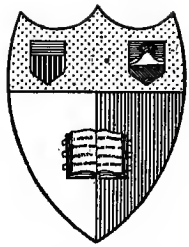


HYGIENE AS NATURE STUDY

GREGG

HYGIENE AS NATURE STUDY

A SERIES OF INDUCTIVE-DEDUCTIVE LESSONS IN HYGIENE FOR GRADES V, VI, VII AND VIII OF THE ELEMENTARY SCHOOLS

By F. M. GREGG, A. M. (Chicago.)

Department of Education and Psychology, Peru State Normal, Author of an Outline of Anatomy, Physiology and Hygiene, A Manual of Parliamentary Law, etc.

Price 70 cents, Paper Bound

PUBLISHED BY THE AUTHOR

PERU, NEBRASKA.

PREFACE

This monograph is an expansion of a bulletin on Hygiene, including a Course of Study for the Elementary Schools, which the author prepared for the Nebraska State Department of Education in 1916. The failure of the legislature of 1917 to provide adequate appropriation, made it impossible for the succeeding State Superintendent to continue the publication. Its re-publication has accordingly been undertaken by the author, in order that the movement for better hygiene work in the elementary schools, especially of his own state, might not be denied this recourse for continued progress.

The general spirit and method of the hygiene teaching provided for in the following pages, has arisen out of the author's contacts with the teaching of hygiene in the Training School of the Peru State Normal. Along with this and back of it is his experience in taking more than sixty classes over the ground of elementary physiology, and in presenting the subject to more than 2000 secondary and collegiate students. The futility of trying to present physiology to grade pupils thus became apparent from two extreme points of view. The book has accordingly been a result of slow development and evolution both in its organization and in its content.

Practically all the thirty-three nature study lessons have been tried out either in the Peru Normal Training School or by teachers in nearly fifty school rooms in Nebraska in the year 1916-17. The enthusiastic reports which have come back from the teachers doing this work in the prescribed way have constituted the chief stimulus in entering upon this larger enterprise. Dean Rouse and Misses Krebs, Perkins, Orr and Van-Middlesworth, of the Peru Training School, are those to whom special acknowledgement is due for sympathetic assistance, and without whose co-operation all experimentation in the teaching of hygiene could not have been entered upon.

Courteous acknowledgment is also made to the Middle-West School Review and to the Nebraska Teacher for the use of matter originally appearing in those journals.

With a few self-evident exceptions, the series of zinc etchings in Vhapter VIII are intended as suggestions for summarizing the different general topics in the subject of elementary physiology. They are not supposed to be used with pupils in the elementary grades, except as they may be simplified by the teacher and brot within the range of the pupil's sense experience. As they stand, however, they should serve as a convenient device for affording a quick general re-

view of the teacher's knowledge of physiology, which should serve as the background of her work in hygiene teaching. They should prove helpful, also, to "normal training" pupils taking the review in physiology.

The actual use which the author has made of the etchings has been in connection with the teaching of physiology to secondary and collegiate students. After a class has been introduced to a new topic in physiology by means of definite work in the laboratory, the next step has been the study of the books. Following the book study, the blackboard summaries have been built up before the pupils, and the latter required to master the outlines to the point of ability to reproduce them from memory.

These methods may seem a bit old-fashioned to certain advocates of "soft pedagogy" but it is the conviction of the author that not a little of the teaching by laboratory and research is lost because of a failure to crystallize and master the essence of the topic under consideration.The author regards the practice of blackboard summarization as the most effective single device he had hit upon in the course of fifteen years experience as a teacher of elementary physiology.

As to the nature-study lessons in Hygiene provided in this manuel, it is not assumed that all of them are practicable for all school conditions, and a few of them in part may not be practicable for any school. Accordingly the author will appreciate and welcome any constructive criticism from any quarter.

F. M. GREGG.

Peru, Nebraska, September 1917.

TABLE OF CONTENTS

CHAPTER I.—SCHOOL SANITATION

SANITATION OF THE SCHOOL PROPERTY

I. THE SCHOOL GROUNDS

1. Is there absence of mud around the schoolhouse when it rains?
2. Is there a good walk leading from the road to the schoolhouse door?
3. Are the school grounds well drained, that is, free from all standing water in wet weather?
4. Are there trees to relieve the excessive heat in summer and to serve as a windbreak in winter?
5. Is there abundant and suitable playground space and apparatus to provide appropriate opportunity and stimulus for healthful physical exercise?
6. Is there a well of pure water on the grounds, or conveniently accessible to the building, and is it so covered as absolutely to prevent the incursion of surface water and all filth?

II. THE OUTBUILDINGS

1. Are the outbuildings in good condition, that is, are they rainproof, do the doors swing freely, are the interior constructions adapted to their purposes, and are they clean and free from unsightly marks?
2. If boys' and girls' closets exist separately, are they suitably screened in the interest of decency?
3. Is there a suitable container for closet excreta, either (1) a dry earth closet, (2) a septic tank container, or (3) a water tight vault or box?
4. Is all thoroughly screened against insects and easily cleanable at frequent intervals, the excreta being either burned, buried, or distributed on tilled land, or reduced by septic tank conditions?

III. THE SCHOOL BUILDING

1. Cleanliness
   (a) Are the floors scrubbed and the windows washed at least once a month, and are board floors oiled every two months?
   (b) Are the floors, doors, walls, windows, ceilings, and school furniture free from accumulations of dirt and dust?
   (c) Are the floors swept daily with sweeping powder, and the seats and other school furniture well dusted with a damp cloth?
2. Heating
   (a) Is the building itself in good condition for maintaining a proper temperature with a good heating apparatus?
   (b) Is the schoolroom provided with a suitable and effective heating apparatus, either a well jacketed stove or a well installed furnace?
   (c) Is there provision for the evaporation of a considerable quantity of moisture at the source of heat supply, so as to humify the air to 60 per cent humidity?
   (d) Is there a good thermometer in the room kept at the height of about four feet above the floor and convenient to the teacher, so that a fairly uniform temperature of 68 degrees F. can be maintained?
   (e) Is the heating apparatus in charge of someone who is thoroughly capable of managing it efficiently and economically?
   (f) Is the fuel abundant and in good condition and is there a provision of suitable kindling?
3. Ventilating
   (a) Is there at least 200 cubic feet of air space for each pupil in the room?
   (b) Is there an aperture a foot square per room for supplying fresh air to the heating apparatus?
   (c) Is there a foul air exit of sixteen inches square

on the wall near the floor and on the side of the room the heat supply comes from?

(d) If conditions (a) and (b) do not exist, is there a provision for open windows in mild weather and for window board ventilators under all other conditions?

(e) Is the practice carried out of flushing the room with fresh air at intermission times whatever the the system of ventilation, and is the whole air of the room regularly renewed about once every fifteen minutes?

4. Lighting

(a) Is the total window glass space equal to one-fourth to one-fifth of the floor space?

(b) Are the sources of illumination, for the most part, on the left of the seated pupils, and on the long wall of the room?

(c) Are the ceilings colored white or cream, the walls light gray or a light green, and the blackboards black but not glossy?

(d) If there are windows at the rear or right of the pupil (for sunlight at some time of the day, or for ventilation), are their bases at least seven feet from the floor?

(e) Are neutral colored window shades provided for both the tops and bottoms of the windows, (the ones at the top being translucent for controlling light on very bright days) and are the shades regularly kept in good order?

5. School furniture, books ,etc.

(a) Are the school seats single and are those of the same size in separate rows?

(b) Are the seats adjustable, and are they fitted to the child at first and refitted every four months thereafter?

(c) Are the devices for using ink kept in good order, and are the desks kept free from ink marks and other defacements?

(d) Are the seats, teacher's desk ,and other furniture of such a nature as to permit ready sweeping and cleaning underneath, and are they of a sort to reduce dust-gathering to the lowest terms?

