filthy condition of the streets, and he urged the members of his church to clean up the town. Fasting, penance, and prayer are now recognized as ineffective substitutes for obedience to the divine law in the physical realm.

As science has been reënforced by rational and active practical effort, several diseases, such as cholera, typhus, and plague, have almost disappeared. Many other diseases, it has been proved, can be controlled to a great extent and perhaps ultimately exterminated. Tuberculosis is a noteworthy example.

As sanitary science has developed, light has been thrown on a good many obscure points, and views concerning other points, especially the real significance of uncleanliness, have had to be materially altered. As a result, there is need of many changes in sanitary practice. This is shown by the increasing use of such terms as "The New Public Health," "Profitable and Fruitless Lines of Endeavor in Public Health Work," "Public Health Fallacies," and "Sources and Modes of Infection," which are becoming familiar through the teachings of progressive and scientific sanitarians.

The pith of the matter is thus stated by Dr. H. W. Hill in a series of illuminating articles on "The Control of Infectious Diseases": "The old sanitation was concerned with the environment, the new is concerned with the individual, and finds the sources of infectious disease in man himself rather than in his surroundings." Dr. Hill pictures "the old ideas that slum dwellers live like pigs and therefore invoke the coming of smallpox, scarlet fever, typhoid fever, and diphtheria. If these diseases invaded the homes of well-to-do, a pin hole in the plumbing accounted for diphtheria, rotten potatoes in the cellar for typhoid, manure piles for cholera, ground air for malaria, impure water for yellow fever. Tuberculosis was considered hereditary and bubonic plague could be banished by improved ventilation."

Dr. Hill also points out that "the old-style sanitary inspector usually condemned everything in sight, from the garbage pail at the back door to the plumbing in the bathroom. But what availed it that the garbage pail was emptied every day or a vent pipe placed on the bath water waste pipe, if the milkman delivered scarlet-fever infected milk or an unrecognized case of measles sat next the children at school?"

Modern sanitarians are urging that public funds appropriated for sanitary measures should be expended in such a way as to prevent the spread of disease. The mistaken idea should be abandoned that everything which tends toward comfort, beauty, good order, and even indirectly toward health, such as street cleaning, garbage disposal, and smoke prevention, belongs to the health department. Dr. C. V. Chapin, in his work on "The Sources

and Modes of Infection," states his belief that such municipal improvements belong no more to the health officials than do "free transfers, cheaper commutation tickets, lower prices for coal, less shoddy in clothing, or more rubber in rubbers—all good things in their way and tending towards comfort and health."

The housekeeper should understand that a broken bed-spring, a worn-out stove, a tumble-down chair, or even more offensive rubbish in a vacant lot near her house, is not a menace to health and is not a concern of sanitary officials. If these objects are offensive to her and the standard of municipal housekeeping is not very high, her complaint should be remedied by an appeal to a private agency, such as a Municipal Art League. Instances could be multiplied to show that the housekeeper needs to be well informed as to advances in sanitary knowledge, in order to direct her efforts intelligently and effectively.

A few illustrations of interest to the housekeeper will show changes in sanitary theory which have been abundantly and conclusively proved. In nearly every case popular opinion and sanitary enactment, as well as, too frequently, expert practice, have lagged far behind in making readjustments, and thus lead to waste in every kind of expenditure. The statements are made in brief and positive form, and together with others will be considered more fully in later chapters.

Night air is purer than day air, and should be admitted freely to the house.

Gases from marshes do not cause malaria.

The quality of the air in the breathing zone is more important than the general air of the room.

The quantity of carbon dioxide or "carbonic acid" is not a measure of the unhealthfulness of air.

Ordinary variations in the normal gaseous constituents of air produce no apparent effects.

High humidity, combined with high temperature, produces the discomfort ordinarily attributed to "bad air," and is unhealthful.

Ordinary buildings and rooms ventilate themselves to a considerable extent. A small house needs comparatively less provision for change of air than a large building.

Air from properly constructed sewers is not harmful.

Sunlight cannot be depended on for disinfection or as a substitute for cleanliness. Its value is physiological, psychical, and chiefly moral.

Actual light rather than window area should be the measure of the efficiency of room lighting.

Odors are not harmful physically, but when unpleasant should be eliminated by cleansing methods rather than by ventilation.

Disinfection as ordinarily practiced, especially by amateurs, is practically valueless.

The housekeeper must not be misled by the new sanitation into the belief that the means at her command for promoting the health of her household have almost reached the vanishing point, since ground, air, and plumbing have lost so many of their terrors. On the contrary, the implications in the modern views, if fully understood and intelligently acted upon, give her greater opportunities than she has ever had and lay upon her still heavier responsibilities. This new phase of house sanitation, which trenches closely upon personal hygiene, needs more

attention than it is receiving and will be discussed in later chapters. Health depends in part on freedom from infection. The probability of obtaining that freedom will be greatly increased by maintaining the body at a high state of vigor or "vitality," as it is popularly called. This implies the promotion of all agencies which have to do with physical well-being, as well as with the control of sources of infection; and in so far as such agencies are made use of within the house, they belong properly to house sanitation.

CHAPTER II

THE RESPONSIBILITY OF THE HOUSEKEEPER

IN promoting the sanitation of the house, the housekeeper should realize that she is helping to solve important social and economic problems. The character of the place in which people live and spend more than half their time necessarily has a close relation to their social and economic efficiency. This is recognized by sanitary congresses, boards of health, and students of scientific and social questions, but it remains for the housekeeper in her home to put into practice those views which otherwise would remain unrelated to human welfare.

This responsibility affords an opportunity for very real service and should not be assumed lightly or without adequate preparation. Abundant knowledge, a fine power of observation and discrimination, and executive ability are qualities that are needed if the best results are to be secured. Hardly less important is an attitude of mind or poise which enables the housekeeper to be always mistress of herself and of the forces she directs, so that uncertainties, perplexities, and even alarms which she may experience will not needlessly disturb her household. In studying the principles of house sanitation, she will find that conditions are not always directly under her control. She must know how to act when such conditions arise so as to reduce to a minimum the harm which might come—in other words, she should be resourceful. She

should at the outset have complete familiarity with the house in which she lives.

The purchaser of a house demands and is willing to pay for a clear legal title to the property; there should be the same demand and the same willingness to pay for a clear sanitary title, *i. e.*, assurance that the house conforms in all respects to the best known laws of sanitation. A purchaser or tenant should have as perfect a guaranty of the latter as of the former.

The time must come soon when, in order to sell or let houses, the owners or agents will be required to show a certificate secured through expert examination regarding the perfect sanitary condition of each house. Already some wise landlords show such certificates. In general, however, the purchaser or tenant must look out for this himself, remembering that all expense incurred is for the safety, health, and possibly the lives of his wife and children and himself.

Wherever there is a Board of Health, an Inspector of Buildings, or a Board of Examiners, they may be consulted as to the laws of that town or city, since as yet there is little uniformity as to details. But, because the members of these boards are not always themselves experts, and because the standard of public opinion does not as yet demand that they shall be, full reliance cannot, in all cases, be placed upon inspection by public authorities.

In houses already occupied, the heating and plumbing systems should be closely watched. If defect is suspected, any person in the house may make a complaint to the Board of Health and inspection will be made without expense.

Given a house in perfect sanitary condition at the start, the housewife should know what is required to keep it in like condition. Barring accidents, cleanness and pure air will usually insure a condition of safety. She should then know what accidents are liable to happen and how to keep the entire house clean. The object of the following chapters is to give her this knowledge. The questions are so framed that an affirmative answer implies a satisfactory arrangement, while the question itself suggests a remedy, if the answer is negative.

In thus pointing out the sources of danger and the ideal standards of sanitation in the perfectly healthful house, it is not the intention unnecessarily to alarm or discourage the householder. The new sanitation, indeed, removes many of the terrors of former times. The aim is to urge the intelligent oversight of these matters, and to indicate the points requiring investigation, the methods of examination, and the practical remedies.

The conditions required under the two topics (Situation and Plumbing) which open the subject may seem as difficult of realization, especially to those already settled in their homes, as they are important. But while the suggestions will be of greater value to those considering the choice of a residence, it is believed that they will also show to those who assume the conditions of their houses to be beyond their control that the remedy frequently lies within their reach. The second topic (Plumbing) is necessarily somewhat technical; but it is hoped that the explanations in the notes will prove the difficulties to be more apparent than real, and that the principles will be easily understood.

It is unavoidable that, in a subject so full of detail, some of the points should appear in themselves trivial, and the risk to health, incurred in ignoring them, very slight; but the sum of such trifles often makes the difference between physical vigor and weakness, and the risk, small as it is, is greater and more serious than that from fire, against which the householder always insures himself.

One of the most dangerous qualities of the unsanitary house is that it slowly and insidiously causes ill health and general languor, which incapacitate for sustained effort, and to which women, from their greater confinement to the house, are especially subject.

In conclusion, the householder must be reminded that it is not enough to secure right sanitary conditions; they must be maintained. This can be done only through the eternal vigilance of the housekeeper, who can thus, in large measure, secure the two essentials of a happy home —good health and its attendant, good nature.

The following motto should be the basis of her efforts:

"Any invention intended to be a substitute for watchfulness will prove a delusion and a snare."

CHAPTER III

SITUATION OF THE HOUSE AND CARE OF THE CELLAR

THE location and surroundings of the house are of the first importance from a sanitary standpoint. Folding doors and carved mantelpieces are attractive to the house hunter; but the satisfaction they give may be more than offset by the disagreeable or harmful effects of a neighboring marsh, a wet, dark cellar, a lack of sunshine, or by unpleasant surroundings, such as factories and smoking chimneys. As W. P. Gerhard well says: "It must be constantly borne in mind that, while defective construction may generally be remedied, unhealthy surroundings, an undesirable aspect, or insalubrious building site cannot be changed."

If, then, a house ready built is to be rented or bought, it is not sufficient that the style of architecture and the social aspect of the locality be considered. The seeker for a house which is to be not only a beautiful but a healthful home must carefully consider the far more important points of character of soil, age of house, honesty of construction, style of plumbing and of heating apparatus, and the possibilities of sunlight and air.

Until there is opened in every city and town an office from which trained inspectors can be obtained—men or women who understand what *living* in a house means and what dangers come in the *using* of apparatus which

while new and untried seems to be correct in principle—until then the house hunter must herself understand the cardinal points of safety.

The chief essentials to be secured are pure air, sunlight, and dryness. These are conditions upon which physical and mental vigor largely depend. Without them the human system loses its power of resistance to disease. Rheumatism and consumption are diseases which seem to be peculiarly prevalent in their absence, and many forms of organic life, known familiarly to us in the form of decay and mold, thrive only in dampness and darkness. An ample supply of pure or clean water is also essential.

Clean soil is the primary factor in making possible clean air and clean water. As sanitary views have changed greatly in relation to the hygienic significance of the soil, a few general principles should be clearly understood, especially as they tend to do away with a great many of the disturbing ideas which used to be held in regard to the ground. Health was supposed to be constantly menaced by ground air and ground water, but it is now known that neither air nor water can cause disease simply because it is in the ground.

We usually think of air as only above ground, not as moving about in it, and seldom realize how great the amount of ground air is until we try the simple experiment of pouring water into a potful of dry earth, and notice how much water the earth will absorb in the space before occupied by air. This air is, of course, originally the same as atmospheric air. When it gets into the ground it usually undergoes some changes due to vegetation. The amount of carbon dioxide and of water in-

creases and of oxygen decreases wherever there is decay of vegetable matter. These changes were formerly thought to make the air very unwholesome, but it is now known that ground air changed only in this way and to the extent which takes place in the ground is quite harmless. Other things, however, may go on in the ground which will bring about undesirable changes. Defective drains and decaying animal matter may produce offensive gases which will mix with the ground air, but even then the changes are not thought to be sufficient in amount or harmful enough in kind to lead to disease. If, however, there are gas pipes in the ground which leak, it is another matter, for one of the components of illuminating gas produces very serious and even fatal consequences if breathed, and should on no account be allowed to get into the house. It is also true that there are no gaseous exhalations from marshes which cause disease. A special kind of mosquito which may infest such places and is quite as likely to be found breeding in any little puddle, and which flies about especially at night, is now known to be the cause of the trouble which has given such a bad name to ground air and to night air. It will be readily seen that in deciding upon measures intended to keep ground air out of the house, the housekeeper needs to know whether it is likely to be polluted in any dangerous way.

Materials ordinarily used for the construction of cellar walls are more pervious to moisture and air than is generally supposed. Dry brick, for example, is so porous that it can take up about twenty-five per cent of its weight of water, and even the finest grained stones absorb some

moisture and allow air to pass through them. If, then, the expense involved in making cellar walls and floor quite impervious to air simply results in keeping out something which is harmless, it is a waste of money which should go to meet real needs. On the other hand, if there is certainty or even probability that the ground air may be polluted, it should be kept out at any cost. This is an illustration of the many ways in which the housekeeper should be guided by exact knowledge rather than by any rule of thumb.

Similar statements may be made in regard to ground water. Fifty years ago a distinguished physician of Massachusetts announced the law of soil moisture, to the effect that residence on a damp soil is a primal cause of consumption, which can be checked or prevented by attention to this fact. This was before the discovery of the germ which causes this disease and without which no amount of moisture can cause it. The belief now is that the relation between them is probably quite indirect and due merely to the fact that dampness depresses vitality. It is certainly true that a great many effects formerly attributed to moisture are due to other causes. It is also true that until the matter is less obscure than it is at present, the safe course is to avoid excessive moisture in the soil, such as is likely to exist where the level of the ground water is high and the soil of such a character that surface water does not drain from it easily and quickly.

Still another charge against the ground has been disproved. It was formerly thought to be crowded with disease germs. The truth is that there is only one patho-

genic or disease-producing form harmful to human beings whose normal habitat is the ground, and that is the germ which causes tetanus or lockjaw. If other disease germs gain access to the ground, they quickly perish. They lack the proper food, the temperature is unfavorable, and there are present many other kinds of germs which are inimical to them. Such germs as those of typhoid fever may be washed into the ground and pollute water supplies, but they do not survive long and cannot be drawn up into the air, as the currents are not strong enough. Just as in the case of gaseous impurities, the housekeeper needs to know whether there is the possibility of disease germs getting into the ground near her house and then should act accordingly.

The emanations from fresh, upturned earth cause alarm to a great many people and are popularly supposed to produce disease. Investigations which have been made where sewer construction has been followed by malaria or typhoid fever prove that these diseases have been imported by laborers who harbored the parasite or the germ of the disease, and have not been due to the upturned soil.

These considerations show that it is not harmful for people to live on clean ground or even below the surface, as in basements, if they have proper conditions and maintain right standards of cleanliness. It is considered very healthful to sleep close to the ground in camps, and when people live on boats they often sleep below the level of the water without harm from that cause.

In any settled community it is almost impossible to know the actual condition of the ground on which the

house is. Accordingly, it is always a safe procedure to avoid dampness, darkness, and dust catchers in the house, and as much sunlight, as dry a soil, as free circulation of air as possible, and as much opportunity for a generous use of soap and water without injury to anything are to be desired.

The following directions will help the housekeeper in determining what points to observe:

Look to the condition of street, yard, rain gutters, cellar walls, cellar floor, and dark closets, if any.

Note if there is any appearance of mold—the odor will usually betray it; of leaks in walls or roof.

Note the sun plan; that is, the hours in the day during which the sun can shine into each room both winter and summer, remembering that sunlight is a great help in maintaining healthful conditions.