(e) Are the desks so related to the seats that a plumb line dropped from the rear edge of the desk will fall two inches back from the front edge of the seat?

(f) Are there seats provided for the left-handed children so set as to permit the illumination to come in over their right shoulders while they are writing?

(g) Are the children's books kept in good order in their desks, and is there insistance on general freedom from litter in and about the desks?

6. Water supply

(a) Is the drinking water wholesome and free from the possibility of germ infection.

(b) Is there easy access to drinking water any time of day without the necessity of disturbing the school in any way?

(c) Is there plenty of chance to get a drink when the demand is heavy, as at the close of intermissions?

(d) If individual drinking cups are used (cups used in common, of course, not being tolerated), are they kept where they are free from schoolroom dust?

(e) If individual cups are used, is the container for the drinking water so fixed that the water runs into the cups and cannot be dipped into?

(f) Are there facilities for the pupils' washing their hands after (a) the use of the toilet, (b) handling soiled objects such as chalk, baseballs, etc., and (c) just before eating luncheon?

(g) Are there individual towels kept in suitable recepticles, or better yet, paper towels conventiently at hand?

EMERGENCY OUTFIT

The following list of emergency materials is modified from Rapeer's "Educational Hygiene." This material (or the outfit mentioned below) should be a part of every rural and city school equipment, and can be had from almost any drugstore at the (war) prices named:

One doz. bandages, one inch, for fingers and toes_____50c
One doz. bandages, one inch, for extremities_____60c
One lb. absorbent cotten_____50c
One yard of sterile gauze for use as sponges or as wet dressings _____15c
One roll zinc oxide adhesive plaster, to draw edges of cuts together and hold dressings on, one inch by ten yards _____50c
One ounce flexible collodion with brush to apply_____15c
Two ounces tincture of iodine, with brush to apply_____25c
Four ounces aromatic spirits of amonia, about_____35c
Six ounces carron oil (apply to burns)_____20c
Six ounces witch-hazel (for sprains)_____20c
One box borax_____10c
Two ounces oil of cloves_____50c
1 can Kreso Disinfectant (Parke, Davis Co.)_____35c
One paper safety pins, small and large_____10c
One pair scissors _____25c
Total _____ $4.70
One copy Gulick's Emergencies, Ginn & Co., Boston____30c
One copy Lynch's "First Aid to the Injured," Am. Nat'l Red Cross, Washington, D. C._____30c

THE RED CROSS COMPANY'S CABINET

The Red Cross Company, of Chicago, have for sale at $2.50 a neat, hard wood cabinet, 3¼x9x12 inches, including an illustrated book of instructions. This outfit they call their First Aid CabinetNo.1, by which title it should be ordered.

CHAPTER II–PEDAGOGY OF HYGIENE

PURPOSES AND PROBLEMS

1. To develop such habits in the pupils as will make for the most wholesome physical efficiency.
2. To vitally impress the specific knowledge necessary to the maintenance of the highest efficiency and to the prevention of diseases.
3. To make immediately available a certain body of definite knowledge preparing one to meet vital emergencies and to provide first aid to the injured.
4. To insure pupils with a deep sense of mutual responsibility for community health, and to arouse a pride in wholesome local conditions.
5. To develop a public sentiment in favor of such laws, regulations, and practices as will make possible a "better race of boys. and girls and men and women in a better world."

THE TEACHER'S PROBLEMS

1. Primary
   (a) To awaken an interest in health practices and to provide motivation for taking them up.
   (b) To supply the most recent and trustworthy information regarding the things that make for good health.
   (c) To seize every natural opportunity and, if necessary, to provide artificial ones for inculcating hygienic practices and habits.
   (d) To so present the lessons of hygiene that they will transfer from the schoolroom and playground to the home and the community.

(e) To impress the greatest single law of hygiene, namely, "nothing in excess," and to make vital the worthwhileness of temperance and sobriety in all situations.

2. Secondary. (From the Indianapolis course of study.)
   (a) To secure home interest and support.
   (b) To employ a textbook in a way to subordinate its use to observation and discussion.
   (c) To subordinate physiology to hygiene, but yet to have it form an adequate background (in the mind of the teacher) for the hygienic laws.
   (d) To select those phases of life for emphasis at the varying points of development that a natural response in action, that is, better living, may result.
   (e) To be positive and convincing in instruction, and yet so liberal and sane as to induce the assent of the child's and the parents' reason.

INSTRUCTION IN HYGIENE AND SANITATION

It is felt that progress in three distinct lines should follow the adoption in spirit by teachers generally, of this course of study in hygiene for the elementary grades. The first of these is in the content of the course, the second in the method of instruction, and the third in the effect upon the pupils taking the course. Sympathetic consideration is urgently invited to the following discussion of each of these points.

I. Content—In content the course has been greatly changed in the direction of greater attention to hygiene. Hitherto a good deal of emphasis has been placed on anatomy and physiology as desirable bodies of knowledge for elementary school pupils. This has been particularly apparent in the character of the earlier textbooks provided for pupils, and in the corresponding nature of the examination questions given to eighth grade pupils. The futility of attempting to teach the rather technical aspects of the

subject to immature minds, becomes easily apparent in the usual answers to eighth grade state examination questions. The following are typical answers taken in the spring of 1915 from the pupils' papers in one of the best educational counties in Nebraska, and the inference is plain:

"Mastification is what is going on."
"A common disinfectant is smallpox."
"Epidermis is a certain kind of medicine."
"The diaphragm is another word for backbone."
"The bones are made up of hard mucous membrane."
"Pericardium is something that will put you to sleep."
"Respiration means all the different juices in the body."
"The Eustachian tube is a tube running all over the body."
"The diaphragm is very delicate and is located in the head."
"Fumigation is when the air is shut off and death may come."
"The nervous system is a kind of tube where blood vessels are in."
"The process of digestion causes headaches and much impure blood. Fried potatoes often cause digestion."
"The way to treat a burn is after I burned it I would put my finger on the stove just where I burned it before."
"A disinfectant is anything you catch by going where they are. Measles and chickenpox are disinfectants. When you have them you should stay in the house and keep warm and try not to give them to others. Pimples on the face are not disinfectants but some kinds are."

A widespread feeling of revolt against the futile physiology grind in the grades finally led to the adoption of the following resolution by the Nebraska State Teachers' Association at its meeting in Omaha in November, 1915:

"Coincident with the widespread movement for bringing the public school curriculm into closer parallelism with the present-day needs of the individual and of the community, and in response to the general demand for more serious and effective attention to the physical well-being of the rising generation, we recommend that more attention be given in the upper grades of our elementary schools to the teaching of practical hygiene and sanitation, and that the teaching of physiology, as such, be transferred to the high school for

a full semester of serious study with substantial laboratory work as an essential adjunct."

In harmony with the spirit of this resolution and the constantly growing demand of the people, a course of study is herein provided that attempts to obviate, at least in part, some of the serious difficulties that have arisen in the effort to provide health instruction for pupils of our elementary schools generally.

II. Method.—But if instruction in hygiene and sanitation is to achieve what it was originally designed to accomplish, a change in method of presenting the subject is quite as important as the change in content or matter. In the light of the examination answers quoted above, the older teaching of hygiene stands impeached, not only for its matter, but for its method as well. Manifestly the pupils had not had the sence-experience necessary properly to image or appreciate the things written about, and the method had been a too exclusively bookish one. It is impossible to imagine anything the elements of which have not come into the actual experience of the individual.

The remedy, of course, lies in an inductive approach to all the major topics of the course. Let things be studied first and books afterward. An effort to make clear what is herein implied is attempted after each of the outlines of the course of study in the grades from V to VIII inclusive, and teachers of hygiene are earnestly enjoined to try to absorb the general spirit of the nature-study method of approaching the successive topics of the subject as there illustrated.

III. Effect.—There is still a third point of departure from older procedure, the importance of which it is hoped that teachers of elementary schools will fully sense. This point is one of so devising the health work of the schools as to develop health habits among boys and girls who come under the influence of our schools. For the pupils merely to be able to say over the words of a book, or to re-echo a list or health platitudes, is not necessarily to guarantee a vigorous and efficient life. To be able to pass an eighth grade examina-

tion in physiology has too often seemed to be the end of the instruction in hygiene. This is, however, only incidental to the real aim, namely, the development of a set of habits that will function in the life of the child and adult.

The accompanying illustration shows how Miss Burley Intermediate Grades Critic Teacher of the Peru Training School, follows up her teachings about cleanliness, by a morning inspection of hands, teeth, general appearance, and appearance of the desk and its contents.

READY FOR INSPECTION!
(Courtesy of the "Nebraska Teacher.")

MOTIVATING THE PUPIL

(1) In the first place, it is important that the school administration in general and the teacher in particular shall see to it that the environmental conditions of the pupil in school are such as to make it easier for the child to get right health habits than wrong ones. The specific details for this are given in the introduction of this manual. With her part of these details the teacher needs to so saturate her consciousness that she will have a feeling of "wrongness" about the schoolroom when any one of them is being neglected.

(2) In the second instance, since the pupil cannot be directly interested in health practices, he must be indirectly motivated to take them on. The approach must therefore be made through certain of the child's natural tendencies. The more important of the "springs of human action" are indicated in the following paragraphs.

(a) A child loves to "do something in order to have something happen," says Thorndike. Since what he does at such times is of secondary consequence to him, the teacher can take advantage of the fact and set him to doing something worth while for health-habit ends and at least temporarily turn the flow of his energy away from the formation of undesirable habits. Volley ball, for instance, is a better form of activity than marbles.

(b) The human child is the imitating animal par excellence. If the teacher commands his respect and confidence, imitation of the teacher is inevitable. A fine primary teacher in Hyde Park, Chicago, whose physique and carriage were ideal, said to her pupils one morning in the presence of the writer of these lines, "How many little soldiers have I this morning?" Instantly the children seemed to take on the natural poise of their teacher and this condition continued during the whole of the hour they were under the writer's observation.

(c) A child is highly suggestible. That is, he uncritically accepts ways of doing things new to his experience, especially if they are indirectly approved by some one or more in whose judgment he has confidence. A teacher wanted to develop the toothbrush habit in certain pupils by the suggestive method. She accordingly posted up by the school washbowl an attractive advertisement picture of a child cleaning his teeth with a brush. A few days after this, one of the most needy of her pupils said to her, pointing to the picture, "We got one

o' them brushes at our house now, and we all use it!"

(d) Play is a deeply rooted tendency in child life. It is because Mrs. Stoner took fullest advantage of this fact that she was able to accomplish the remarkable intellectual and healthful development of her daughter, Winifred Sackville Stoner, described in her book, "Natural Education." Many desirable health habits can be started by incorporating them in a game, and many undesirable ones can be broken up in a similar way.

As an example of the first sort, a teacher taught her pupils to use a toothbrush properly and to do other acts of the morning toilet, through a game called "Getting ready for breakfast." The class was divided into two contesting groups and the various acts were done in pantomine, the tooth brushing, for instance, being shown by a twisting motion of the hand in its position for using a brush on the teeth so as to make the brush work the long way of the teeth as well as crossways. The sides did the acts alternately and the teacher was "umpire," checking against each side for each of its individual errors. Such a game is capable of indefinite extension.

An instance of inhibiting bad habits through the use of games is the case of the teacher who broke up the practice of moistening the thumb with the tongue when turning the leaves of a book, or handling papers. This game involved a contest to see who of the class could find a certain page the quickest, all having the same book. If any one wet his finger in the common way, he was out of the game till another page was sought for. The game was varied by requiring the picking out of ten cards most quickly from a pack of authors' cards.

There is a chance for some ingenious school

teacher to distinguish hereself and render a great educational service by developing a set of health-habit games and of suggesting appropriate dramatization of health lessons.

(d) One of the most potent of the springs of human action is the love of approbation, or the instinct of self-assertion. This instinct crops out conspicuously when either children or grown-ups try to "show off." What child, or what adult, for that matter, who has said or done something "smart," does not try to repeat his act at the first opportunity? This tendency to play "smart," or be "stuck up," or get into the limelight, is a primitive exhibition of the instinct in queston. Refined behavior requires that we suppress this tendency, or at least cover it up as much as possible. Yet it undoubtedly lies at the basis of a good deal of our social and even moral behavior. Else whence the potency of the idea, "What'll folks think?" when we are contemplating some doubtful social act?

The specific point about this matter is that the teacher can make more progress in teaching practical hygiene by the social appeal and by invoking group influence than by any other means. As a direct illustration of this method we reproduce the "personal inspection" device found in Hoag and Terman's "Health Work in the Schools."

PERSONAL HYGIENE INSPECTION BY TEACHER AND PUPILS

"The personal inspection of pupils must be adapted to the peculiar needs of individual conditions, but in the main may follow the method outlined below.

"The pupils themselves may be easily taught to take part in this inspection by the teacher's appointing the one passing the best inspection to act as inspector of the rest of the class, for a given length of time. The complete inspection

need not be introduced at once, but the pupils may be led very gradually into it, so that their interest will be aroused and their fears or prejudices overcome. Other points not mentioned in the outline here given may be introduced, at the discretion of the teacher, and in order to meet local requirements. Some points may, of course, be omitted for the same reason, but in general the plan here suggested will be found fairly satisfactory in the majority of schools.

"It should be noted that in this personal hygiene inspection the questions are asked so that the negative answers indicate the number of undesirable conditions existing.

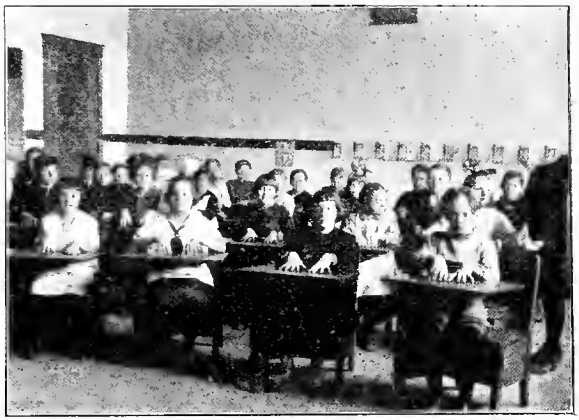
Daily inspection of pupils in the first four grades.

1. Are the hands clean?
2. Is the face clean?
3. Is the hair clean, well brushed, and cared for?
4. Are the nails clean and neat?
5. Do the teeth look clean?
6. Has the toothbrush been used?
7. Are the ears clean?
8. Is the clothing neat and clean?
9. Are the shoes neat, clean, and well fitting?
10. Does the child have a handkerchief?

Additional information to be obtained by the teacher, at intervals:

1. Is at least one window kept open in the bedroom at night?
2. Does the pupil drink coffee? How much?
3. Does he drink tea? How much?
4. Does he always have breakfast?
5. What does he usually eat?
6. Does he always have lunch?
7. What time does he go to bed?
8. What time does he get up?
9. Is he suitably clothed?
10. How often does he bathe?

11. Is he required to do any work for pay? What sort?
12. Are the bowels evacuated daily?
13. Has the pupil apparently any bad sex habits?
14. Does the child use an INDIVIDUAL toothbrush?
15. Does the child visit a dentist at least once every years?



A MORNING INSPECTION
(Courtesy of the "Nebraska Teacher" and of Miss Burley of the Peru Training School.)