Note relation of windows to the prevailing direction of the wind.

Note character of interior construction and finish with reference to holding dust.

Examine the drainage plan from attic to cellar. Never move into a house the drainage pipes of which are so built in that they cannot be readily seen. Note the traps, the slope of the main pipes, etc.

Secure a written statement from the city inspector; if possible, be present when the inspection is made.

Every housewife should know the "sewer odor"; it is as characteristic as that of onions, and its presence shows that the sewers are not carrying off waste matters as quickly and completely as they should.

Examine the heating apparatus; note if the cold-

air box, etc., answers to the requirements given in Chapter VI.

Note the possibilities of obtaining a quick change of air in every room.

Carefully inspect the apparatus for water supply—the tank in the attic, if there is one (each water-closet must have its own separate flush-tank); avoid the use of a well in any thickly settled region. Learn from competent authority if the town supply is well cared for. Beware of house filters; water, that prime necessity of human life, should be like Cæsar's wife—above suspicion.

Much of the air which enters the different rooms of the house comes from the cellar. A heated house acts like a chimney. Not only does it draw in air from the ground through the cellar walls and floor, unless they are made impervious, but the movement of air is from the bottom upwards, and the air of the cellar makes its way into every part of the house. A German experimenter proved that one half of the cellar air made its way into the first story, one third into the second, and one fifth into the third. The upward movement of air is shown frequently by ceilings. The dark streaks are formed by the deposit of dust from the air which passes through the plastering.

These facts prove the necessity of especially considering the cellar in its function of a reservoir of air for the whole house; and it will be readily agreed that there is little use in adopting special methods of ventilation for the living rooms and sleeping rooms if foul air is allowed constantly to rise from the cellar. Therefore, during most of the year there should be a free circulation of air through screened open windows. In very hot summer

days the windows should be closed during the day to prevent the deposit of moisture upon the walls.

The reader may exclaim, "Why, you would be more particular about the cellar than the parlor!" and she would not be far from right. The day has not passed when a contemplated visit to a cellar is, in many cases, a cause of some trepidation and alarm. There are the breakneck stairs to grope down, and some calculation is needed to land in safety on the board floating about at the bottom. A few steps farther and the intruder may knock her head against a hanging shelf, covered with an accumulation of fragments of food. She decides that a little fresh air would be desirable. She makes her way toward one of the narrow windows through whose covering of cobwebs and dust a few rays of light straggle. The first attempt to open a window is a failure, for the coal-bin forms an impassable barrier; and the second window is as inaccessible, because of the row of old barrels, filled with decaying vegetables and household rubbish, which are placed against the cellar wall. The only other inlet for fresh air is the cellar door, which is too heavy to lift, and the visitor is forced to retreat without fulfilling her good resolve.

For the reverse of this picture we may refer to the cellar which is not only sanitarily ideal but practically possible. It is as light and dry and clean as any room in the house. The windows are large, are on different sides, and can be opened easily. The walls are free from dust and cobwebs, and look quite attractive in their coat of whitewash. The sweetness and purity of the air are not only a satisfaction to the good housekeeper when she in-

spects her cellar, but they have much to do with the well-being of the family. The following questions suggest methods of keeping undue dampness and harmful ground air out of the cellar and of providing suitable and healthful surroundings for the house.

Questions

1. When you selected your house did you make sure that it was in a healthful locality as well as in a convenient and fashionable one?

2. If the house is situated on rising ground, is the surface water (from rains) carried away on all sides by either natural or artificial drains?

3. If the ground is level, are there under-drains carrying away the rain water?

4. Are special pains taken to see that there are no leaking drains or cesspools, defective gas pipes, or other sources of contamination for the ground air within two hundred feet of the house?

5. If the soil is clayey and compact, is there special provision for drainage and for keeping water out of the cellar?

6. Is the house far removed (by at least a quarter of a mile) from garbage dumps or pools of stagnant water where flies or mosquitoes could breed?

7. Are the first floor beams of the house laid upon stone, concrete, or brick foundations, three to six feet above the ground?

Note.—Only about half the height of the cellar is then below the surface of the ground.

8. Is there a cellar or ventilated air space under the whole house?

9. Are the vegetables and other perishable articles stored in a light, cool, and dry room walled off from the main part of the cellar, especially if it contains a heating plant?

10. Is the cellar perfectly dry at all seasons of the year?

11. If not, are special drains laid under the cellar floor?

12. If the ground air around the house is not clean and dry, are the floor and walls of the cellar made impervious by asphalt or other means?

13. Is the cellar thoroughly cleaned and whitewashed *with lime* every spring?

Note.—Lime is a good disinfectant.

14. Has the cellar several windows on opposite sides, if possible, so that it is light and well aired?

15. Is care taken to keep the ground outside the cellar windows free from any contamination?

16. Are these windows accessible?

17. Is the coal cellar a light and dry place?

Note.—The decomposition of the sulphides in the coal goes on much more rapidly in a damp atmosphere. Sulphides cause silver to tarnish.

18. Do the living rooms and sleeping rooms have the sunshine a good part of the day?

Note.—Shade trees often surround the house too closely and prevent the entrance of sunlight, the circulation of fresh air, and the consequent evaporation of moisture.

19. Are there windows on two sides of every room or suite of rooms, or some other efficient means of producing a strong current of air when needed?

20. Does the supply of drinking water come from a source absolutely free from contamination?

Chiefly applicable to a city house:

21. Is the street pavement usually clean and dry?

22. Are the gutters clean, and does the water run freely from them to the drain?

23. Are the alleys well paved and kept clean?

24. If the lot is on made land:

(*a*) Have you consulted old topographical maps, in order to learn the original character of the soil and direction of the water courses?

(*b*) Was the site well drained before the process of filling in was begun?

(*c*) Does the soil consist of gravel, sand, or loam, not a mixture of ashes, street sweepings, and house refuse?

(*d*) Have some years passed since the lot was filled in?

25. Is the back yard provided with a drain for rain water, and is the drain easy of access for cleaning?

CHAPTER IV

PLUMBING

VIEWS in regard to plumbing have probably changed more radically than in any other branch of house sanitation. The old beliefs have led to certain practices which need to be modified in the interest of true sanitation.

Less than a generation ago, books on hygiene frequently contained such passages as the following: "If we look for the cause of the large mortality from zymotic diseases in our cities, we find it principally in sewer-gas poisoning," or, "To bad plumbing we may attribute the prevalence of pythogenic pneumonia, peritonitis, inflammatory rheumatism, typhoid and malarial fevers, croup, diphtheria, and many kindred diseases." It was generally believed that such diseases lurked wherever plumbing was introduced. People read and heard of the dangers threatening them from typhoid fever and diphtheria if they had water-closets, bathtubs, and washbowls in their houses, but the temptation to enjoy the comfort and convenience of these appliances often got the better of their fears.

When the germ theory of disease was developed, it was seen that if "sewer gas," or, more properly, sewer air, caused infectious disease, it could only be by carrying the specific germs of the disease. It was proved, moreover, that germs adhere to moist surfaces and are

not easily given off from liquids into the surrounding air except by splashing or very strong currents of air or the bursting of bubbles of gas formed by decomposing waste matter. All who observed normal conditions in actual sewers believed that the danger of infection was slight.

A few years ago, Major Horrocks, an English experimenter, found typhoid organisms in a vertical pipe more than three feet above the liquid through which the organisms had been passed. This led people to think that perhaps, after all, sewage emanations might be the cause of outbreaks of disease.

On the other hand, many observers had found that the number of bacteria in actual sewer air is extremely small, and that they are generally air forms and not sewage forms. In fact, the air of sewers is usually freer from bacteria than ordinary atmospheric air, as it is usually quieter, and this gives a chance for the bacteria to settle. Later, under the auspices of the Master Plumbers' Association, who with many others desired to have the question settled, Dr. Charles-Edward A. Winslow conducted an investigation and found that mechanical splashing may produce a local infection of the air in immediate contact with the spray, but that it does not extend for any distance or persist for more than a minute or two, and then only four times in two hundred liters of air. He urged that sanitation should deal with practical probabilities rather than with theoretical possibilities, a doctrine which housekeepers may well take to heart.

The conclusion from his experiments is that, if one were to breathe for twenty-four hours the undiluted air of a house-drainage system at any point not immediately

affected by mechanical splashing, less than fifty intestinal bacteria would be taken in, whereas in the amount of New York City water which one would drink in the same time there would be one hundred, or twice as many, ingested. The contrast in the probability of these two experiences occurring to any one living in New York or, in fact, in any city is quite striking. It seems, therefore, that the chance of direct bacterial infection through the air of drains and sewers is extremely slight.

It is not surely known what effect is produced by odors and gases emanating from decomposing matter. It is perfectly clear, however, that, if the process of carrying away wastes is properly conducted, there will be no such emanations. Many plumbing regulations are, however, of such a nature as to retard the flow of sewage and furnish conditions favorable for decomposition. These rules are based on the old idea of the poisonous quality of sewer air. When we are convinced of the real facts, we shall see that the water-carriage system is not merely the most effective but the most sanitary device for carrying away liquid waste matter. Scientific experiment and experience alike have shown that the threatened dangers are simply bogies, that germ diseases cannot originate in the plumbing, and, if introduced, the germs can with very great difficulty and not at all in well-constructed plumbing make their way out of the system of pipes into the house.

Accordingly, instead of reducing the number of fixtures to a minimum and absolutely prohibiting the use of any in a bedroom or a room without a window, sanitarians are urging the more general use of well-constructed

plumbing as a safe and adequate means of maintaining proper standards of personal and domestic cleanliness. There are many plumbing codes and sets of building regulations which need to be completely revised from the point of view of modern knowledge. The result would undoubtedly be much higher standards of cleanliness and more general sanitation, accompanied by saving of expense in construction.

Fortunately, the very great complexity and elaboration of pipes which was formerly thought essential has given place to much greater simplicity, and thoroughness of construction is now far better understood. It may still seem to the housekeeper that the system is a thing of mystery, but for the encouragement of the reader it may be likened to a tangled skein in which, after the first few knots are disentangled, the rest of the difficulties vanish of themselves. Defects in plumbing, while not likely to give rise to specific disease, may cause annoyance and discomfort. In many instances these can be averted, without expense or even technical skill, by intelligent oversight and a knowledge of what defects to look for, how to find them, and how to remedy them.

When an expert is really needed, a little knowledge enables one to recognize the fact in season to save the heavy penalty of discomfort or expense which delay often involves. In no department of household economy are the old adages about the ounce of prevention and the stitch in time more applicable. The questions aim to save the pound of cure and avert the nine stitches. They do not aim to supplant the mechanic or engineer, or to supply the place of a scientific treatise.

They are based upon the principles stated by Rogers Field as the three canons of house drainage:

1. All refuse matters must be completely and rapidly removed.

2. No passage of air can be allowed to take place from drain or waste pipes into houses.

3. No communication can be permitted to occur between the drains and the water supply.

In two ways these questions are designed to be especially helpful.

First. To enable those selecting a house to judge of its sanitary condition. It cannot be too strongly urged, in this connection, that every inch of pipe, every drain and joint and trap, must have been seen and tested by the plumbing inspector of the Board of Health. One test should be made when the house is in process of construction, before any of the plumbing has been concealed, and another should be made on the completion of the house. If all is satisfactory, a certificate to that effect should be issued by the inspector. Inspection by a competent person should follow at occasional intervals after the house is occupied. Inspection which insures honest workmanship and good materials is of great pecuniary advantage, since a leakage or break is liable not to be discovered until it has produced serious trouble, and then there is often delay in having repairs made and, if the plumbing is concealed more than it should be, the partial demolition of floors and walls is often necessary to get at the root of the trouble.

Second. To aid those in charge of a household to maintain healthful conditions. The larger the staff of

servants and the more complicated the drainage system, the more necessary is intelligent supervision. When the mistress has little realization of the importance of sanitary precautions, it is scarcely to be expected that even the most trusty servants will display greater interest, foresight, and intelligence in the daily care of the house. The two most important things are undoubtedly to start right in the beginning with a simple and efficient drainage system of good materials, well put in, and to keep all fixtures in good condition by proper use and by constant watchful attention. The importance of apparent trifles must be felt and careful regard paid to them. The fixtures should not receive any material which is neither soluble in water nor easily divided into small particles by the water. Newspaper in closets, matches, withered flowers, rags, hair, etc., may cause stoppage of the pipes. Of equal importance is the smoothness of the inner surfaces of the pipes, since rough surfaces or the projections which are apt to be left when joints are made serve as a lodging place for solid matter passing through the pipes.

The following brief descriptions may be of help to the reader who is not familiar with plumbing, and it will aid in the most intelligent use of the questions if some simple descriptive manual be read in connection with them to serve for further explanation and illustration.

Fixtures include water-closets, washbowls, tubs, sinks, etc.

The *soil pipe* conveys the contents of water-closets and urinals to the house drain. It may also receive the contents of waste pipes. The *waste pipes* carry other refuse fluids, as of tubs, sinks, washbowls, etc., only.

These pipes may discharge either into the soil pipe or directly into the house drain. The *house drain* is the pipe which receives the contents of the soil and waste pipes and conveys them outside the house. It is nearly horizontal, with an inclination of at least one in fifty, while the soil pipe should be vertical.

A trap is a bend in a pipe, with or without an enlargement, which retains a sufficient quantity of the water

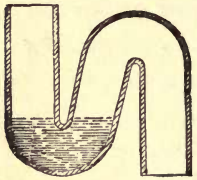


FIG. 1

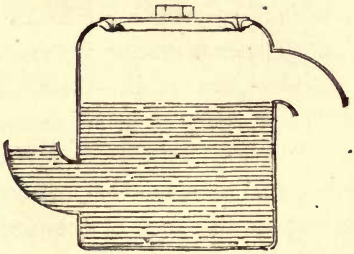


FIG. 2

that passes through it to prevent the passage of foul air back through the pipe and into the room. There are many kinds of traps. The S trap (Figure 1) and the bottle trap (Figure 2) are in common use.

The water standing in the trap is called the *seal*. It is effective when the water is deep enough to close the pipe entirely and thus prevent the passage of air from the drainage system back into the house. If it stands lower, space is left above the water for the passage of foul air back through the pipe, and the seal is "broken," as in Figure 3.

A trap, to be effective, must also be of such a size and shape that it will be self-cleansing. If the water seal

is too deep, solid matter will not all be carried out of the trap.

A seal may be "broken" or "lost" in three ways, viz.: by siphonage, by evaporation, and by capillary attraction. Siphonage usually occurs under the following conditions: When a body of water with considerable momentum is discharged into a pipe (as in emptying a pail of slops or flushing a water-closet) it drags air along with it, and

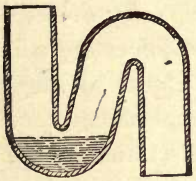


FIG. 3

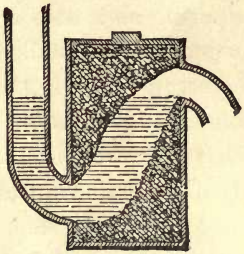


FIG. 4

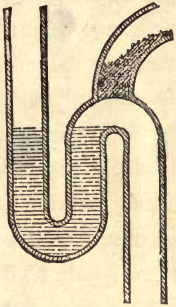


FIG. 5

partially exhausts the air in all the branch pipes. The pressure of the atmosphere outside the pipe, upon the water in the trap, will then be greater than that from inside the pipe, and the water in the trap will be forced down into the pipe, until the water seal is broken and space left for the passage of foul air up into the room.