CHAPTER III.–WORK OF GRADES I–IV

THE AIM AND THE SPECIAL PROBLEM

In the subject of hygiene the primary aim with children in all the public school grades, is the formation ofwholesome health habits. By this is meant the ability to react wisely in all health situations, without having to think much about it. While this aim is true in general for all education in hygiene, it is especially important in the earlier years of a child's life. Teachers of primary and intermediate grades must therefore concern themselves more with the art of developing habits than with that of imparting information. Their most important pedagogical ally is the psychology of habit formation.

Children under ten years of age do not have any particular interest in health as such. Yet it is also true that the general outline of a child's character is pretty well established by that age. The problem of health training, then, becomes the imparative one of developing desirable habits in a field in which the natural interest of the child is small.

SUBJECT MATTER FOR GRADES I-IV

1. No written or formal hygiene work should be given or required in these grades.
2. The work that is to be given should come in, for the most part, incidentally and at an hour a situation or need arises with the group or with an individual.
3. In general, the needs of the individual pupil and of the group as a whole should be the guide as to what subject matter to present.
4. The following are some positive habits that the teacher

may well keep in mind and seek to establish among her pupils:

A. Personal cleanliness.
   (a) Skin.—Use of water, soap, washrag and towels in connection with hands, face, neck, ears, body, and limbs.
   (b) Hair.—Importance of combing, brushing, and occasional washing.
   (c) Nails.—Keeping them clean and well shaped.
   (d) Teeth.—Use of brush and importance of annual examination by a dentist.

B. Taking food and drink.
   (a) Foods.—Simple, wholesome, sufficient. Candy only just after meals, and then not over much.
   (b) Eating.—Small bites eaten slowly and chewed thoroly. Ordinarily at meal time only.
   (c) Drinking.—Plenty of cool water between meals and also at meals, but not to help swallow the food. Pure milk is a valuable beverage.
   (d) Caution.—Only wholesome food and drink, a fork, a spoon, a tooth pick, and dental thread should, under ordinary circumstances, be admitted into the mouth.

C. Breathing and the care of the nose.
   (a) Breathing.—Pure air and only thru the nose except in violent exercise.
   (b) Care of the nose.—See that clean handerchiefs are provided and their proper use developed.
   (c) Coughing and sneezing.—Desirable to turn face away form others and to cover mouth with handkerchief.

D. Posture and exercise.
   (a) Sitting.—Comfortably erect, limbs not crossed.
   (b) Standing.—Ideally a straight line should be able to touch the outer end of the eyebrow, hip, knee-cap, and middle of foot arch.

(c) Walking.—In walking on a level surface the leg is swung forward, the heel strikes first but not violently, and the foot then rolls forward. The arms should hang pendent, swing naturally, and the body should retain good form. In going up and down stairs, the hall strikes the tread first.

E. Personal attire.

(a) Clothing.—Simple, sufficient, clean ,dry, non-constrictive.

(b) Shoes.—Clean and dry. Heels low and toes broad.

(c) Extra clothing.—Sweaters, heavy coats, and overshoes are for outdoor use in cold weather, to be removed on coming into a warm room.

5. The following are some undesirable tendencies the teacher must seek to combat effectively.

A. Uncleanliness.

(a) Unclean skin with its attendant disagreeable odors (the chief source of "bad air" of school rooms).

(b) Unclean or decayed teeth.

(c) Ill kept hair and nails.

B. Undesirable nasal and breathing habits.

(a) Imperfect breathing from bad posture or constricting clothing.

(b) Fingering the interior of the nose.

C. Imperfect food-canal practices.

(a) Neglecting breakfasts.

(b) Eating candy and nicknacks between meals.

(c) Hurridely gulping down food at mealtimes.

(d) Gum-chewing—it is both hygienically and esthetically undesirable.

(e) Exchanging bites of candy, apples, etc., with other pupils.

(f) Putting pencils, papers, and other promiscuous things into the mouth.

(g) Unwholesome beverage and drink habits.
(h) The spitting nuisance.
(i) Neglect of alimentary elimination.

D. Neglected exercise and posture.
(a) Persistently undesirable sitting and standing attitudes.
(b) Slovenly walking.
(c) Reluctance to engage in games.

E. Undesirable clothing.
(a) Wearing unclean or unsuitable clothing.
(b) Wearing wet or muddy or ill-fitting shoes.
(c) Wearing overshoes or other heavy outer clothing during school hours.

Dramatization.—"Getting Ready For Breakfast
("Courtesy of "The Nebraska Teacher")

CHAPTER IV.—GRADE V: HABIT HYGIENE.

AMOUNT OF TIME

It is intended that a half year shall be given in Grade V to the study of hygiene, with recitations of 15 minutes duration, making a total of about 80 recitations. These may occupy either the first or last half of the school year, or may be distributed through the year in alternation with some other subject. The latter is rather the better arrangement as giving the longer time in which to develop and fix the desired health habits.

In case the fifth and sixth grades are combined in the study of hygiene, as they may be, then a whole year should be given to the two courses. If seventh and eighth grade hygiene courses are also combined, then the one-room teacher would have V-VI grade hygiene one year, and VII-VIII grade hygiene the next year. This arrangement would require only one class in hygiene a year (but running daily thru the year) in the one room school.

THE AIM

As may be readily gathered from the list of topics for study in Grade, V, the general aim is to continue the work of the first four grades in the development of desirable health habits. However, a larger world opens out to the fifth grade pupil than he has known before, a greater expansion of his horizon than he has experienced at any previous time. He is capable now of taking on more skill in doing things and both his wish and his capability to understand the reasons for what he does are greater. The health work can accordingly now be more definite and formal, but the aim remains the same as in lower grades, namely, the specific development of health practices and habits.

METHOD OF PROCEDURE

The fifth grade teacher needs to read and thorly digest what is said about "Methods" under Grades I and IV. To that background of fundamentals the following particular considerations must now be added:

A. The plan requires that each general topic shall be approached in the nature-study way. That is, each major topic in the course and, in some cases, the subtopics, must be studied in a concrete way before the pupils are sent to the books at all. The purpose is to give pupils the necessary sense-experience before taking up book study so that when they come to the latter they can have something in terms of which to image and understand what the books try to tell This part of the procedure should throw as much responsibility on the pupils as possible. They should assist in collecting materials and in constructing apparatus so far as they can, and their study should be done as nearly as possible independently of the teacher and of books. Here is an opportunity to start pupils on project work, one of the great, new things in education.

B. In opening up a new topic the recitation time should be given over to reports on what has been learned by each pupil in his original study, or in conducting a class experiment, to be followed by questions that throw the pupil into original discovery and thinking. If this is skillfully done a great many questions will arise in the mind of the pupil which his work thus far has excited but not answered. Now is the time to send the pupil to nature for more study if profitable, and to the books if the information cannot be gotten otherwise.

C. The book study, when at last it is taken up, should be carried on topically. In the course of study following will be found references to a number

of good recent text books on hygiene. If at least one of the books can be in the hands of each pupil and several of the other books named can be on the teacher's desk for the use of the pupils in turn, then the very best results can be secured. Especially is this true if the recitation is carried on after the plan of the so-called "socialized recitation." The less experienced and more conservative teachers may hold with varying degree to the use of a single book.

D. Finally if the pupil is to fully conserve the gains from his study of a topic, he should have a notebook for his hygiene lessons, and should be required to set down in as systematic a way as possible, the crystallized results of his observation, experiment, research. The hygienic conclusions reacht should be stated with especial definiteness and reviewed until they become well fixed in mind and in behavior.

FIFTH GRADE HYGIENE TOPICS.—HABIT HYGIENE

1. BREATHING GOOD AIR.
    1. Why does the body need air?
    2. What air is good air?
    3. What breathing is best?
2. TAKING CARE OF THE NOSE AND THROAT.
    1. What is the nose for?
    2. How keep the nose in good condition?
    3. When is the throat in the best condition?
3. WHAT AND HOW TO EAT AND DRINK.
    1. How choose good foods?
    2. What are the best habits of eating?
    3. Why chew till the food is like thin soup?
    4. Why, when, and how much water shall one drink?

4. CARING FOR THE TEETH.

1. How improve the teeth?
2. Why form the tooth-brush habit?

5. HARMFUL STUFFS FOR THE MOUTH.

1. Why are tea and coffee drinks that injure?
2. Why are alcoholic beverages drinks that destroy?
3. How does the tobacco harm good athletes?
4. How do cigarettes spoil quisk thinking?

6. MAKING THE BODY STRONG AND STRAIGHT.

1. What are the best body postures?
2. What are the best play and work habits?
3. What are the best feet for running?
4. What are the best sleep habits?

7. CARING FOR THE SKIN, NAILS, HAIR, AND SCALP.

1. Why keep the skin clean?
2. How keep the nails nice?
3. How take care of the hair and scalp?
4. What are the nature and treatment of a headache?
5. How treat cuts, burns, and bruises?
6. How care for poison ivy and other skin poisons?

8. CARING FOR THE EYES AND EARS.

1. When are spectacles needed?
2. What light is good for the eyes?
3. How remove foreign bodies from the eyes?
4. How care for the outer ear?
5. How treat earache and running ears?

9. WHAT TO DO WHEN ACCIDENTS HAPPEN.

1. How avoid the common accidents?
2. How care for sprains and broken bones?
3. How get skill in the art of bandaging?
4. How save the life from drowning?

NATURE-STUDY LESSONS AND TOPICAL REFERENCES

Note.—It is to be understood that no attempt is here made to indicate how much work shall be assigned for each single recitation, as the length of the assignment will have be be determined by the length and number of recitations that the school gives to this important subject. The CHAPTER references following the major (Roman-numbered) topics are for the TEACHER'S especial use. The PAGE references following the minor (Arabic-numbered) topics, are for the PUPILS' and teacher's use. The key to the books referred to is given in Appendix A. The teacher must know that it is not necessary to have or to use all the books referred to, but the more she can have both for herself and the pupils the better.

LUNG TESTING

I. BREATHING GOOD AIR.—Al. V; Dr. X; H-S. X; Wa. VI.

The Nature-Study Approach

Aim.—To learn about breathing, and something about air.

1. Apparatus for a class experiment—A home-made spirometer, or lung tester, can be prepared from a gallon bottle by some one of the pupils as a piece of home-project work, as follows: By calculation or otherwise, determine and mark the level to which an ordinary water glass must be filled to contain just ten cubic inches of water. With this measure, pour ten cubic inches of water into the glass bottle sitting on a level table, and with a new three-cornered file make a scratch at this level of the water. Now pour in another ten cubic inches of water and mark the new water level as before. Repeat till the graduation of the bottle is complete.

   For this study there will also be needed a tub or other vessel of water, and a rubber tube of about a half inch internal diameter and two feet long. This tube should have a short glass tube fitted into one end of it to serve as a mouthpiece for the experiments.

2. Procedure—Children like to "test their lungs." After filling the bottle with water by immersing it in the large vessel of water, hold it up, but keep its mouth under water, and insert the rubber tube in the mouth. Now let a pupil fill his lungs completely while standing erect, and then take the mouthpiece of the tube between his lips, and exhale all the breath he can, delivering it into the bottle. Just before the pupil quits exhaling, see that the water in the inside of the bottle is level with that on the outside. When exhalation is complete, take the reading of the pupil's capacity from the volume marks on the bottle.

   After each using, rinse the glass mouthpiece in a glass of clean water, pour a little hydrogen peroxide on the mouthpiece to disinfect it, and rinse it again. This process is not only hygienic, but it will act suggestively to impress the need of care in such matters. Now take the record of the remaining pupils in turn, and post the records on the blackboard.

   Take each pupil's lung capacity again, but this time in filling the lungs have each one "sit on the small of his back," as pupils are often inclined to do while studying books. Set down these results alongside the other results.

3. Additionl experiments.—
   (a) Take a record, in seconds, of the longest time each pupil can say "ah," using as little force as possible while doing this. Set down these time results alongside the other results.
   (b) Exhale through a glass tube into a glass fruit jar and, when the jar is filled with exhaled air, invert it over a short, burning candle. At the same moment invert another similar jar with fresh air, over another burning candle. Note the times the candles continue to burn.
   (c) Get a number of small bottles just big enough to hold large-sized locusts (commonly called "grasshoppers"). Select pairs of locusts of equal size and put each locust into a vial. The bottles for one locust of each pair should be filled with exhaled air and the other with fresh air. Cork and set aside for several hours. Note the relative times when the members of each pair quit breathing, and, if possible, remove each from the vial at that moment and note what happens after a short time.
   (d) Let each pupil fill a mason jar with his own breath, cover at once and let stand for some time. When the pupils come in from outdoor play let each smell his own bottle. Do not ask for reports here, but simply explain that bad odor is a sign of decayed teeth, or something of that kind (not from carbon dioxid, which is practically odorless).

Questions On The Experiments

In the light of the above experiments, and before any book study has been engaged in, consider with the pupils such questions as the following: Of two boys of the same size, but of different lung capacities, which do you think could run the longer distance without getting out of breath? Give a reason why one should sit erect in his seat. What do you notice about the chests of the finest looking boys and girls you meet on the street or highway? Do you suppose a boy or girl could get a larger chest and lungs? Shall we test our lungs once a week to see who can make the biggest improvement?

How do we know that the air we breathe out is different from that we take in? Do you think exhaled air is poisonous? If not (and it isn't), why did one set of locusts quit breathing sooner than the other? Can you give any good reasons why it is not good to breathe

continuously air that has been once breathed? If your own breath should smell disagreeable, what do you think should be done? Why?

Studying the Books

If the preceding experiments have been entered into heartily by the pupils, they will be keen to find out more about breathing, and now is the time to send them to the books. The assignment would be to the successive page references in the regular text book and also to such other books as the school may provide. Ideally, there should be in the school library several sets of the hygiene books listed for pupils, and the teacher should study the references suggested for her own use. If now the recitation is carried on topically, each pupil will be able to contribute something the others will probably not have, and the whole recitation will prove highly interesting to pupils and teacher alike.

I. 1. Why does the body need air? Con. I, 88; Hu. I, 35; Je. I, 1.
2. What air is good air? Con. I, 89; Gu. I, 6; Hu. I, 44; Je. I, 6; O-K. 8, 82; Ri. I, 46.
3. What breathing is best? Con. I, 91; Gu. I, 1; Hu. I, 41; Je. II, 107; O-K. I, 93; Ri. I, 57, 138.

Writing up the Note Book

A pupil's notebook on hygiene should contain all the main points gathered from the experiments and the book study. The teacher should provide an outline for the pupil's books and the latter should be encouraged, even required, to complete the record in a neat fashion.

More important than the note book, even, is the following up of results of improved breathing capacity and sitting and standing positions in the schoolroom, and in the practice of exercises that will develope free breathing. The weekly or monthly testing of the lungs will do more than anything else to get these desired health habits.

II. TAKING CARE OF THE NOSE AND THROAT.—Ho. I; Te. XII.

The Nature-Study Approach

Aim.—To get some first hand knowledge of the nose and throat.

1. The exterior of the nose. With a hand mirror examine the nose to see whether it comes down straight

from between the eyes, or bends sideways at any point, and whether the partition between the nostrils divides the space evenly. Put your head sideways to a larger mirror, and about a foot from it. Place the small mirror straight in front of the face, but let it be turned half way between the face and the large mirror so that looking into the small mirror one can see whether the pencil touches the nose at three points, or only at the upper and lower ends, or only once and that in the middle.