A pot trap is one like Figure 2, with a chamber large enough to hold a deep water seal which cannot be easily broken. A small pot trap will not resist siphonage, but a large one will. These traps, however, retain filth and are liable to clog. (See Figure 4.)

The vent pipe is an air pipe attached to the highest

part of the bend in the trap, on the sewer side of the water seal, thus affording free admission of air to the inside of the pipe, to balance the pressure of the atmosphere outside and preserve the water seal when the air in the branch waste pipes has been swept away by a discharge of water. The opening sometimes becomes clogged, as in Figure 5.

In view of this fact, many cities have adopted a complicated system of venting and reventing. In this system no trap is vented at the crown, as in Figure 5. This reventing system, requiring as it does a multitude of pipes, is not only very expensive to install, but the multiplicity of joints increases correspondingly the difficulty of keeping the pipes absolutely tight, unless the joints are perfectly made, which is very expensive. Under all these circumstances, it is natural that an attempt should have been made to devise a non-siphonable, self-cleansing trap. The S trap fulfills the latter condition and the drum trap the former. The *Sanitas trap* offers a combination of the two and seems to be the best on the market at present. When it is used, the venting and reventing systems need not be installed.

Mechanical traps are those having, in addition to the water-seal, some mechanical contrivance, as valve, ball, flap, etc. They are liable, from their complicated construction, to get out of order; they are not self-cleansing and accumulate deposits.

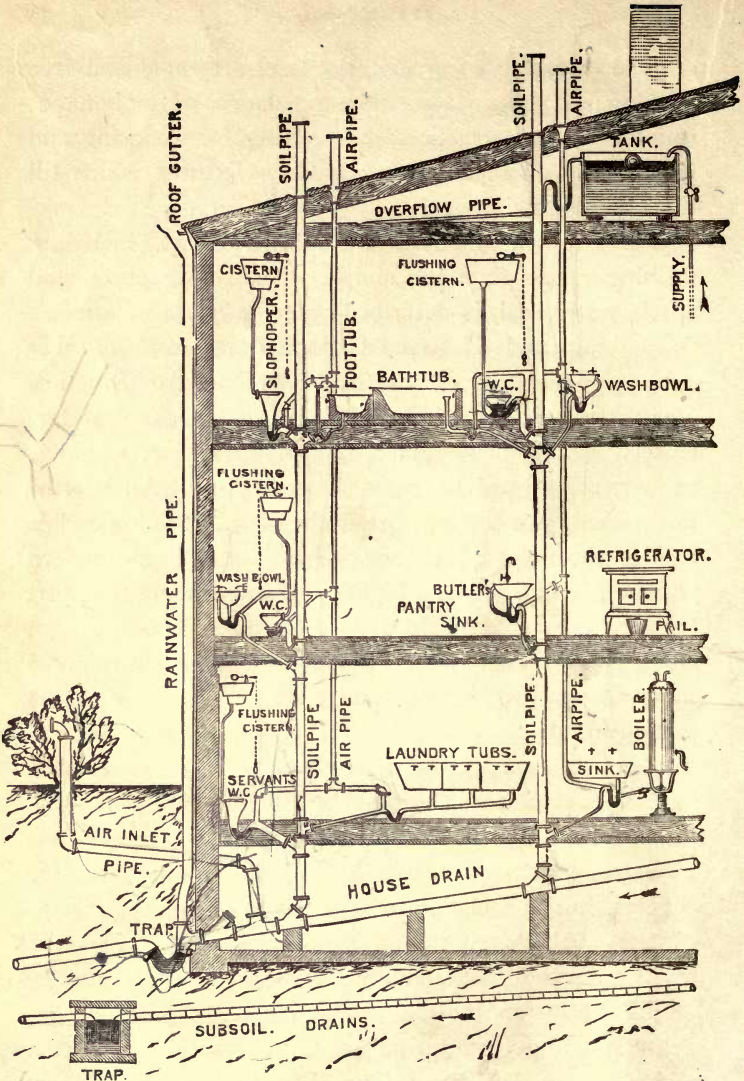
In view of these objections, it is generally considered best to use vent pipes with water-closet traps; and bottle traps, frequently cleaned out, under sinks, basins, and tubs.

The essentials of a sanitary closet are rapid and free flushing; a deep water-seal; avoidance of siphonage; simplicity of construction; accessibility for cleansing and inspection. There are many modern fixtures which fill these conditions.

An excellent modern wash-down closet, including flushing rim, siphon jet, simple yet solid structure, and ample water seal, is described on page 492 of Putnam's "Plumbing and Household Sanitation," and another one on page 167 of Starbuck's "Standard Practical Plumbing." A list of the old-style, complicated water-closets would include pan and plunger closets, valve, anchor, offset, and long and short hoppers. All but the last named have the trap below the floor, It is impossible to keep them clean, and they are prohibited in all modern plumbing codes. The multiplicity of joints about the short hopper makes it an objectionable fixture. The wash-out closet is prohibited in some places, but, though it requires more care in keeping it clean, it is much liked by nurses and physicians.

The question of the disposal of sewage outside the immediate premises is beyond the control of the individual in the city. The disposal of sewage where there is no water-carriage system will be touched upon in a later chapter, but any elaboration of the practical application of the methods suggested should be sought in some treatise devoted to the subject.

In conclusion, we may quote from Mr. J. Pickering Putnam ten general principles of universal application which might be called The Ten Rules of Sanitary Drainage:



This figure shows types of plumbing which in some places are still required by law, but which should be superseded by more simple and less expensive devices.

1. Simplicity.
2. Accessibility.
3. Soundness of material.
4. Tightness of joints.
5. Ventilation.
6. Thorough flushing.
7. Avoidance of mechanical contrivances.
8. Automatic operation.
9. Economy of water.
10. Noiselessness.

Questions

1. Have you a plan of the system of pipes in your house? (See W. P. Gerhard's diagram on preceding page.)

2. Is all the plumbing work exposed to view or easily accessible?

3. Are the fixtures on the different floors placed over each other, so as to avoid horizontal soil and waste pipes?

4. Are all the pipes air-tight, as shown by the peppermint or other reliable test?

Note.—Pour two ounces of oil of peppermint into the soil pipe at its mouth above the roof, if it is accessible, or into the basin or water-closet nearest the roof, first closing the vent pipes which appear above the roof. Pour in, immediately after, a pailful of hot water; if the odor of peppermint is perceived at any lower fixture, it is an indication that there is an opening in some pipe through which foul air may escape. The peppermint should be kept outside the house until needed, and the person who pours it in should remain on the roof, or in the room with

closed doors, until the examination of the fixtures below has been made by assistants; otherwise, the odor will come from the bottle or the clothing of the person and spoil the test. Oil of peppermint is sold for the purpose in two-ounce vials, hermetically sealed.

5. Is the house drain carried in full sight along the face of the cellar wall or suspended from the cellar ceiling?

Note.—If there are fixtures necessitating the laying of the pipe at a lower level than the cellar, the drain should be laid in a mason-work trench (or on special foundations, in filled-in land), under the cellar floor, with movable covers, that leakage in the joints of this important pipe may be surely and quickly detected.

6. Is the drain protected from the settling of the cellar walls by an opening, arched or crossed with a long stone, where it passes through them?

7. Is the continuation of the house drain outside the house to the sewer or cesspool properly laid, *i. e.*:

(*a*) Are the pipes of small size, not more than five inches in diameter, in order that they may be thoroughly scoured by the rush of water?

(*b*) Are they laid with a continuous grade of at least one in fifty?

(*c*) Have they tight joints?

8. If this outside drain is in made ground, or quicksand, or near trees, or a well used for drinking, is it made of iron? If otherwise, if not of iron, is it of earthenware, with cemented joints?

9. Is the house drain connected directly with the sewer without any intervening trap?

Note.—Such a trap retards the removal of waste matter and double-traps all the fixtures, which may cause trouble in case the vent to this trap is stopped. In the absence of this trap, better circulation of air through the sewer is secured.

10. Is the soil pipe:

(*a*) As small as four inches in diameter?

(*b*) Carried in a straight line at least two feet above the roof for ventilation, with its opening away from windows, chimney flues, and fresh-air ventilators?

(*c*) Is this extension of pipe at least four inches in diameter, so that its mouth may not be closed by frost?

(*d*) Made of cast iron with calked lead joints, and coated inside and outside with asphalt or some equivalent substance?

11. Do the branch waste pipes connect by a Y branch and one-eighth inch bend with the soil pipe?

Note.—A Y branch is so named from its shape.

12. Has each water-closet, washbowl, bathtub, sink, set of laundry tubs, etc., a separate trap, and *one* only?

Note.—If a fixture has two traps, or if there are two traps on the same length of pipe, the air between them may be so compressed that it will force its way through the trap having the shallower water-seal. This is the cause of the irregular gurgling sound sometimes heard. It may be remedied by removing one trap, or by connecting the crown of one of the traps with a vent pipe, as is now usually done with all traps.

13. Does each water-closet have a sufficient supply of water, discharged with enough force when emptied, com-

pletely to scour the traps and branch waste pipes, *i. e.*, four gallons to each closet at each flushing?

14. Are the water-closets flushed with water from a special cistern used for that purpose alone and frequently scrubbed with strong soap and water?

15. Are all objects excluded from the fixtures which are likely to obstruct the pipes or empty the trap by capillary attraction, such as hair, strings, rags, china, glass, or anything not quickly and easily dissolved?

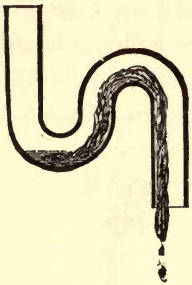


FIG. 7

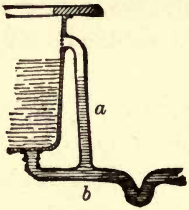


FIG. 8

Note.—See Figure 7.

16. When a fixture is not to be used for some time, is the evaporation of water in its trap, which would destroy the seal and admit foul air to the house, prevented by pouring down oil, so as to cover the water in the trap, or is the water replaced by glycerine?

17. Are the fixtures as free from woodwork in the form of casings, etc., as possible?

18. If not, can the woodwork concealing them be easily removed, and is it frequently removed for the examination and cleaning of the fixtures?

19. Are concealed overflow pipes avoided, and standing overflow pipes or some substitute used? If the overflow pipes (*a*) are concealed, are they frequently flushed with clean water? Do they connect with the waste pipe between the bowl and trap (*b*)?

20. If the vent pipe is used, is it (*a*) either extended through to the roof and two feet above it, entirely separate from any chimney flue, or branched into a soil pipe above the inlet from the highest fixture?

(*b*) Is it either vertical or continuously sloping, to avoid collection of water by condensation?

(*c*) Is the main vent pipe at least three inches, and the branch vent pipe two inches, in diameter?

21. Are slop-hoppers thoroughly flushed after each use?

22. Is their outlet provided with a strainer?

23. If a grease trap is provided for the kitchen sink, is it frequently cleaned and inspected?

Note.—Grease carried from the kitchen sink by hot water soon becomes cold and adheres to the sides of the pipe and trap unless the drain has a very good pitch. A special trap placed near the sink to intercept the grease before it congeals is called a grease trap. If there is no grease trap, the sink should be frequently washed out with a hot solution of washing soda or potash. This is more effective if done at night after all other work is finished.

24. Is the space under the kitchen sink free to light and ventilation, and accessible for frequent cleansing?

25. Are all articles excluded from the sinkpipe which are likely to obstruct it? (Question 15.)

26. Is the refrigerator waste pipe free from direct connection with the soil pipe or drain?

27. Is it discharged by a pipe opening above a sink in the basement, or emptied on the ground in such a way that it drains off quickly?

28. If the sink is used, is the waste pipe from this sink effectively trapped before entering the drain?

29. Are the waste pipes which lead from the sheet-lead safes provided under basins, tubs, water-closets, etc., to prevent flooding of floors and ceilings, not directly connected with the soil pipe or drain, but discharged into an open sink in the cellar, or over water-closet cisterns?

30. Are the overflow pipes of all cisterns used for drinking, cooking, or washing free from direct connection with the soil pipes?

31. Are they either discharged on the roof, or over an open sink, etc., as above?

32. Are rain-water leaders used for that purpose only, and never as soil, waste, or ventilating pipes?

33. If, unhappily, the leader does discharge into the drain and its top opens within ten feet of a window, is it trapped at the bottom, just before entering the drain?

Note.—When the contents of these waste pipes (in Questions 26–33) are eventually discharged into the drain, they are of great assistance in flushing the pipe. The disconnection by trap and at the open sink reduces to a minimum the danger of back passage of foul air.

When these wastes are discharged directly into the soil, they are liable to cause standing puddles, to gut lawns, and to increase the dampness about the house and the possibility of dampness in the cellar.

34. Are the surfaces of all fixtures and receptacles for water perfectly smooth, so that they may easily be kept clean?

35. After sinks and bowls have been used, is fresh water turned on to fill the traps and displace the dirty water which would otherwise stand in them?

36. Have you enough fixtures and are they placed conveniently enough to make it easy to secure a high degree of cleanliness for your household?

CHAPTER V

AIR AND VENTILATION

THE necessity for wholesome air in our homes cannot be too strongly urged, and its importance should secure for it the careful daily attention of every housekeeper. She will find it difficult, at best, to keep off illness from her family; but much may be done by good ventilation toward keeping each member of the household strong, active, and happy.

The supplying of such air in a cold climate undoubtedly entails expense, for a great deal of fuel is needed to prepare outside air for our use; but, in estimating the actual cost, several points should be considered. Not only must the bills for coal and wood be compared with the bills for doctors and nurses, but account must be taken of the increase in headache, listlessness, laziness, irritability, and nervousness which follow as a consequence of breathing unfit air.

When, however, the housekeeper comes to inquire what is meant by good ventilation, she meets with difficulties. She finds almost hopeless confusion in the reference books she consults, and the results of expert engineering skill in ventilating public buildings, such as theaters and schools, which she visits are most unsatisfactory. What is she to do then practically in order to secure those conditions for her family upon which she is told their welfare so greatly depends?

In the first place, she must know that carbon dioxide, popularly known as carbonic acid, whose presence in the air was long taken as an index of its impurity and which is still recognized in many legal enactments as determining the fitness of air for breathing, as well as defining "overcrowding," is no longer considered harmful in the amounts found even in air which causes great discomfort. Its presence in the proportion of six parts in ten thousand of the air of a room has been fixed upon theoretically as the proper maximum limit. In order to keep the amount as low as this, when its source is air from human lungs, an average of three thousand cubic feet of fresh air an hour has to be supplied for each person. It was discovered, however, some years ago, and has been many times verified since, that, if other conditions are right, no discomfort is felt even if the proportion goes up to over two hundred parts, and people have worked mentally and physically for more than twelve days with only two hundred and twelve feet of air an hour and have felt no discomfort.

In fact, Lehmann's experiments show that in well-ventilated rooms a person sitting or standing quietly inhales air with twenty-five to thirty-five parts of carbon dioxide (or four to six and one-half per cent of the air which has just been exhaled); and in rooms in which the air is not very impure, up to sixty or even seventy parts. Thus it not infrequently happens that the air immediately surrounding the head of a person contains a much larger proportion of carbon dioxide than the air as a whole. In other words, the actual breathing zone is quite different from the general air.