With the thumb and finger bend the nose back and forth sideways to discover that in the middle is a gristle, such as one finds on the breast bone of a spring chicken. Half way up the outside of the nose one finds that the outer fleshy wall of the nose begins to cover boney walls. These walls should stand out distinctly from the inner gristle, if the nose is just right.

2. The inside of the nose.—For this study one needs to sit with one's face turned away from a strong source of light such as the sun, or any strong artificial light. Holding the mirror with the right hand so it will reflect light abundantly into the nostrils, with the left index finger press the point of the nose back and up, so as to show as much of the inside of the right nostril as possible, meantime fixing the lower mirror so it will throw light well into the right nostril. Now note (1) the numerous hairs at the entrance, (2) the direction the nostril takes at its inner end, (3) the redness and moisture of the nostril in its deeper parts, and (4) the irregular outer wall and smooth inner wall. Next, take the mirror in the left hand and study the left nostril similarly.

3. Some uses of the nose.—Present any strong smelling stuff (either agreeable or disagreeable) to the nose and inhale from it strongly thru the nose. Again, instead of taking one strong breath, take several sniffs of air and note the difference in the strength of the odor.

While talking out loud press with a finger against the side of the nose so as to shut off the air from one nostril. Now try the other side and then both sides at once.

Close the nostrils and thru the mouth inhale some very dry air from over a hot stove or other

warm body. Now inhale dry air again but this time only thru the nose.

If weather or other conditions permit, try the above experiments by breathing in very cold air under the two conditions.

Figure out, if possible, two other uses of the nose from what was seen when looking at the inner surfaces.

Keep the nose pinched shut for about five minutes while reading or doing something else, just to see how it would be if one could not breathe thru one's nose at all.

4. Using a handkerchief.—Taking a clean handkerchief in hand, place a part of it loosely over both nostrils and hold it in position by pressing it lightly against the lower side of one nostril, but not stopping up this nostril, while the other nostril is compressed shut. Now force a lot of air thru the open nostril without making a loud noise, for to make such a noise is not regarded as refined behavior. Now treat the other nostril in the same way.
5. Washing the nose.—Take a tincup or glass of warm water and with it mix a spoonful of common salt. Close the mouth and hold one edge of the cup or glass against the upper lip and lower edge of the nose. Now close one nostril with a finger, duck the nose into the water, and very gently draw the salt water up into the nostril, and then force it out. Repeat several times for each nostril.
6. Studying the pharynx (far-ingks).—Making use of a mirror as in Study 1 above, throw light into the wide-open mouth for a study of the cavity back of the mouth, known as the throat, or pharnyx. Hanging down from above at the back you will see a nipple-like body, called the uvula, and arching down from each side of it a double band of flesh that opens out like a V as it passes down to the root of the tung. This is the back boundary of the mouth and what is behind this yet is the pharnyx, thru which both food from the mouth and air from the nose pass to organs below.

Now examine the pharnyx carefully to see if you can discover some dark red flesh just back of each border of the root of the tung, and between the sides of the V-shaped flesh coming down from the uvula. In shape each is about like a ripe mulberry,

and if the tonsils are in good condition they should not be any larger, if so large. If they are enlarged, they may look like two big red marbles.

Thoroly clean your finger and with it feel the roof of your mouth. Note that the farther back you get, the softer it becomes. This soft part is called the soft palate, and it ends in the uvula. The soft palate hangs down in front of the upper end of the pharnyx, into which the nostrils lead.

Hold the mouth and nose shut and gently force air into the nose till the ears "pop," that is, till a puff of aid passes into the middle ear. Any distress in the ear can be relieved by swallowing. There are two holes that lead from the upper end of the pharynx to the middle ears, and these are what the air went into.

It is in this upper back pharnyx that a growth often developes that stops breathing thru the nose, and which is quite like the tonsils in appearances. This growth is known as "adenoids," and can easily be removed.

Questions for Consideration

1. Is your nose straight or crooked? Is it a Grecian nose, a Roman nose, or a snub nose? (One kind is as good as another if only the nostrils are open!)
2. Where do the nostrils seem to lead to? What do you think the hairs are for at the entrance of the nose? Why is the outer side of a nostril wall so very irregular? What makes the walls of the nose so red? Is it very warm in there, do you think? Why? Where does so much blood come from when one has the nose bleed? What does this show about the blood supply of the nostrils?
3. Why sniff when you want to get a good smell of anything? When "talking thru your nose" do you really use your nose? Can you take a breath thru each nostril separately? If not, why not? Do you sleep with your mouth shut? Can you imitate snoring? How do you do it? Do you snore when asleep? If so, why? Judging from your experience with the dry and the cold air, what two distinct advantages come from breathing thru the nostrils (except when running rapidly)? Is the moist surface of the nostrils just water, or is it a sticky liquid? What would it do for germs and dust? What would the moisture on the surface do for

dry air? Can you now give four distinct uses of the nose? Can you give five important reasons why one should breathe thru the nose?

4. Can you blow your nose without making a loud noise? Do you always keep a handkerchief over the end of your finger if you have occasion to reach up into your nose? Why should one always use only a clean handkerchief? Why use a handkerchief at all? Why not sneeze into other people's faces? Why is it better to sneeze into a handkerchief than elsewhere?
5. Can you wash out your nose readily as directed, and without bothering your middle ear or choking yourself?
6. Do you find that your tonsils are swollen and inflamed? If so, do you sometimes have the rheumatism? (Sometimes rheumatism is traceable to diseased tonsils, and sometimes to diseased teeth). Do you find adenoids present in your upper pharnyx? If so, these should be removed for they will make lots of trouble if allowed to remain.

Writing up the Note Book. (See Grade V, Study1)

1. What is the nose for? Con. I, 92; Gu. I, 131; Hu. I, 41; Je. I, 134; Ri. I, 67.
2. How keep the nose in good condition? Con. I, 201; Gu. I, 134; Je. I, 134; Ri. I, 59.
3. When is the throat in the best condition? Con. I, 92, 74; Hu. I, 87; Je. I, 134; Ri. I, 59.

Writing up the Note Book (See Study 1).

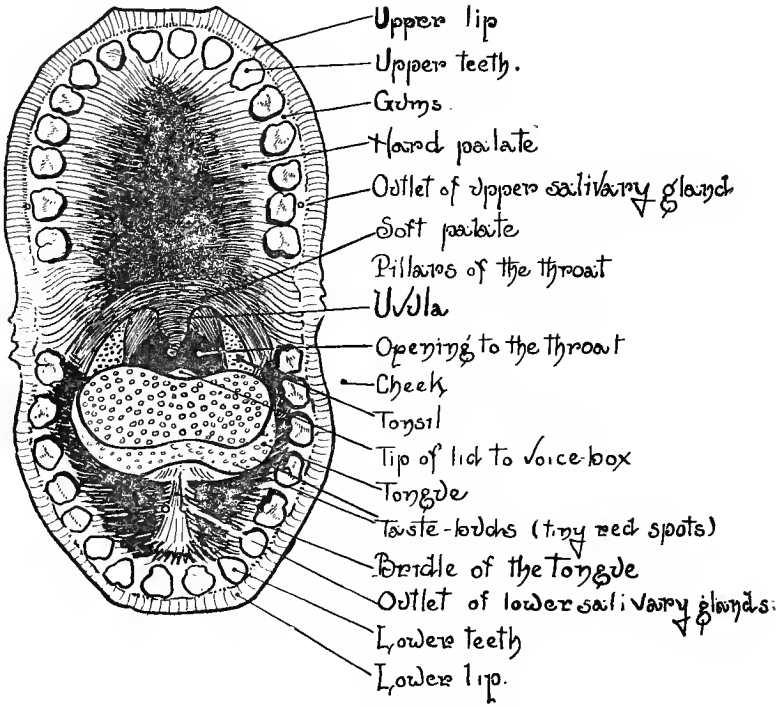
III. WHAT AND HOW T OEAT AND DRINK.—Ho. IX; H-S XIX; Te VIII; Wa. VII.

The Nature-Study Approach

Aim.—To learn something of foods and of the mouth and its uses.

1. As an important preliminary study, the pupil should take a mirror and examine his mouth cavity. The effort here should be to discover and be able to descide the different structures visible in the mouth (15 or 20, not counting the different kinds of teeth). It will be worth while to try to see which pupil can find and describe the greatest number. Let particular notice be taken of the points in the mouth at which saliva comes in freely when one is beginning to eat a bite of cracker or bread.

2. When the teacher has gotten from the pupils the reports of the results of their studies, she may summarize by placing on the blackboard a sketch of the open mouth (a diagrammatic representation of the mouth opened so wide as to show its upper and lower parts as if they were hinged back into one plane). Indeed the sketch may well be on the board when the pupils' reports are called for, the final summarizing consisting in a table of the structures that may be seen.



Structures in the Mouth

3. The studies that follow have to do with the uses of the mouth. First, let the pupil pinch his nose shut for a minute or two and note the effect on his breathing.
4. After the pupil has given the most common sound of each of the letters, let him reach a conclusion as to the way in which the consonant letters are made to sound different from the vowel letters.

5. Require the pupil to make observations as to how a bird or chicken drinks water.
6. Let each pupil take a good big bite of cracker, crush it rapidly with his teeth and then try to swallow it quickly.
7. Either eat, or recall the eating, of an apple or other semi-solid fruit or vegetable, and consider how the teeth help in the eating act.
8. Put a teaspoonful of raw starch in a glass of water, and into another glass of water put a teaspoonful of sugar. Stir, and note the effect on the starch and on the sugar.
9. Supply each pupil with an oyster cracker that is fairly free from salt, and require him to chew it until a new and agreeable taste comes from it.
10. If conditions permit, let each pupil compare the relative time it takes to get a similar result from a teaspoonful of raw corn starch and from one of cooked starch.
11. Provide each pupil with a teaspoonful of clean wheat grains, and let him chew them till a small mass of "wheat gum" remains. Explain that wheat is made up mainly of starch and protein, and that it is the latter that is not dissolved by the saliva, while the starch is dissolved. The protein must pass to the stomach and small intestine before it is dissolved or digested.
12. Similarly let each pupil discover that a piece of fat meat will not dissolve in the mouth; and explain that fat is practically, if not wholly digested in the small intestine.
13. Let each pupil arrange to eat a meat sandwich at luncheon on one day quickly and on the next day slowly and conclude which one gives the most satisfaction to hunger.
14. On another day let each pupil eat very rapidly at luncheon as many meat sandwiches as it will take to satisfy hunger. The next day, other conditions being the same, let every sandwich be eaten very slowly and chewed till each bite becomes like pea soup before it is swallowed. Compare the number of sandwiches required to satisfy hunger in the two cases.
15. Try drinking a glass of water on rising in the morning or just before breakfast. Also drink plenty of water at mealtime, but always when the mouth is free of

other food. Report at the end of a week whether you feel better because of these practices.

Questions for Consideration

1. How many structures did you find in the mouth?
2. Can you describe and give a use for each one of the structures?

3-9. Can you state nine different uses of the mouth?

10. Can you give a reason why starchy foods may well be cooked to eat.

11-12. What sorts of foods does the mouth not digest?

13. How eat to get the most good out of each bite of food?
14. How can one eat so as to save money in his eating or food bills?
15. What has been the result of your following directions about drinking?

Note.—If you cared to make the experiment, you might find that if you always chew your food abundantly, you would naturally crave less meat, and thus you could save more money, for meats are our most expensive foods. Then besides that, those who have tried the plan say they are freer from headaches, tiredness, etc. Have you ever read the interesting story of Horace Fletcher and his eating? If not, you could learn much from this unusual American.

Studying the Books (See also Grade V, Study 1)

1. How choose good foods? Con. I, 18; Gu. I, 157; Hu. I, 156; Je. I, 157; O-K. I, 117; Ri. I, 9, 15.
2. What are the best habits of eating? Con. I, 10, 24; Gu. I, 151; Hu. I, 160; Je. I, 155; O-K. I, 119; Ri. I, 33.
4. Why, when, and how much water shall one drink? Con. I, 41; Gu. I, 155; Hu. I, 68; Je. II, 130; O-K. I, 130; Ri. I, 33.

Writing up the Note Book. (See Grade V, Study 1)

IV. CARING FOR THE TEETH—Al. IX; DR. XVII; Te XI.

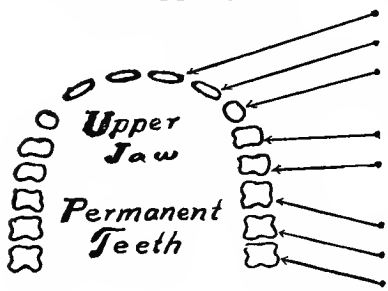
The Nature-Study Approach

Aim.—To learn about the teeth and to discover reasons for their care.

1. Assign as a study to be reported on at the next recitation hour, the number of teeth each pupil may find in his own and his larger and smaller playmates' mouths.
2. With this same assignment there should go one re-

quiring each pupil to study, with a mirror, his own teeth so as to be able to describe the difference in the appearance of the four knds of teeth in his mouth.

3. At the class hour pupils report their discoveries. If the teacher desires to give the technical names for the various groups of teeth, the necessary motivation may be secured by asking the pupils if they would like to be able to talk to the doctor, priest or pastor in their language, about teeth when these men pay a visit to their homes.
4. The functions of the different groups of teeth may be inductively studied by supplying each member of the class with grains of wheat, pieces of thread and sticks of candy, and noting the uses of groups of teeth employed in dealing with these materials . Ask what teeth are used to get meat from a chicken bone?
5. As a further study, now that the names of the teeth are known, the pupils can be directed to find out, so far as they can, when their own and their playmates' various second teeth came in. At the class hour, a tabulation can be made on the blackboard of all the results reported. There will be variations, of course, but the final table should average up about as follows for the upper jaw:



Middle incisors—7 years.
Lateral incisors—8 years.
Canines, or cuspids—11 years.
First bicuspids—9 years.
Second biscuspids—10 years.
First molars—6 years.
Second molars—12 years.
Third molars—17 to 45 years.

6. The parts of a tooth can best be studies by providing the pupils with human teeth obtained from an obliging dentist. After the parts of the teeth have been decided upon by the pupils, the terms crown, neck, and root may be supplied.
7. The structure and materials of a tooth can be grossly studied from a tooth that has been ground in a transverse plane and from one that has been ground in a longitude plane, and the names, enamel, dentine, and pulp cavity supplied.

8. Secure from the laboratory or the druggist some blue litmus paper, and in the presence of the class, demonstrate its use in discovery of acid substances, by putting on a piece of it a drop hydrochloric and other acids and noting that acids turn the paper pink.
9. Test the decayed spots on spoiled fruits, such as bananas, apples, etc., with litmus paper, and let the class report their conclusions from the effects observed.
10. Now provide each member of the class with a piece of blue litmus paper and a fresh wooden tooth pick. Give directions for each to put some scrapings from his own teeth on the litmus paper. Not the effect after a few minutes ,and draw the appropriate conclusion.
11. When the reports of the effect of the tooth-scrapings on the litmus paper come in, recall with the class that germs cause decay and that conditions that favor the growth of germs are warmth, moisture, air, and dead matter.
12. At this time apply dilute hydrochloric acid to one of the teeth previously studied, and permit each member of the class to see the little bubbles that arise from the tooth. Watch the acid's "eating" the tooth.
13. Now connect up this phenomenon with the acid condition of tooth scrapings and secure the proper inference as to the cause of decay, namely, the action on the teeth of acids developed by germs of decay in foods left in the mouth and between teeth. Explain that sugars, candy, and starchy foods most quickly yield these acids that eat teeth.
14. The matter of using the teeth to crack nuts, etc., may be taken up here, and the reasons made clear why it is especially desirable to preserve the enamel of teeth intact.