When these facts about carbon dioxide were first learned, it was thought that it might still be an index of the condition of the air for breathing, even though it might not in itself be significant. But it was soon seen that other impurities and changes in physical properties of the air bear no fixed relation to carbon dioxide. It is not always accompanied with poisonous gases, such as carbon monoxide, with an excessive amount of moisture, a high degree of heat, or harmful dusts.

These theories having failed to explain the facts about "impure" air, it was suggested that a volatile, organic poison is given off with the breath from the lungs. Assiduous efforts to detect and measure this substance have failed, although recently its detection has been claimed by the use of a reaction known as anaphylaxis. Further research is needed in order to prove this theory, although it appears to be a possibility.

The significant discovery was made that in the experiments where the carbon dioxide went up to one hundred and fifty and more parts no discomfort was felt unless the humidity was increased. If the air contained half as much moisture as it could contain, or had a relative humidity of fifty per cent, "the discomfort did not begin until the temperature reached 26° C. (79° F.), whereas if the humidity was seventy-five to eighty per cent the discomfort was invariably noticed at 24° C. (75° F.)." The temperature of the skin rose and there was an increase in humidity on the covered portions of the body, in addition to disagreeable subjective sensations. Moreover, if the body was inclosed in the experimental chamber at a relatively high temperature and

humidity, the sensations were disagreeable even if pure air from outside was inhaled, while if the subject was placed outside and inhaled air which had been made impure by another person, there was no disagreeable effect.

In other words, it seems to be definitely proved that chemical contamination of air by the body does not affect the comfort of people, whereas moisture and temperature do. Physically and mentally, the subjects were apparently uninfluenced by the long sojourn of two weeks or more in vitiated air.

A man leading an active life produces heat enough in one day to raise six hundred pounds of water from freezing to boiling. If he is less active, a proportionally smaller amount of heat is produced. The body, however, must be kept at a practically constant temperature and all the other functions of the body are subordinated to this —digestion, mental work, and so on. This heat is lost by heat transfer or radiation, conduction, and convection, and by the evaporation of water from the skin, or perspiration. If the body produces a great deal of heat and the humidity of the surrounding air is high, and if the perspiration cannot evaporate and thus regulate the heat of the body, the blood then rushes to the skin from the different organs, so as to increase the means of losing heat. In consequence, the other functions of the body are impaired, mental work becomes difficult, one feels drowsy, and the conditions prevail which we recognize as the same on a warm, muggy day or in a crowded, ill-ventilated room.

Humidity acts in two ways, viz., cooling and heating.

First, high humidity with a temperature below 70° F., as on a cold, damp day, increases the conductivity of the air; the body loses its heat rapidly and feels chilled. *Second,* high humidity with a temperature above 70° F., as on a warm, sultry day, interferes with the evaporation of perspiration, which would otherwise help cool the body, and the effect is that of heating. Dr. C.-E. A. Winslow's experiments show that a temperature of 80° F. with moderate humidity, or 70° F. with high humidity (over 70 relative humidity), produces depression, headache, and dizziness, and that at 78° F. fever often sets in.

Between 68° and 70° there is a so-called neutral zone, where high humidity makes little difference and consequently may be ignored. But a very slight increase in the temperature makes the humidity evident, and the discomfort is wholly independent of the quality of the air that is introduced.

The amount of moisture in the air may have effects of a different kind. The capacity of air to hold moisture increases with its temperature. Air which is heated has therefore a low relative humidity and seems dry. It tends to take up water, as may be seen from the way in which furniture often warps in rooms heated by steam. It even draws water from the tissues of the body to an undue extent, and thus makes the body less resistant to unfavorable conditions. The sudden transition from the dry, highly heated air of city houses to damp, cold, out-of-door air involves a difficult adjustment for the body, and it is probably true that one reason why living in rooms with open windows is so beneficial is that it lessens the amount of this strain.

One factor in badly ventilated rooms which seems a source of harm is the odors from the bodies and clothing of people, but such odors are not believed by scientific authorities to cause directly harmful effects on health. When odors are noticed—and they often exist without being noticed—and are unpleasant, they frequently cause psychical disturbances and should be eliminated. It is more proper to say that their causes should be removed, for their presence should always be taken to mean that processes are going on which should not be tolerated. The removal of their causes means more complete cleanliness, and this is more effective than so clumsy a contrivance as moving large volumes of air or removing odors by ventilation. It should be remembered that odors are always more offensive when the air is hot and humid.

A book on air, which was for a long time a standard authority, cites among the ways by which air may be defiled "putrefactive processes, sewage emanations, and excremental filth," and "poisons of unknown nature evolved by damp and filthy soil." It is not now believed that disease can be caused by air defiled in any of these ways. On the other hand, the proof is conclusive that malaria, the disease which is often attributed to marsh air, is caused by means of infection through a special kind of mosquito, and typhoid fever, so closely associated with "sewage emanations," is due to infected food or contact infection. Night air, which is often thought impure, is in reality purer than day air. It contains fewer germs, because usually there is less wind to blow them up from the surface of the ground; and, as there are fewer fires in use at night, there are fewer products of

combustion in the air. The notion that it was dangerous came from its connection with malaria. If windows were kept tightly shut and the night air was thus prevented from getting in, people suffered less from malaria. The explanation is now known to be that the infection-bearing mosquitoes, flying at night, were kept out, and the same is true of the freedom from malaria which comes from not staying out of doors after sundown, as was thought necessary in Italy before the marshes were drained and the mosquitoes exterminated.

It must not be thought that in this discussion the significance of the presence of a really poisonous gas, like carbon monoxide or those gases which come, for example, from burning dust on surfaces of hot radiators, or of pathogenic germs and irritating dusts is overlooked. The remedy, as with odors, is to prevent their getting into the air rather than to attempt to remove them by the costly and often ineffective method of moving the air which contains them. This is a safe conclusion to reach, even if one is reluctant to accept the opinions which are rapidly gaining ground that very few diseases are air-borne and that the germs come from contact with persons rather than from the environment.

Under the influence both of experience and of physiological experimentation, there is a growing belief in the wholesomeness of open-air treatment for sick people and of open-air life for well people. The results obtained, however, are not due to the greater purity of the air, for it is indeed sometimes less pure, as when dust is blown by the wind; or to greater pressure of oxygen, for in many health resorts in high altitudes it is less than

normal; but to the movement, coolness, and relative humidity of the air. Flügge, the German scientist, urges that the real reasons for life in the open should be understood. It is not that the chemical condition of inside air is harmful, but that the overheating of rooms causes disturbances of health. One should go into the open, not because one may breathe there chemically purer air, but because its almost constant motion carries away the body heat and causes a beneficial stimulation of the skin and brings about a heightened cell activity that aids in the development of sturdy health. It is confinement in overheated, stagnant air, which pervades the buildings in which people live and work, that is responsible for their depressed mental and physical vigor.

It should also be remembered that the human body has great power of adaptation to heat and cold, and by practice can improve this power and by disuse can lose it in large part. It is therefore a mistake to attempt to avoid the danger of "colds" by living in an even temperature. The result is harmful rather than beneficial, except, of course, in the case of sick or feeble persons who need special treatment.

In an exhaustive study of the ventilation of sleeping-cars, Dr. T. R. Crowder comes to certain conclusions which seem applicable likewise to buildings. He says: "Overheating is the paramount evil. It is the thing to be chiefly guarded against in the attempt to maintain comfort and good hygiene. It is not feasible to cool the naturally overheated air in summer or to dry it when excessively humid. Fan motors and open windows are the available means by which the difficulties arising in

hot weather may be most readily overcome. Carry away the body heat as rapidly as possible by a strong current of air." The same conclusions may be drawn with reference to crowded rooms, where the body heat from the people is sufficient to raise the air to a summer temperature.

In seeking means of establishing movement of air, it should be remembered that a surprisingly large amount of air is admitted through the walls of the house and around the windows and doors. This so-called "spontaneous ventilation" is dependent upon the difference in temperature between outdoor and indoor air, and may therefore be depended upon to a greater degree in winter, when the opening of windows or the admission of large volumes of air through big openings is apt to cause discomfort through the excessive cold. The rate of spontaneous ventilation is also affected by the character of the wall surface. Experiments have shown that in a room containing about two thousand cubic feet, with masonry walls covered with wall paper, 2.5 per cent of the air is changed in every hour for every degree centigrade difference in temperature. The whole air would be changed in less than two hours if the temperature outside were freezing and indoors 70° F. If the walls are covered with oil paint, the exchange will take place in less than three hours, and if whitewashed or calsomined, in less than one hour. The larger the room the smaller are its walls, floor, and roof in proportion to its contained air; hence this kind of ventilation is not as efficient in large as in small rooms or buildings.

Recent investigations seem to show that the "smoke

nuisance," while still retaining its title, is not the source of danger it was formerly thought to be. The gaseous pollution of the air, negligible except where the air is constantly stagnant, and the soot which, except close to the chimney, is an impalpable powder, is objectionable in that, first, it darkens the atmosphere and thus depresses the spirits; and, second, it blackens and injures household furnishings, and thus forms an unnecessary cause of expense and labor. Cinders and large particles of unconsumed coal from badly managed fires are objectionable.

In the light of all these facts, what measures can the housekeeper take to promote the well-being of her household? What conclusions can she draw from the evidences that the bad effects of overcrowded rooms are due, not to diminished oxygen, not to any toxin discharged from the body, but to the absence of free ventilation, or movement of the air, and to the warm and humid atmosphere in such places? What measures can she adopt to secure, not only conditions of health and vigor, but of comfort for her family? The following principles will guide her:

1. She must keep the air of her house as free as possible from harmful and offensive gases. This means that the house must not be in the neighborhood of

(*a*) Leaking gas mains.

(*b*) Objectionable factories.

(*c*) Defective drains.

2. She must exclude the germs of infectious diseases and irritating dusts. This means that

(*a*) She must not allow particles from any body wastes to get into the air which is to be breathed.

(*b*) Her house must be on a clean, well-paved street, open to sunlight and with yards kept free from rubbish and dust.

(*c*) There should be no near-by chimneys smoking unduly.

(*d*) The cleansing processes in the house should be conducted so as to keep the air dust-free.

3. Her house must be so constructed that air can be made to move through it by means of

(*a*) Location where the air is in constant motion, or at least very seldom stagnant.

(*b*) Spontaneous ventilation or, if the house is built very tightly, inlet and outlet flues.

(*c*) Windows open as freely, both night and day, as is consistent with comfort.

(*d*) Electric fans to be used when natural means of moving air are inadequate.

4. The humidity and temperature of the air must be kept favorable. This means that

(*a*) The temperature of artificially heated rooms should not go above 70° F.

(*b*) In rooms occupied by one or two people and artificially heated, provision should be made for the evaporation of water.

(*c*) In rooms occupied by a large number of people, no added humidity is necessary; the temperature of the room itself should not be above 64° F., and special means should be provided by electric fans or otherwise for moving the hot, moist air which tends to accumulate about the bodies of the occupants.

5. No offensive odors should be tolerated. Their cause should be removed.

Questions

1. Is there a constant supply of fresh air in every part of the house?

2. Are you sure that the construction of the house is such that there may be a movement of air in all living rooms and sleeping rooms when they are occupied?

Note.—Spontaneous ventilation may be aided by transoms, fireplaces, flues, windows, and other outlets for air.

3. Are the windows and doors so placed that there may be a specially rapid movement of air when it is needed?

4. Is an outlet for impure and overheated air, as well as an inlet for fresh air, provided in the different rooms?

Note.—An outlet, in the shape of a box, between the ceiling and the floor above, extending from the chimney to the chandelier or lighting fixtures, with apertures over the latter, is an effective outlet for the heat from the illumination.

5. Are the inlets and outlets arranged so that the people in the room will not be made uncomfortable by the movement of air?

6. Are electric fans used when needed to increase movement of air?

7. If there is a gas grate, has it a flue which you can make use of for ventilation?

8. Is there a skylight at the top of the house, so placed with regard to the prevailing winds that it may be kept open a few inches most of the time as an outlet for impure air without causing a downward draught through the house?

9. If such a skylight is impracticable, can a window in the top story be kept slightly open most of the time?

10. Are the outside or double windows made with two sashes or with movable panes, so as to permit movement of air when desired?

11. Are all windows arranged so that they can be lowered easily from the top?

12. If there is a water tank, is the air of the room in which it is placed kept fresh and pure, and is it frequently cleaned?

13. Are the halls supplied with plenty of pure, warm air?

14. Are sleeping rooms kept cooler than living rooms?

15. When a sleeping room is used as a sewing room or sitting room during the day, is it thoroughly aired before bedtime?

16. Do you open your chamber windows before you go to bed?

17. Do you provide for the ventilation of your clothes closets?

18. At night is a piece of cheesecloth hung over the opening of the window, a board inserted, or a screen placed before the bed to break the force of the current of air?

Note.—The piece of cloth not only breaks the force of the air, but strains out the coarser particles of dust.

19. When you give a room a thorough airing, do you see that it is at once warmed again enough for comfort and to prevent remonstrances from the family?

20. When there is a great difference between the temperature indoors and out, do you remember that a

great deal of air finds its way in through the walls and around the windows, and that the window need not be open as far as at other times?

21. In ventilating the bathroom, do you consider the direction of air currents, in order to insure the escape of odors out of doors instead of into other parts of the house?

22. Is there a thermometer in every room?

23. Are the living rooms kept at a temperature not exceeding 70° F.?

24. Do you make sure that the air of your rooms is neither too dry nor too moist for comfort?

25. If a nursery, schoolroom, or sitting room is occupied a large part of the day, or by many people at one time, are the windows occasionally opened for a few minutes to change the air, at a time when the family are at their meals or occupied elsewhere?

26. Does the member of the family who is the last to retire thoroughly air the room where the family have been sitting through the evening, and thus remove the impurities and odors instead of having them escape into the rest of the house during the night?

27. Has the kitchen adequate arrangements for constant ventilation and occasional airing?

28. Do you keep a window lowered a little from the top?

29. Is there a ventilating flue in the kitchen chimney?

30. If odors from cooking are especially troublesome, can a hood over the range or stove be connected with the flue, or are kettles used which have special provision for carrying away the odors?

31. Are there windows on opposite sides of the kitchen for quickly changing the air?

32. Are there openings on different outside walls with register ventilators which may be closed in very cold weather? Are these protected from dust by cheesecloth?

Note.—These should be so placed that no draught will be felt in the part of the kitchen most in use, and should be as near the ceiling as possible, in order to move the upper strata of hot air, which usually carry odors over the whole house.

CHAPTER VI

HEATING

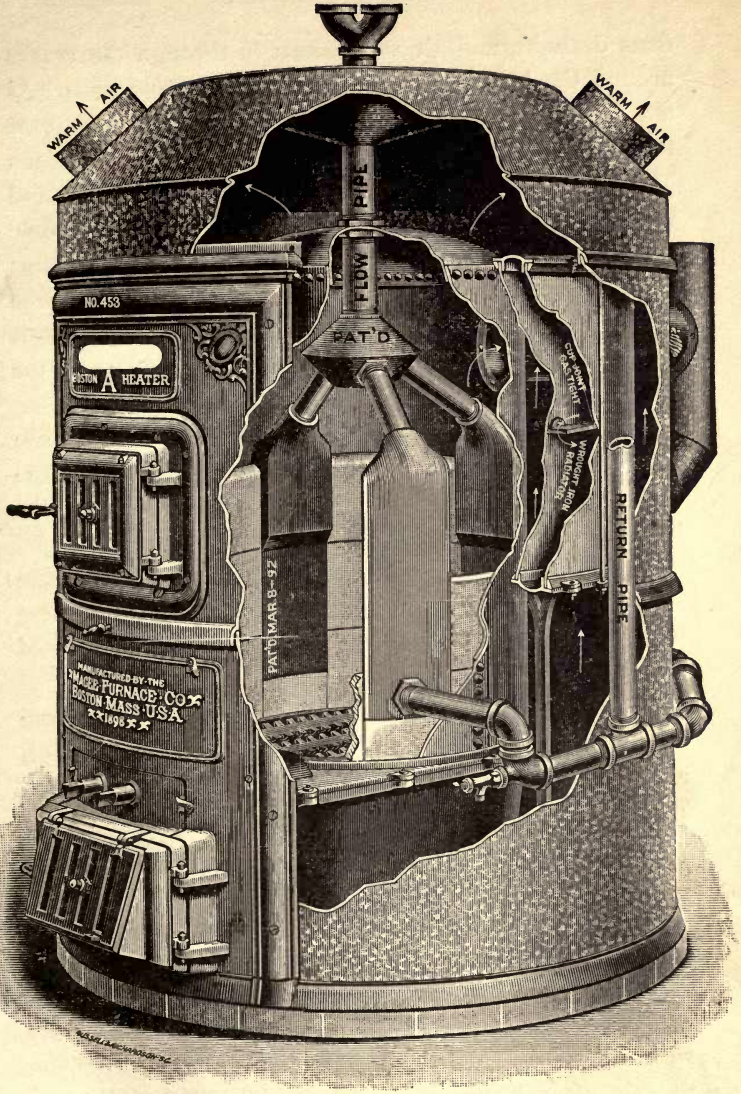
IT must be the aim of the housekeeper to provide all parts of the house with air that is not only fresh and pure, but sufficiently warm for health and comfort. These results are secured, not by having hot air to breathe, but by keeping the walls and floors warm. The different rooms and halls of the house should be of so nearly the same temperature that no chill is felt in passing from one to another. Equable temperature is best obtained by gentle, continuous heat. To accomplish this in extremely cold weather, it may be necessary to furnish heat all night.

In Northern climates, the question of heating the air is an important one during the greater part of the year. Many kinds of apparatus have been devised which are very effective in furnishing a high degree of warmth. In consequence, many buildings are greatly overheated, and the effects on the health are more serious than from cold. If the heat comes from hot metal in the room, as is the case with steam or hot-water radiators, there is the added drawback that the air becomes too dry for health. The housekeeper needs, therefore, to exercise great care to keep her rooms at a moderate temperature, preferably between 68° and 70°, except when more heat is needed by aged persons, and to provide moisture for the air, unless the rooms are to be occupied by a good many

people. In that case, ample moisture will be given off from their bodies. She should remember also that there is quite a difference in temperature between the air near the floor and that higher up—sometimes as much as 15° —and this must be taken account of when babies are put on the floor. Many an attack of "snuffles" will yield to care on this point.

The system whereby a large central heating plant is established and steam heat is furnished to different houses is increasing in popularity. The plan has been tried in several cities of moderate size and is becoming more successful as the manufacturers grow more expert in installing the apparatus. At first the difficulty was to find means whereby the pipes carrying the steam could be sufficiently protected from loss of heat. The present method is to apply a preparation of tarred wood pulp to the pipes and then wrap them in asbestos. This system minimizes the waste of fuel, does away with the dirt and trouble of separate furnaces, and if it can be installed without too great tearing up of pavements is not extremely costly. In a short time there should be such improvements as will enable heat to be furnished coöperatively at much less expense to householders. The method has not thus far proved to be appreciably cheaper except in economy of labor and trouble—two very important considerations in many cases. It is therefore necessary to consider devices for separate heating which will for a considerable time be the main reliance of the housekeeper.

The old-fashioned fireplaces which our grandfathers used were very large and required an immense amount of fuel. When the fire was lighted it caused a tremen-


WARM AIR
WARM AIR
FLOW PIPE
RETURN PIPE
NO. 453
BOSTON A HEATER
PAT'D
PAT'D MAR. 8-92
MANUFACTURED BY THE
MAGEE FURNACE CO
BOSTON MASS USA
1896

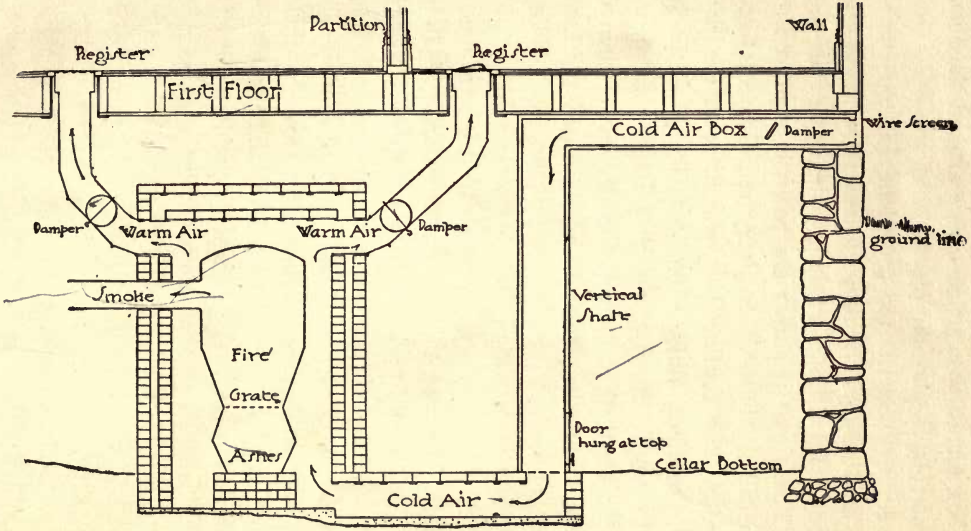
dous draught, and air was drawn in through the cracks around the loose windows and from the cold halls. As a result, the only warm place in the room was close to the fireplace, and this was often too hot for comfort. The modern fireplace and chimney are much smaller, and serve to remove the impure air without causing sensible draughts. The heat radiated from the fire does not warm the air directly, as may be seen by placing in front of the fire a thermometer with its bulb covered. The heat is absorbed by surrounding objects, which in turn warm the air. This is a distinct hygienic advantage.

When the house is heated by a furnace, or by steam or hot-water pipes passing through an air chamber in the cellar, and hot air is thus introduced into the rooms, the hot-air conductors serve also as ventilating flues.

The furnace is best adapted for houses of moderate size, and, if open fires are used in connection with it, there is also the best possible provision for the removal of impure air.

No part of the household machinery requires more intelligent or judicious management than the furnace, and it should never be left wholly to the care of servants. As its essential parts are usually completely hidden from view, the accompanying cuts are given to aid the housekeeper in understanding its construction.

A furnace is practically a large stove standing in an enclosed air chamber. The enclosing surface may be galvanized iron, as in a portable furnace, or brick. The cold-air box is the passage which connects this chamber with the out-of-door air, and the hot-air pipes distribute the air after it has been heated. These should be so


Partition
Wall
Register
Register
First Floor
Cold Air Box
Damper
Wire Screen
Damper
Warm Air
Warm Air
Damper
ground line
Smoke
Vertical
Shaft
Fire
Grate
Ashes
Door
hung at top
Cellar Bottom
Cold Air

planned in reference to each other that the air from the cold-air box has to pass at least once around the furnace before entering the hot-air pipes.

In order to meet the too prevalent demand for compactness and cheapness, many furnaces are made on the principle of furnishing a small volume of air highly heated. The air as it enters the room is then in a state which is called "burnt." Sanitary requirements strictly forbid this. The cold-air box, the fire-pot, the hot-air chamber, the pipes, and the registers should all be large enough to supply the rooms with a large volume of air moderately warmed, not over 120° F. Only then does the furnace meet the demands of both sanitary heating and ventilation.

The material of which the furnace is made is of less importance than the thoroughness of its construction. In cast-iron furnaces, the few joints necessary should be horizontal. The old notion that cast iron allowed carbon monoxide to pass through it probably arose from the fact that cast-iron furnaces and stoves have many joints which it is difficult to keep tight; but stoves with loose covers and cracks have been used in kitchens for years with apparent safety. A moment's consideration of the conditions will show that there is little danger from this cause if the draughts of the furnace are properly arranged. If all the dampers of the kitchen stove are suddenly shut, the gas comes into the room, but not otherwise. So in a furnace, if the draught is up chimney, as it should be, there is little danger of contaminating the air.

As the tendency of warm air is always to rise, it will

be found difficult to heat rooms on the first floor if the pipes leading to them, which are necessarily nearly horizontal, are more than fifteen feet long.

Air at 70° is capable of containing much more moisture than it can at a lower temperature. A dish of water placed near the furnace, where it will rapidly evaporate, supplies this need and prevents the air from seeming parched and dry.

Unless the amount of fire in the furnace can be regulated easily, the family are apt to suffer when warm spring days come, and the fire is allowed to go out. There should be provision for open fires, or a low fire should be kept constantly in the furnace until settled warm weather. The amount of heat can be most easily regulated when the house is heated by hot water, and with this method there is no danger of overheating or burning the air. Excellent furnaces are on the market which use hot water as an auxiliary to hot air. These are especially adapted to buildings which it is difficult to heat with hot air alone.

If the rooms are heated by stoves or by radiators, some other means must be devised to bring in fresh air. It is sometimes introduced through the floor around the stove, so that it is warmed before passing into the room.

Questions

I. If furnace heat is used,—

1. Is the furnace large enough to heat the house thoroughly and at the same time furnish air for ventilation?

2. Are all the joints tight and the castings smooth and sound?

3. Are the furnace and pipes periodically examined and cleaned?

4. Is the smoke pipe at least sixteen inches from the ceiling?

5. Is the smoke pipe so arranged that there is a good draught?

6. Is there provision for the evaporation of water?

7. Are the hot-air pipes so arranged that they do not come within two inches of any woodwork?

8. Is each horizontal pipe less than fifteen feet in length?

9. If your house is so arranged that there must be a horizontal distance of more than twenty-five feet between two registers, do you provide a second furnace, instead of attempting to make one furnace keep the house warm?

10. Have the hot-air pipes dampers in the cellar, by which the heat may be cut off from any part of the house when desired? Are these labeled?

11. Is the cold-air box short and direct, opening out of doors?

12. If necessarily long, is it easily cleaned and so arranged that it cannot become a receptacle for rubbish?

13. Is it kept perfectly clean and dry?

14. Is the area of its opening equal at least to the area of all the registers less one-sixth?

15. If, unfortunately, the cellar is not kept clean and the air in it free from contamination, is the cold-air box so tight that the furnace cannot draw any air from the cellar?

Note.—Wooden air boxes are not to be recommended, because they are liable to have cracks and imperfect joints.

If such exist, some of the injurious effects may be removed by filling the cracks with cotton wool. If an opening or door, such as is shown in the cut, is provided, to be used in cleaning out the air box, it should be made to close tightly, so that air may never be drawn from the cellar into the furnace.

16. Has it a movable slide by which the amount of air admitted may be regulated?

17. Are there two cold-air boxes, on different sides of the house, to avoid the annoyance of too great wind pressure?

Note.—This is especially desirable for a country house in an exposed situation.

18. Has the outside opening of the cold-air box a wire netting to keep out falling leaves, or cats, rats, etc.?

19. Is this opening away from every drain ventilator, cesspool, yard gully, ash barrel, swill tub, privy, or other source of contamination?

20. In a city house, is it on the side of the house farthest from the street, to avoid the entrance of dust, etc.?

21. If not, is cheesecloth or bunting stretched over it to sift out the dust and is this cloth frequently cleansed?

22. Is it at least two feet above the ground?

23. Does the surface around it slope away sufficiently to carry off moisture rapidly?

24. Are the registers so placed as to collect as little dust as possible, *i. e.*, in the wall, when practicable?

25. Are they large enough for the room they try to heat, *i. e.*, two square feet for ten thousand cubic feet of space?

26. If they are in the floor, are they taken out at least once a month and thoroughly cleaned and the pipe wiped out with a damp cloth as far down as possible?

27. Are you careful to provide an outlet for the air in the room, especially in very cold weather, as otherwise there will be no chance for the warmed air to enter?

28. Are the registers so placed with regard to the fireplace, ventilator, or window that the pure, warm air, on entering the room, does not at once pass out by the outlet for foul air, and thus cause a draught and lessen the benefit from the furnace?

II. If the house is heated either wholly or in part by open fires,—

1. Do you see that an abundant supply of fresh air is furnished to the fuel to avoid the formation of carbon monoxide by imperfect combustion, and also to prevent the air used to replace that which passes up chimney from being drawn from other parts of the house?

Note.—With coal, a *blue flame* indicates the presence of carbon monoxide, a most poisonous gas.

2. Are the draughts of the chimney strong enough to carry away all the products of combustion?

3. Is the hearth laid on a brick arch, to prevent danger from fire?

III. If stoves are used,—

1. Is there a provision for the introduction of fresh air to take the place of that drawn from the room by the stove?

2. When the fire is kindling, after putting on fresh fuel, are the draughts arranged so that no carbon monoxide or coal gas passes into the room?

Note.—Neglect of this precaution often leads to serious or fatal consequences.

3. Do you keep an open dish of water on the stove to give the requisite moisture to the air?

IV. If the house is heated either by steam or hot water,—

1. Are the boilers inspected once every year, to see if they are in good condition?

2. Are the pipes tight, so that they do not leak?

3. Are the pipes in the cellar covered with asbestos or some other nonconducting material?

4. If the rooms are heated by direct radiation, *i. e.*, if radiators for hot water or steam are placed in the rooms, are means provided for introducing plenty of fresh air and supplying needed moisture to the air?

Note.—The need for moisture is imperative when the air is heated excessively, as it is with steam or an overheated furnace.

CHAPTER VII

LIGHT AND LIGHTING

LIGHT is considered, both scientifically and popularly, as of great importance in warding off disease and maintaining health. The phrase has become stereotyped that "every room should have the sunlight during a part at least of each day." Under the influence of bacteriological lore, the reason for this is increasingly believed to be that sunlight acts as a disinfectant and destroys disease germs. In the abstract this is true. Tuberculosis and typhoid fever germs, for example, survive but a few minutes when exposed to sunlight. The action of diffused light and of the electric light as well is to lessen the activity of bacteria and other forms of germ life, and they may perish in a few days. Their growth takes place in the dark, as is shown not only by the methods used by the bacteriologist in his laboratory, but by the experience of the housewife with the molds in her bread box or her covered cheese.

These facts need careful interpretation if they are to be used as the basis for sanitary practice. A process, in order to be truly called disinfection, must act with a fair degree of rapidity. This is true of sunlight only when it is direct, and there are very few places in a room on which the sun shines directly even for a few minutes. The light is chiefly diffused and even then is

still further dimmed by the shadows from furniture, curtains, and other large, dark objects. In consequence, for practical purposes of disinfection, the admission of sunlight is not to be trusted. It is not a substitute for cleanliness. The proper method is not to allow disease germs or other forms of microscopic life to be harbored in a room, to be destroyed by the long and uncertain process of devitalization by diffused light. This point becomes still more reasonable if it is true, as bacteriologists are beginning to suggest, that dried, dead bacilli may have harmful effects.

The question may well be asked, "What becomes, then, of sunlight as a sanitary agent?" It does not indeed disappear, but its value must be recognized as psychical and moral rather than as bactericidal. The effect of the mind on the body is well known though not clearly understood, and living in sunshine for a part of the time undoubtedly affects the spirits in such a way as to react upon the physical condition, increase the vitality, and enable the body better to resist disease. Sunlight also is a moral spur to cleanliness. It not only reveals dust and dirt, but, if one has any standard of decency, proves a great stimulus in removing the offending sight.

Another aspect of light is of significance from a practical standpoint. Any observer of plant life, such as a vine, can readily determine that growth takes place at night or in the dark and is checked by sunlight, just as in the case of bacteria. The same is true of animal life. This would indicate that young children in whom the cells are multiplying should not be exposed to direct sunlight for more than a brief time, if at all. The baby can easily

be kept out of doors and given the advantages of free air and at the same time be properly shaded.

The effect of bright light on the nerves is another consideration. The excitement which is felt in a brilliantly lighted dance hall or the untimely waking when the early morning sun pours into one's bedroom are in contrast to the feeling of quiet which comes on entering a dimly lighted church or from drawing the shades for an afternoon nap or to relieve a nervous headache.

Such considerations show that there are limits which must be observed in the use of sunlight for health purposes, and that while sunlight should have free access to rooms there should be provision for excluding it when advisable.

There seems no valid reason to object to dark sleeping rooms, provided they are kept clean and well ventilated, for dark they must be when in use as sleeping rooms and dirty they should not be then or if occupied at any time for other purposes.

Much legislation concerning the required size of windows rests on a false assumption. If the size of the window bears a given relation to the area of the floor, as the law often requires, it does not necessarily follow that the room will be adequately lighted or even ventilated. The window may be so shielded by a near-by building or tree, or may be so curtained or obstructed, that comparatively little light can enter, while it may be so heavy or so unwieldy that it is not easily opened for the admission of air. The requirement of adequate light should be based not on the size of the window, but on the actual light admitted, and this can be determined by the ability

to read ordinary type at a fixed distance from the window during the middle of the day.

Under the conditions of modern civilization, much reading, writing, and sewing is necessarily done in the evening and by artificial light. During the hours spent under artificial light we are in abnormal conditions—conditions which at best are unsanitary and unnatural—and all possible precautions should be taken to render them as harmless as possible. It is believed that much headache, often attributed to other causes, is in reality due to unsuitable lighting. This may come about through the escape or production of harmful gases, excessive heat, or insufficient or too strong a light. These dangers are least to be feared from the electric light, which is, fortunately, coming into more general use, although candles, kerosene, and gas are still used.

The two chief points to be observed in connection with the artificial light are: *First,* To avoid undue vitiation and heating of air in the room. *Second,* To secure a strong and steady light without glare.

All combustion uses up oxygen, produces carbonic acid gas and water vapor, and increases the heat; hence, with the exception of the electric light, all artificial illumination of a room is a great tax upon the air supply and upon the means of ventilation.

As the discomforts arising from poorly ventilated rooms are largely due to excessive heat and moisture, the method of lighting is a matter of great importance.

Combustion not only furnishes the desired light, but it also yields undesired heat, and this heat is the cause of much of the headache in the evening as well as of much

injury to the eyes. If it is necessary to hold the head near the light, it is best to have some kind of shade which is not a good conductor of heat.

The amount of vitiation of the air and the amount of heat given off are seen by the following table:[1]

	Quantity consumed	Candle power	Oxygen removed	CO_2 produced	Moisture produced	Heat calories produced	Vitiation equal to adults
			Cu. ft.	Cu. ft.	Cu. ft.		
Tallow candles	2,200 grains	16	10.7	7.3	8.2	1,400	12.0
Sperm candles	1,740 "	16	9.6	6.5	6.5	1,137	11.0
Paraffine oil lamp	992 "	16	6.2	4.5	3.5	1,030	7.5
Kerosene oil lamp	909 "	16	5.9	4.1	3.3	1,030	7.0
Coal gas, No. 5, batwing burner	5.5 cu. ft.	16	6.5	2.8	7.3	1,194	5 0
Coal gas, Argand burner	4.8 " "	16	5.8	2.6	6.4	1,240	4.3
Coal gas, regeneration (Siemens) burner	3.2 " "	32	3.6	1.7	4.2	760	2.8
Coal gas (Welsbach incandescent)	3.5 " "	50	4.1	1.8	4.7	763	3.0
Electric incandescent light	0.3 lb. coal	16	0.0	0.0	0.0	37	0.0

[1] Notter and Firth: Treatise on Hygiene, page 141.

Since in natural illumination the light is diffused through the room, it would seem to follow that artificial illumination should be similarly diffused in order to avoid undue strain upon the eyes when looking up from book or work.

Welsbach burners favor complete combustion as well as greatly increase the light.

It has been estimated that one ordinary gas jet will consume as much air as two people, and a kerosene lamp will use as much as four people.

Unless the burner is of a good pattern, there may be an escape of unconsumed gas, which still further vitiates the air. All so-called whistling of the gas means an escape of unconsumed gas and should not be allowed. All illuminating gas contains carbon monoxide, which is odorless and extremely poisonous. It is more to be dreaded than any other harmful substance that may find its way into the house. Its effects are insidious but certain, and that makes it a greater source of danger even than disease germs, to which people are often immune. Water gas is nearly odorless, and as it contains a considerable amount of carbon monoxide the law should compel that some odorous gas should be mixed with it, in order that its escape may be quickly and easily detected. The dangers from illuminating gas may be summarized as occurring as follows:

1. Leakage from poor construction of pipes in the house, imperfect tubing, badly fitting stopcocks, premature turning on, incomplete shutting off, and defective pipes in the ground.
2. Gases produced by combustion.
3. Oxygen used up by combustion.
4. Excessive heat.
5. Increase of humidity.

Since it is estimated that one-third of the fires which occur are caused by kerosene lamps, it may not be out of place to mention some precautions as to their use.

Kerosene is obtained by distilling crude petroleum, which consists of a variety of inflammable and more or less volatile liquids. The more volatile give the most brilliant light, such as gasoline used in gas machines.

The vapor of these volatile portions mixes readily with air, and mixtures thus formed explode violently when ignited.

Some of the cheaper kerosenes on the market will give off inflammable vapors when the oil is heated to 90° or 100°F. That is, if the reservoir of the lamp, with the burner and wick removed, were half filled with kerosene and placed in a dish of warm water, when the oil was warmed to 90° or 100° F. the space above the reservoir would be filled with a vapor which would explode if a lighted match were brought in contact with it, and if the lamp were broken and the oil spilled it would burn freely, setting fire to whatever it reached.

Since it is not uncommon to have lamps near the stove, and since, especially with a lamp shade, much heat is reflected downwards, it will be seen that a temperature of 90° to 100° F. is not unfrequently attained.

The only real safety is to use an oil which will not give off inflammable vapor at any temperature likely to be reached. Oil which can be heated to 140° F. without yielding this vapor will not take fire even if the lamp is broken and the oil spilled; it will only burn at the wick, where it is heated much more.

The different state laws fix the temperature (called the "flashing point") below which the oil must not give off these inflammable vapors, at different degrees from 100° to 130°. 120° would seem to be a good mean.

To blow the flame strongly is to run the risk of driving it down into the reservoir. The lamps should therefore have a mechanical appliance for putting out the flame.

Assuming that oil of reasonable safety is used, two additional points ought to be noted:

1. The lamp should be filled daily, for two reasons: (*a*) The higher the flame from the reservoir of oil, the less is the light given for equal volumes of oil burned. (*b*) The larger the air space over the oil in the reservoir, the greater is the danger of an explosion.

2. Perfection of combustion also depends upon sufficient access of air to the wick where the burning occurs. This is attained in two ways: (*a*) By round wicks with air space inside as well as outside (the Argand and student lamps are of this type). (*b*) By the access of air to both sides of the flat wick (the duplex burner, with double flat wick and extinguisher, is the type most used). A good burner allows the air to enter freely at the base, and hence the small apertures must not become clogged.

Questions

Natural Illumination

1. Does direct sunlight enter some, if not all, of the rooms during a part of the day?

2. Are window shades so arranged that rooms may be darkened at need?

3. Are the windows large enough and so placed as to admit light to all parts of the room?

Note.—This should aid in preventing the accumulation of dust.

4. Is the light strong enough on winter days to enable one to read ordinary type eight feet away from the window between the hours of 10 A.M. and 3 P.M.?

5. Do you remember that glass may be cut so as to throw light in any desired direction?

Artificial Illumination

1. If gas is used,—

(*a*) Have you a plan of the gas pipes in the house?

(*b*) Do you know how and where to turn off the gas from the house?

(*c*) Were the gas pipes and fixtures constructed thoroughly and inspected carefully before they were used?

(*d*) Are the gas pipes and fixtures kept tight, so that no gas can escape into the room and vitiate the air?

Note.—The meter should be read from time to time when gas is not in use.

(*e*) Is an abundance of pure air introduced into every room in which a lamp or a gas jet is burning, to make up for the oxygen consumed by the flame?

(*f*) Is sufficient precaution taken to provide means for the quick removal of the gases generated by the flame?

Note.—In case stationary gas jets are used, it is practicable to have the products of combustion carried out of the room by means of flues.

(*g*) Do you also provide for the removal of the air, which is always superheated and unduly humid as the result of the combustion of gas?

Note.—This may be done by providing for circulation of air through the room by means of inlets and outlets, such as doors and windows.

(*h*) Are the modern gas globes used, with large openings at the bottom, in order to secure a steady flame?

(*i*) Is the gas cock so arranged that it will turn no farther when the stream of gas is shut off?

Note.—Gas cocks without a stop turn all the way round, and it is difficult to know when the gas is shut off. Probably more fatal accidents arise from this cause than from blowing out the gas.

(*j*) If drop-lights are used, do you make sure that the tubing and connections are sound and tight?

(*k*) Is especial care taken that a match is lighted and ready to apply before the gas is turned on, in order that none may escape to vitiate the air unnecessarily?

2. If kerosene is used,—

(*a*) Do you use oil of 120° F. flash test, as shown by standard instruments?

(*b*) Do you take care to select the best burner possible?

(*c*) Does the burner have some mechanical means of putting out the flame?

(*d*) If not, is care taken to turn the flame down and blow across the top of the chimney and never directly down into it?

(*e*) Are the burners boiled occasionally in water containing a little washing soda, to prevent creeping of the oil, as well as to clean them?

(*f*) Are you careful not to leave the lamps with the flame turned down?

(*g*) Do you change the wicks often? They strain out impurities and soon become clogged.

(*h*) Are "packed lamps," which have wicking saturated with oil and no liquid, provided for carrying about the house?

(*i*) Are the servants cautioned never to fill a kerosene lamp near a fire or burning lamp?

3. If electricity is used,—

(*a*) Are you sure that all wiring is properly done, in order to prevent danger from fire?

(*b*) In the placing of bulbs, do you remember that you can get better diffused light from several scattered bulbs than from a single one of high power?

(*c*) In choosing globes, do you take into account the purpose for which they are intended, *i. e.*, to diffuse or to concentrate light?

CHAPTER VIII

FURNISHING

IT may be assuming too much to claim that the true standard of beauty in house furnishings conforms strictly to that required for the best sanitary conditions; but, surely, it is not extreme to declare emphatically that the conventional standard is far from being one either of beauty or of health. Wholesome air and sunshine, two essentials of healthful living, cannot be obtained in full measure in the modern elaborately furnished house. And a common and growing mistake is that of using our houses chiefly as a means of displaying the objects which our tastes and our wealth permit us to procure, while we disregard the far more important claims of good health. "The first wealth is health," says Emerson. Our homes are preëminently for ourselves. Why should we turn them into show rooms, that our neighbors may come and gape? Is there no better way of responding to affectionate remembrance or safeguarding true sentiment than by cumbering one's rooms with useless and quite possibly not beautiful gifts from friends?

The canons of good taste everywhere demand simplicity and adaptability as their true basis. Furnishings which destroy comfort and injure health cannot, when judged by this rule, be recognized as truly beautiful.

That furnishings may destroy comfort cannot be denied by any woman who has found herself penned in

an overfurnished room, where the mere act of turning around may be attended by direful consequences in the shape of overturned Lares and Penates.

But how can furnishings injure health?

(*a*) By preventing free access of light and air.

(*b*) By laying unnecessary work on the shoulders of the busy housewife, so that the proper care of her house becomes a burden and an annoyance to her and absorbs her time and strength to the exclusion of other worthy interests and occupations.

(*c*) By forming catch-alls for dust. Dust is composed of many widely different things: particles of carbon (soot), of granite, sand, or other mineral matter; pollen of flowers, bits of plant stems, bark, leaves; manure, small pieces of hair, dried skin, shreds of clothing, and microscopic forms of life, such as bacteria and molds—these are some of the almost infinite possibilities of dust.

In the past, all kinds of dust have been condemned indiscriminately. We now know that while it may not be sightly to have particles of sand or soot on the piano or bookcase, there is no possibility of any harm to health from them. On the contrary, the constant chase after dust which lies quietly out of the way may lead to fatigue and worry, and should no longer be taken as the measure of a housekeeper's skill. Her chief concern should be centered on the microscopic forms of living dust, especially if they are floating in the air. Some of these germs can attack the human body, causing disease. Fortunately, they do not long survive outside of the human body, particularly in light, dry places. Moreover, they have to come from people who have the disease, and we are learn-

ing to adopt methods by which sick people shall not be a menace to well people.

Other germs work in kitchen and storeroom, and are responsible for the souring, fermentation, decay, and molding of foods. Moreover, organic dust, when decomposing under the influence of heat and moisture, is one source of the close, stuffy odor often noticed in ill-ventilated or heavily furnished rooms. It has been claimed that such dust decomposing on the top of hot radiators gives rise to substances which make the air distinctly harmful. This would suggest that the horizontal surfaces of radiators should be smooth and kept scrupulously clean. The safe course in regard to dust is to discountenance all kinds.

It is obviously impracticable to formulate hard and fast rules as regards furnishings. It must rest with the judgment of each housekeeper to determine how rigidly the law of simplicity shall be applied. Where many servants are at hand to do the extra work imposed by elaborate furnishings, there is no reason for excluding objects of beauty—carved woods, rare bric-a-brac, rich hangings—which by their presence afford us daily pleasure. But when proper care cannot be given to such accessories, let them be sacrificed, unquestioningly, on the altars of comfort and cleanliness. Simply remember the *raison d'être* of furnishings and it will be impossible to go far astray. They are agents to minister to our comfort or our pleasure. As soon as their proper care becomes a burden to the housekeeper, so soon as she allows her furnishings to crowd and elbow her in her own home, she has reversed the proper relationship: she has not conquered,

but succumbed to her environment. Let each housewife be mistress of her furnishings, else will she be their slave!

In general, then, emphasis should be laid on simplicity, both for the sake of comfort and for the sake of cleanliness. Fortunately, it is easy to satisfy the æsthetic sense through beauty of color and line. The following suggestions serve to show how these ends may be attained:

Floors. Carpets entirely covering and nailed to the floor cannot be kept thoroughly clean, and are, moreover, a constant temptation to the economical housewife to exclude the sun. Mattings and loosely woven carpets allow dust to sift through them to the floor beneath, whence it cannot be removed. Hard polished or painted floors, with rugs, are, in the opinion of many, preferable to carpets or mattings, although their care involves much hard work and heavy lifting, and where there are old people or children they are not very safe because of the danger of slipping. On the whole, the rug or carpet which nearly covers the floor and is not nailed down is most desirable, and with the help of the vacuum cleaner is much more easily kept clean than hardwood floors and small rugs, which formerly received the stamp of approval of the sanitarians.

Walls, Ceilings, Woodwork. Each should be so finished as to be easily kept free from dust. To this end it is advisable to have the inside woodwork, walls, and ceilings smooth and of a nature to permit thorough cleaning.

Windows. These are for the purpose of admitting light and sometimes air. This purpose cannot be accomplished where, as is not uncommon, they are barricaded

with two sets of blinds, two sets of shades, and lace curtains or heavy draperies. It is quite as possible, however, to have too few curtains as too many. There should be enough to shut out the glare of the sun when desirable.

Furniture and Hangings. The woodwork of furniture, even the concealed surfaces, should be smooth and varnished or oiled, to prevent the lodging of dust and the absorption of gases. On this account, also, the use of upholstered furniture or of heavy woolen draperies of loose texture, which cannot be easily freed from dust, should be reduced to the lowest possible point.

QUESTIONS

I. General

1. Is the inside finish of the house as free as possible from horizontal projections, such as elaborate cornices and mantels, which may serve as lodging places for dust and which require more time for cleaning than the housekeeper can give?

2. Are the walls so finished that they can be easily freed from dust by the use of a wall mop?

Note.—A good wall mop may be made by fastening a soft cloth firmly around a broom or by drawing over it a bag of Canton flannel.

3. Are the wall papers, draperies, and carpets free from arsenic?

4. Since dust sifts through mattings and loosely woven carpets, are the floors laid with closely matched boards, even where they are to be covered?

5. In case rugs or carpets covering only a portion of

the floor are not adopted, are the edges of the carpet frequently cleaned after sweeping, by the use of a damp sponge or cloth?

6. If there is a carpet under the dining room table, is it occasionally sent to the naphtha laundry to be cleansed?

7. Are the inside shutters made without slats?

8. Are the Venetian blinds banished to the piazza?

9. Are the windows of all rooms so curtained as to offer scant hospitality to dust and to admit or exclude light according to need?

10. Are hangings and draperies so arranged as to be easily taken down and shaken?

11. Is the upholstered furniture made without tufting, so that it can be thoroughly cleaned by brushing?

12. Do the living rooms contain neither furniture nor ornaments which cannot be properly cared for, or do not give satisfaction or comfort to the members of the family?

13. Are clothespresses, cupboards, and storerooms kept free from dust, mold, and accumulations of rubbish?

II. The Bedrooms

1. Are soiled clothes removed at once from the sleeping rooms and placed in a suitable receptacle?

2. Are useless ornaments and needlework banished from the bedrooms?

3. Have the windows such curtains only as can be washed?

4. Is the air allowed to circulate freely around the beds, unobstructed by curtains?

5. Are mattresses and pillows aired daily, often

turned and dusted, occasionally cleansed with naphtha, or otherwise, and frequently exposed in the open air on a sunny day for several consecutive hours?

6. Are the bed coverings of material which can be washed?

7. Are the beds stripped and the bed coverings thoroughly aired every morning?

8. If mantel beds or folding beds must be used, are they so made as to allow, when folded, the circulation of air about the mattress?

III. The Bathroom

1. Has the bathroom a tiled, oiled, or painted floor, with no other carpet than a rug which is often aired out of doors?

2. Are the corners of the floors rounded, to secure ease in cleaning?

3. Are the walls finished with tiles, paint, or varnished paper, to prevent the absorption of moisture and odors?

4. Are those receptacles for dust and rubbish, the drawers and cupboard usually connected with the set bowl, exchanged for a wall cupboard?

5. In summer, does the fly screen cover the whole window, so that the upper sash can be lowered as well as the lower one raised?

6. If the bathroom is used by the family for toilet purposes, are there conveniences for keeping the individual towels, soap, and brushes separate?

7. Are the surfaces of the fixtures perfectly smooth, so that they will not retain waste matter?

8. Are fixtures in use which permit turning the water on without the use of the hands?

IV. The Kitchen

1. Is the kitchen floor either oiled, painted, or covered with oilcloth, linoleum, or other impervious covering?

Note.—Oilcloth carpets must be fitted closely to the wall, in order that dust may not collect under the edges. Great care should be exercised in washing them, lest water run under the edges.

2. Are the walls made proof against moisture and odors by tiles, paint, or varnished paper?

3. Is the kitchen free from that nuisance, a closet under the sink?

Note.—This closet too often serves an untidy servant as a place of concealment for unwashed pots and pans, soiled rags, etc., and is an attractive spot for water bugs.

4. Is a large, light, and airy pantry substituted for the several small, dark cupboards which usually join the kitchen?

5. Is the sink of porcelain, soapstone, or iron?

6. Is the pipe which conveys the drippings from the refrigerator entirely disconnected from the drainage system of the house?

Note.—All shelves, boxes, and jars, especially refrigerators, in which food is kept should be kept with the most scrupulous care, and usually only the "eternal vigilance" of the mistress herself will accomplish this.

7. Is the artificial light placed near where the work is done?

8. Is care taken to provide separate hand towels?

CHAPTER IX

THE COUNTRY HOUSE

IN deciding upon a country home, the first consideration is the character of the soil and of the underlying rock formation, since the artificial drains and careful grading of the city engineer are wanting.

If the soil is clayey, or has an impervious clayey layer a short distance below the surface, then at certain seasons of the year water is liable to stand for some time in pools and even to penetrate to the cellar. This class of soils also allows surface drainage to run for long distances along its impervious surface, and so to reach wells at some distance from the source of the water.

A slaty rock with joints or a broken conglomerate with many cracks also allows water to percolate for long distances, while a deep, sandy loam presents the most favorable conditions for two reasons in particular. *First,* The porous nature of such soil allows of quick drainage of rain water, so that the cellar and surrounding soil may be always fairly dry, with no stagnant water. *Second,* Such soil allows the ready purification of all polluting material which is buried in it or flows through it, so that the outflowing water is freed from its former harmful ingredients. This is accomplished, as we now understand, by an abundance of plant life of a peculiar character in the upper layers of the soil. This plant life is most abundant in the first two feet and in sandy loam.

When these plants, known as nitrifying organisms, have plenty of air, they convert into harmless nitrates all the putrefying nitrogenous matter brought to them; but they cannot do their beneficent work if they are smothered in water, or otherwise deprived of air. In that case, other less desirable plants thrive and work, and noxious products may result. Hence it is necessary, for quick and complete purification, that a drenching of the soil with water which carries anything organic and liable to decompose (and what water washing the surface of the ground does not?) should be followed by a period in which air, and not water, may penetrate to a considerable depth, thus furnishing the needed oxygen for the nitrifying plants to grow and to free the water from its harmful organic matter.

For this reason, the sink spout, so often seen in country farmhouses, delivering dirty water at all hours of the day on one spot, resulting in a wet, soggy soil, should be moved at its outlet each day, so that a new area of soil may receive the water while the old one is doing its work of purification. In from three to five days, according to the depth of the sand or loam, the same spot is ready for another flooding.

Because of this same characteristic of the beneficent plant life, the leaching cesspool is wrong in principle when it delivers its foul liquid below the level at which the most vigorous plant growth occurs, and thus allows this unpurified water to mingle with the underground water, which is commonly held to be good because of its freedom from surface contamination. The leaching cesspool, carrying filth below the surface, is a backward step from

savage life, which threw its refuse on the surface; or even from animal life, for animals frequently use care to scatter earth over their body wastes, and thus instinctively secure right sanitary conditions. Leaching cesspools may be used without danger or offense, provided they are so located that, *first,* contamination of the water supply from them is impossible; *second,* an amount of grease which would interfere with quick leaching is not allowed to run into them; *third,* they are not so deep as to deliver their wastes below the level of the nitrifying bacteria of the soil. An additional precaution is the use of two or more cesspools in turn, so that the ground shall not be constantly soaked, but be supplied with the air which is necessary for purification of the wastes.

Septic tanks may well be used for the preliminary treatment of sewage. These are water-tight receptacles so constructed that they retain the solid particles of waste matter long enough for most of them to be liquefied by those bacteria which thrive without air. These tanks furnish the most satisfactory means of sewage disposal in the country when they are so constructed that they empty automatically and intermittently, by means of a syphon, into a system of open-jointed tile drains laid just below the surface of the ground. When some spot of land, sloping away from the house and at a distance of one hundred feet or more, can be found to which a large amount of water may be carried by pipes and automatically distributed to the advantage of trees and crops, it is possible to dispose safely of all house drainage. This is the simplest way of caring for it, and is called, technically, surface or broad irrigation. This is perfectly safe

and successful only when the principles referred to are scrupulously followed, namely: *first,* the quick disappearance of the water from the surface without overdosing any one spot; *second,* the utilization of the prepared food by growing trees or crops. The accumulations of the winter under the ice are quickly disposed of by the vigorous growth of spring. The system is easily and cheaply constructed. In many states the Board of Health is prepared to give detailed instructions as to the best method of construction.

It should be constantly remembered that the purifying power of the upper layers of the soil is enormous, and should be utilized by all country dwellers to the profit of the agricultural crop which feeds on the nitrates that are the product of this invisible plant life.

The earth closet takes advantage of this property, and every country house should possess this means of sanitation, unless it is provided with the water-carriage system. Plenty of absorbent loam can be brought from the fields in dry weather, and when further dried in barn or shed can be used to absorb the moisture from the closets and chamber slops and then removed to the fields and replaced by fresh earth. If iron tanks on trucks are used, this may be readily done as often as necessary. In a large country house this method necessitates the supplementary use of the septic tank system or the properly constructed cesspool for the disposal of the liquid wastes from bath-tubs, laundry tubs, and sinks.

Because of the porosity of the ground and the rather free circulation of water below the surface, wells are peculiarly liable to be contaminated when ignorantly

placed in close juxtaposition to the house and its waste drains. Too great care cannot be taken of the surroundings for even a considerable distance. If, as is often the case, the waste water from the well falls upon the ground at its mouth, it should be carried away by a cement or other impervious drain. The mouth of the well should be protected from any surface leakage; it is advisable to place a layer of cement on the outside of the stone or brick curb, which should rise a foot or two above the surface and extend two or three feet below. This cement will also serve to keep out the angle worms and other small creatures which are liable to fall into the well. The well should never be used for cold storage. The practice of hanging dressed meat, poultry, and milk cans in the well should never be tolerated. There is too much risk in such methods, for clean drinking water is becoming one of the most precious possessions of mankind.

Rain water is used in a great many places. It should not be collected and stored in cisterns until enough rain has fallen to wash the dust and other impurities from the roof and surfaces on which the rain falls. There are in use two methods for the distribution of water through houses having a private supply. The older method is to have an elevated tank, usually in the attic. This is filled by a hand or power pump, and the pipes are served by gravitation. The more modern method is by the pneumatic tank located in the basement, from which the water is forced over the house by means of compressed air. The great advantage of this kind of tank is that it can be located where there is no danger of freezing or leakage, and where the cost of construction is compara-

tively small. In addition, the water is delivered at a nearly constant temperature the year around. If the water supply is brought from a mountain spring and is soft, it should be conveyed in wooden or tin pipes, since such water is liable to dissolve lead or brass pipe to a dangerous extent.

The lighting of the rural home is a much simpler matter now than it was some years ago. With the establishment of electric service, country dwellers are able to have the privilege and convenience of electric lights. Gasoline gas is also a satisfactory illuminant, and aside from the cost of piping a plant need cost very little. Acetylene, which is rapidly coming into favor, furnishes a clear, steady light, and may also be used for cooking.

In places where it is not the custom to have cellars, it is only necessary to emphasize the importance of a free circulation of air under the house. It is possible to live even over water, provided this air space is sufficient to keep the floor from becoming sodden and moldy and is kept clean.

This lack of air space is the bane of country buildings in the northern United States. For the sake of protection from freezing in winter, the house, or portions of it, rest on the ground, or are banked up so that no circulation of air is possible. In other portions of the country, where this necessity for warmth does not exist, this space is constantly open, and rubbish is likely to accumulate in it, which is, of course, likewise objectionable.

Clean soil is the primary factor in the possibility of securing clean air and clean water. If the house is on a proper site, which is kept in good condition and has

free circulation of air and sufficient sunlight, unhindered by close growing trees, it only remains for the housekeeper to carry out the suggestions made in the other chapters to secure conditions conducive to the health of the family. It is ignorance of sanitary principles which causes the deplorable state of affairs often found in the country, and which not infrequently makes the country a much less healthful place to live in than the city.

Questions

If the house has not the water-carriage system,—

1. Are earth closets, ash closets, the pail system, or some method of frequent removal and disinfection, adopted?

2. If not, is the receptacle of the privy cemented, to prevent leakage and soakage, and to permit the complete removal of its contents?

3. Is the receptacle accessible from outside the house?

4. Is the closet separated from living rooms and sleeping rooms by a ventilated passageway protected from storm and cold?

5. Is a box of dried and sifted loam placed near, and enough thrown in after each use to keep the contents dry?

Note.—Gravel and sand are useless for disinfection.

6. Is a separate receptacle and drain provided for slops and other fluid wastes?

Note.—The efficacy of earth depends on its deodorizing and absorbing properties, which exist only when it is dry; as well as upon the action of the nitrifying bacteria present, which cannot do their work if the earth

is saturated constantly with water; hence, if slop water is poured into the receptacle, a larger amount of earth is needed to absorb it and to promote decomposition than can be conveniently used.

7. Are you careful not to throw slop water frequently on the same spot of ground near the house?

If leaching cesspools are used,—

8. Is there absolutely no danger of contaminating the water supply?

9. Is there more than one, so that the action may be intermittent?

10. Are they so shallow that the contents are delivered near the surface of the soil, *i. e.*, within one foot, where the nitrifying organisms live in greatest numbers?

11. Are you careful not to allow much grease to run into the cesspool?

If a septic tank is used,—

12. Is it emptied (*a*) by a flush tank through an impervious pipe into a series of earthen or tile drains with open joints, and its contents discharged into the ground a short distance below the surface? Or (*b*), are its contents carried through an impervious pipe and emptied on the surface of the ground at a distance from the house or a source of water supply? and is the position of the outlet of the pipe occasionally changed?

Note.—(See *a*.) Flush tanks are self-emptying, tight receptacles which receive the liquefied sewage from the septic tank. They are made automatic in various ways, and are thus emptied intermittently. By this action the liquid is forced more rapidly through the pipes and they are prevented from being choked. The sewage is also

more widely distributed and has time to subside, instead of keeping the ground a little wet all the time; the air can then enter, and in the aërated soil the bacteria can do their work of purifying the sewage and rendering it harmless and inoffensive.

13. If the house is in a village lot which is too small to permit of any of the preceding arrangements, is a barrel closet or some other form of small, water-tight receptacle provided and its contents regularly removed to a place where they can be absorbed by the soil without offense?

14. Is the kitchen sink furnished with a tight drain which will carry the drainage away from the house, instead of depositing it under the windows to decompose and act as an important factor in the production of disease?

15. Is the end of the drain next the house connected with the kitchen sink by a lead pipe with a trap?

16. Is the kitchen fire often made use of and considered an effective and economical way of disposing of articles which might otherwise be offensive?

17. Is every receptacle for waste food and sewage, earth closets, cesspools, etc., screened so that no flies have access to their contents?

18. Are you careful to prevent rain water from running into the cistern until after the roof has been washed?

19. Are cisterns and wells so constructed that contamination is impossible?

20. Are facilities provided so that the members of the family will not have to use the kitchen sink for toilet purposes?

CHAPTER X

HOUSEHOLD CONTROL OF INFECTION

IN the previous chapters it has been pointed out that sewers, plumbing, garbage, night air, damp cellars, carbonic acid, odors, and dust have in large measure if not wholly lost their terrors, since they are now known not to be the cause of disease. The housewife may possibly ask if there are left any matters of sanitary significance. The answer to this question involves the consideration of several aspects of the new sanitation which have a bearing on the house and its provisions for proper living.

After the germ theory of disease was accepted, there seemed to be evidence that many diseases were air-borne, that disease germs lived for long periods of time in clothing and articles used by infected persons, and that sewer gas was a carrier of many diseases, such as typhoid fever and diphtheria. We know now, however, that the air of sewers, especially if well ventilated, contains very few bacteria of any kind. The contact of the air with the wet surfaces in the sewer frees it from so many bacteria that it usually contains fewer than ordinary air does. We know, too, that the danger from air-borne diseases and from fomites, *i. e.*, infected objects which retain the infection for some time, is much less than was formerly thought.

Pathogenic or disease-producing bacteria live and reproduce within the bodies of men and animals, and outside of their normal habitat lose their virulence and die more or less quickly, very few of them reproducing outside of the body. As Dr. C. V. Chapin says: "We can now see that persons in whom the germs are growing are much more likely to be the agents of infection than are the things on which the germs are dying."

Cases of infectious disease are grouped into three classes, viz.: known or recognized cases, missed cases (mild, unrecognized, early, and convalescing cases), and "carriers" (infected persons capable of infecting others but not showing any symptoms themselves or made ill by the disease germs they harbor). The bacteria pass from the bodies of these infected persons in the various excretions from the nose, mouth, bladder, and bowels, and the greatest care should therefore be taken to prevent the exchange of body discharges from person to person. Such exchange may take place through water, food, insects, or milk, the so-called "public routes" of infection, or by contact, the infection which proceeds directly from the infected person, the so-called "private route."

The new house sanitation teaches that the person in the house, not the house itself, is the source of danger from infection, and it therefore implies control over all means of conveying disease from one person to another. These means practically resolve themselves into one general principle, *i. e.*, the control of all body discharges. The general measures to be followed with special reference to house sanitation may be briefly indicated.

All waste matters from the body must be rapidly

and completely removed. Habits of personal cleanliness are of fundamental importance, and every facility should be available for aiding in establishing and maintaining them. There should be training in early childhood to use individual toilet articles—soap, towels, brushes, and handkerchiefs—and not to exchange them with other persons. Children should also be taught to keep their mouths clean, to avoid the use of common public drinking cups, to wash the hands frequently, and especially to wash them well each time after using the toilet. The task of keeping clean is a difficult one at best, and it is the part of house sanitation to make it as easy as possible by the provision of generous facilities for bathing and washing. An abundant supply of water, both hot and cold, should be provided at convenient points in the house, especially near the toilet.

Special precautions should be taken to make sure that all persons within the house who have any part in the preparing or handling of food not only are not suffering from any infectious disease, but are not "carriers." Tests of a practical nature can now be made by physicians for such diseases as typhoid fever and diphtheria, which are apt to remain unrecognized. In order to reduce the risk in connection with food, all persons in the house who handle it should be instructed in matters of personal cleanliness. Facilities for washing hands should be provided so that the kitchen and pantry sink need not be used for this purpose. Such utensils as forks and spoons should not be used by different people without careful washing. Dishes washed in clean, soapy water and rinsed in plenty of scalding water have been found to be prac-

tically free from germs. Of course they must be allowed to dry without the use of a towel, that bane of the careful housewife.

It is known that diseases may be carried and transmitted by insects. So far as is known, the common house fly carries bacteria from body discharges mechanically; that is, it does not seem subject to any of the diseases man is subject to, but carries on its feet and body infectious material from open cesspools and privies directly to food stuffs. Public attention has been called of late in many striking ways to the importance of the fly as a factor in disease, but there is danger lest the real significance of the fly nuisance be misinterpreted and people repeat some of the errors of the past and believe that if they are simply busy killing flies—action, action, swatting, swatting—they will accomplish sanitary marvels. The truth is that the fly itself, although very annoying and disagreeable, cannot cause typhoid fever or any other disease. The presence of the fly does not necessarily mean danger from disease. Flies multiply with enormous rapidity wherever they have access to garbage, manure, or filth of various kinds. It seems indeed to be their function to help dispose of such matter. The presence of the fly means, then, that the environment is not clean. In order to play any rôle in causing disease, conditions must be such that the fly can carry the bacteria of disease from the body discharges of one person and, by depositing them on food or drink or dishes, cause these bacteria to gain entrance into the body of another person. Manifestly, killing flies is not a way of getting at the root of the trouble at all. A small proportion of

the effort now expended in encouraging people to kill flies, if devoted to training them to demand effective scavenging, would be much more likely to accomplish the end sought. Garbage and food supplies should be kept covered, refuse in markets and streets should be promptly cleared away, stable manure should be removed frequently and always be screened from flies, and, above all, places where body discharges are placed should be absolutely fly-proof. Toilets should have screened windows and spring doors. If it is not possible to abolish the vault, it should be built so as to be tightly screened against flies and insects of all kinds.

Mosquitoes are carriers in a different way. One kind is subject to infection with the organism which causes malaria, and another kind with that of yellow fever. In each case the mosquito passes on the infecting organism to the person bitten. It is necessary, therefore, in districts infested with either kind of mosquito to have the house and especially the rooms used at night well screened.

Ticks, fleas, bedbugs, rats, and mice are all capable of carrying disease germs, and should not be tolerated in a house. Cats and dogs are subject to many of the diseases from which human beings suffer. The danger from infection, however, is not very great, and, if the animals are healthy and kept reasonably clean, the advantages of having them as pets, so far as our present knowledge indicates, outweigh the remote chance of their proving to be a source of infection.

Because of the general lack of knowledge on these points, there is a striking difference between the rates

at which theory and practice are advancing in the matter of disinfection. A review recently made of the methods of disinfection employed in twenty-nine large cities showed clearly that there is no assurance that disease organisms are destroyed by ordinary house disinfection. Several members of a French medical society have claimed that disinfection as carried out in Paris has been wholly ineffectual in checking the spread of scarlet fever, diphtheria, and measles. It is stated that emphasis wrongly placed on disinfection tends to draw attention away from the mild cases and from the carriers who are the chief factors in the spread of the common contagious diseases.

The practice of "terminal disinfection," or the disinfection of rooms and their contents in general after cases of diphtheria and scarlet fever, was discontinued in Providence, Rhode Island, in recent years; and the results, judging by the number of recurrences in that city since that time, indicate that terminal disinfection is of no appreciable value. In other places, disinfection after measles and cerebro-spinal meningitis has been without effect in checking these diseases.

There are many factors involved in accomplishing the destruction of germs, such as the amount of disinfectant used, the amount of time spent in the process, the humidity, leakage, wind, and rapidity of evolution of the gas used. One need only remember these facts to see that almost any result or even no result at all may be obtained from ordinary or even fairly skillful attempts at disinfection. It has been truly said that "present conditions and practices are farcical."

Attention should, of course, be directed to the actual infective material, and this means constant, scrupulous attention to the cleanliness of the patient and of the objects with which he comes in immediate contact. This attention should be given during the progress of the disease, not afterwards. Soap and water should be used every day in abundance. All bed linen and everything in use by the sick person should be kept thoroughly clean. Boiling is the best means of accomplishing this result. Free exposure to direct sunlight is likewise effective. Dr. Porter, the health officer of Florida, after declaring that if such processes of daily cleansing are carried out when the patient gets well the house will be clean, goes on to say: "Then, if it will give you a little comfort, or if it will appease the neighbors, or if for any other good reason you wish to do it as a sort of celebration of the termination of the disease, burn a little sulphur or use a little formalin, saying at the same time whatever little incantation you like best; but, above all things, don't rely on the sulphur or incantation, but upon keeping things clean."

Of course, there are many kinds of infected material which may properly be destroyed. This may be by fire (burning), as in the case of worthless clothing or magazines, or by strong chemicals, like chloride of lime, as with body discharges. Disinfection and destruction here are synonymous, and they are the only household processes on which complete reliance may be placed for removing danger from infection. The use of deodorants is valueless in this regard. It is indeed a tacit avowal that cleanliness is not maintained.

In "The New Public Health," by Dr. H. W. Hill, the following rules prepared for use in the public schools are quoted. They indicate not only the main points to be taught concerning protection from infectious diseases in the schools, but also pretty closely what can be done in the home.

The germs of infectious diseases are in the discharges of infectious persons. Infectious diseases are caught from infectious persons simply by taking into the mouth some portion, usually very small, of their infected discharges.

1. Exclude from school all infectious persons, thus excluding all infectious discharges.

2. Since infectious persons may enter school at times despite the greatest vigilance, restrict, so far as possible, the scattering of any discharge of any person at any time in school. (This will also train the children to restrict their discharges out of school and in after life.)

a. Mouth discharges are transferred directly to and taken directly from drinking cups, towels, pencils, chewing gum, whistles, etc. Mouth, nose, bladder, and bowel discharges are transferred directly to hands many times daily. Hands go to mouths many times daily; therefore,—

Provide individual drinking cups, individual towels, individual pencils, individual modeling clay, etc. There should be a sign in every school, "Wash your hands after every visit to a closet."

b. Sputum (spit) or other discharges, deposited on floors, sidewalks, etc., are picked up by shoes and so carried into homes. When handling shoes (putting on, taking off, etc.), discharges are transferred to hands, which go to mouths, or touch things that go to mouths; therefore,—

Avoid depositing discharges—sputum, etc.—on floors, sidewalks, or elsewhere, where other people may step on them.

c. Mouth spray is thrown out in talking, singing, coughing, sneezing, etc.; therefore,—

Avoid throwing mouth spray into other people's faces by avoiding close face-to-face conversations, recitations, singing exercises, etc. Cough, sneeze, etc., into a handkerchief always.

d. The air of a schoolroom in use necessarily receives mouth spray into it in talking, reciting, etc.

e. Bladder and bowel discharges are carried by flies when flies can get at them. During early autumn and late spring or summer sessions, flies may carry these discharges from toilets to children's lunches, etc.; therefore,—

Make toilet vaults fly-proof. Provide springs or weights to automatically close toilet doors, and fly screens for toilet windows.

f. Three things destroy comfort and success in school work: Temperature too high; atmosphere too dry; air not in motion. Also, no child can work well in a poorly lighted room; but do not imagine that good lighting, good heating, and good ventilation will prevent spread of infection if infectious persons gain entrance. No school is a sanitary school if the children exchange their discharges without restriction; but only those schools where infectious persons are watched for and excluded are safe schools; therefore,—

Note daily the general state of health of each child. No child who shows any decided change from the usual for that child, especially fever, headache, sore throat, stomachache, or general dumpishness, should attend school until seen by a physician. This rule permits early detection of infectious children. It also excludes children who should be excluded for their own good, even if non-infectious.

g. Children showing defective vision, hearing, breathing, etc., should be referred to the principal, superintendent, or school board for action.

The picture which has been drawn in the preceding pages has dark shadows of uncertainty, of positive error, of danger, but the reader must see the light in it as well. Day by day, through the devotion and skill of scientific

men and women the world over, mankind is learning to understand the various infectious diseases and, what is still more encouraging, to control them and to fortify himself against them. The part which women in the household have to play in using this knowledge is steadily increasing in importance and in happy results.

Questions

1. Is each member of the household provided with individual toilet articles, soap, towels, brushes, etc.?

2. Are toothbrushes kept separate from each other and not put in a common mug?

3. Are the children trained early to brush their teeth night and morning and to keep their mouths clean?

4. Are the children taught not to use the clothing and especially the handkerchiefs of other people?

5. Is there a washstand with running water, both hot and cold, in every bedroom?

6. Has each member of the household, including the employees, access to a bathtub with plenty of hot and cold water?

7. Is each person careful to scrub the bathtub thoroughly every time after using it?

8. Is each member of the household provided with a separate bed?

9. Is the linen always changed when a person other than the usual occupant is to use a bed?

10. Are the children and babies shielded from people who would kiss them on the mouth?

11. Are the hands of each member of the household thoroughly washed before each meal?

12. Are there facilities for washing the hands so that the kitchen sink need not be used for the purpose?

13. Are the persons who handle and prepare the food and dishes of the household known to be free from infectious disease, including colds?

14. Are they, as well as every member of the family, careful to wash their hands after using the toilet?

15. Are the dishes washed in plenty of *clean, soapy, hot* water and rinsed with much clean, scalding water?

16. Is care taken to prevent two persons from using the same dishes, forks, spoons, etc., without washing between times?

17. Are the hands not only washed but disinfected each time after caring for or handling any person ill of an infectious disease?

18. Are all places for the deposit of excretions, as privies and cesspools, screened to exclude flies?

19. Are the pet animals of the household known to be clean and healthy?

20. Are the children taught not to kiss animals nor to allow themselves to be licked by the tongues of animals?

CHAPTER XI

CONCLUSION

ONE by one, until the number is now very considerable, diseases have been proved to be infectious, and the end is not in sight. There seems to be little doubt, however, but that many disorders of the nervous, circulatory, and digestive systems will always have to be considered on a different basis. They are none the less important, and house sanitation will fail in its proper function of maintaining health if it ignores them.

It is naturally beyond the scope of this book to enter into any discussion of pathology or therapeutics. There is, moreover, too much uncertainty as to what the effects of environment are and in what "vitality," or resistance to disease, consists to make many dogmatic statements concerning the relations between housing or habits of living and health. But, although science may as yet fail to give explanation or proof, experience leads us to think that certain principles in regard to living are essential to health. That house cannot be truly called sanitary which does not make provision for carrying out these principles. Several of these have been enumerated in previous chapters. In addition, the following may be briefly indicated:

Accommodations for quiet, comfortable sleep in cool, fresh air.

Wholesome, nourishing, and attractive food at regu-

lar intervals, served in a pleasant environment and with agreeable company.

Opportunity for rest, quiet, and privacy when needed.

Facilities for exercise, recreation, and interesting occupation.

Standards of pure and moral living.

Such conditions will undoubtedly contribute to the upbuilding of sound bodies.

A still more important factor may be mentioned, although it has to do with that subtle and mysterious problem, the effect of the mind on the body. It may be safely said that all the suggestions which have been made in the preceding pages may be conscientiously and sedulously carried out and yet the result may be quite unsatisfactory. The very concern of the housewife to secure health for those in her keeping may lead her to place too much stress on the machinery she employs, and thereby unduly to call the attention of her household to the dangers from disease and to keep them in a constant state of mental anxiety as well as of bodily and spiritual discomfort. It may be difficult to decide where to draw the line, but mental impressions are so vivid and react so seriously on the body that it seems wise to keep an atmosphere of health rather than of disease about the household. Children may be trained in right living and may be taught cleanly habits so that they will become automatic, without arousing their fears and shocking their nerves by giving them too minute particulars as to the reasons or explanations better suited to the expert sanitarian or pathologist.

Such conditions as these prove that, as has already

been pointed out, the housekeeper has an opportunity for exercising large functions, which need not only wide knowledge but keen insight, power of discrimination, and sound judgment.

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