Questions for Study

It is assumed that the teacher will be easily able to frame up appropriate questions on the above experiments. They are accordingly ommitted here.

Studying the Books. (See also Grade V, Study 1.)

1. How improve the teeth? Con. I, 65; Gu. I, 146; Hu. I, 168; Je. I, 149; O-K. I, 151; Ri. I, 43.
2. Why form the tooth brush habit? Con. I, 55; Gu. I, 151 Hu. I, 161; Je. I, 151; O-K. I, 156; Ri. I, 41.

V. HARMFUL STUFFS FOR THE MOUTH—Al. XXXVI; H-S. XX; Wa. VIII.

The Nature-Study Approach

Aim.—To get some important facts about tea, coffee, alchohol, and tobacco.

1. As a preliminary exercise, pass small pieces of alum to each member of the class, requiring the pieces to be tasted, and explain that alum is called an astringent because of its "puckering" effects. Explain that tea and coffee contain a similar astringent known as tannin.
2. Have pupils make a pair of balance scales by passing a pin halfway through the exact center of a foot rule, and attach by three strings to each end a pair of cardboard scale pans. With this instrument weigh out three samples of black tea, three of green tea, and three of freshly ground coffee, equal in quantity to the weight of a dime, and distribute in nine jelly glasses.
3. Nearly fill one glass of each of three sets with cool or cold water and one each with water that has been boiling. Fill the remaining three glasses with boiling water and place in a pan of boiling water so as to continue boiling. Keep all nine glasses in the above conditions for just four minutes, then drain all of them off into other similar glasses, keeping track of "which is which." Now pour two spoonfuls of a strong solution of copper (copper sulphate) into each glass and note the fleecy stuff (copper tannate) that forms in each. When this precipitate has settled, the resulting quantities easily show the relative amounts of tannin in each sample of tea and coffee.
4. Of course people drink tea and coffee not for the tannin, but for another substance that serves to stimulate, namely caf-fe-in. It is not easy to show the presence of this substance but it can be shown that the amount of caffein in the cool and the boiled specimens is about the same, and less in the cold specimens.
5. Space does not permit descriptions of concrete studies of soda water and other soft drinks, but a little ingenuity and suggestions from a good druggist will enone to show that a glass of milk is very much more wholesome and nutritive as well as less expensive than any of the soft drinks.

6. Provide a small bottle of denatured alcohol for direct observation of its appearance, its odor, its weight as compared with water, etc.
7. Pour some alcohol on the raw white of egg The effect here is not unlike that of alcohol on the protoplasmic contents of the body cells.
9. Immerse a fishworm ,or other soft bodied "worm" or "grub," in a small quantity of alcohol and note the effect on the behavior and tissues of the creature. The teacher should know (without any guess work) the difference between a stimulant and a narcotic. The early behavior of the "worms" is due to irritations and not to stimulation.
10. It would be an illuminating experiment for adolescents and adults if some poultry raiser could be induced to keep a screened pan of alcohol under the straw of a setting-hen's nest of eggs. Only a few chicks would be hatched and they would be deformed.
11. Take about a thimbleful of your sample of alcohol, pour it into a small bottle, and add five more thimblefulls of water. Now tie a wire to a bottle, and add five more thimblefulls of water. Now tie a wire to a little piece of sheet copper and heat the copper red hot and continue till the copper appears dark on cooling. While the blackened copper is still red-hot, thrust it into the solution of alcohol. Remove and note that the copper is now bright again. Blacken the copper again and this time thrust it into pure water. It remains black. Apply this test for alcohol to Peruna and other patent medicines whose labels report as much as 15 or 20 per cent of alcohol.
12. Take the dilute alcohol used in No. 11 and bring it to boiling. Now bring a lighted match to the mouth of the bottle and not the flash of light from the burning alcohol. Treat Peruna and other alcoholic patent medicines similarly.
13. Pour several drops of alcohol into a saucer and set fire to the alcohol. Observe three things about the flame different from that of a burning match.
14. If weather permits, try freezing alcohol.
15. Pour alcohol on separate sample of oil, fats and resins.
16. Secure a small packet of tobacco seeds and give the pupils an opportunity to examine them through a simple magnifying glass. Provide a suitable receptacle and start some of these seeds to growing. They will

germinate and develop sufficiently to be interesting to the pupils while their later studies of tobacco are being made.

17. Many greenhouses will have some species of these plants growing, and here a plant can be obtained for examination and study. Note the generally disagreeable odor of the plant, particularly of a crushed leaf. Something of the history of the plant may well come in at this point, supplied by the teacher.

18. A bit of plug tobacco as big as half a pea, in an inch of water in a test tube or other glass vessel, will soon give the water a dark brown color, showing that tobacco contains substances that are highly soluble in water. The most important of these substances is, of course, nicotine.

19. Try a similar amount of tobacco in about a half-inch of saliva collected in test tube or vial and note that saliva also dissolves the substance of tobacco.

20. Take a bit of the raw white of egg and on it place a drop or two of the liquid from No. 13. Note that the white of egg takes this into itself. Point out that this white of egg is not unlike the living matter that makes up the cells of which our bodies are made up.

21. Put a drop of solution from No. 13 on a fly or other insect and note the result. If you think it not unwise, take a medicine dropper and inject some of the solution into the mouth of a mouse. Keep the animal out of sight, of course, till "all is over" and then present the final result for examination.

22. Have a little girl with a particularly white and clean little finger immerse it in some of the tobacco solution for a few minutes, and note the discoloration.

23. Now take a bit of tobacco no larger than a pea and place it on a thin metal plate supported over an alcohol or other flame. Place flies or other insects caged in wire screening, over the fumes, and note results. The odors that come from the heated tobacco disclose the volatile character of nicotine.

24. A bit of tobacco may now be held by pliers and burned in the alcohol flame, the odors again being noted and any other facts considered that the teacher deems it wise to present, such as the effect of this burning on the nicotine itself.

Questions For Consideration

1. How does alum affect your tung? What use do barbers sometimes make of alum?
2. Can you find from the books what causes the difference in the appearance of black tea and of green tea?
3. How must tea and coffee be prepared so they will have the most tannin? The least tannin? Which sort of tea, black or green, has the least tannin?
4. How can tea and coffee be prepared so they will come nearest to yielding the most caffein and the least tannin.
5. What makes soda water effervesce ("boil up")? Why is a glass of sweetened milk more nutritious and wholesome than the drinks at the soda fountain?

6-7. What different terms can you employ to describe the physical properties of alcohol?

8. What is the effect of alcohol on raw white of egg? What else does this experiment teach?
9. Why does the "worm" behave as he did at first and at the last?
10. Query for adolescents and adults: Why are there so many imbeciles in countries where alcoholic drinks are freely used?

11.-12. What are the two ways to tell whether a medicine has a good deal of alcohol in it?

13. Why (three reasons) is alcohol so well adapted to use in "alcohol lamps"?
14. Why is alcohol instead of mercury used in low temperature thermometers?
15. What is meant by "spirits" of camphor, vanilla, etc?

16-24. Are any insects found around a growing tobacco plant other than the green-house white fly? Why do housewives sometimes take a solution of tobacco and sprinkle it on houseplants? Why are pieces of tobacco sometimes placed among articles of clothing that have been laid away for the summer or winter? Why do entomologists (bug men) find empty cigar boxes especially good for keeping their preserved specimens in? Do you know of any other good uses to which to put tobacco?

Would you think tobacco a good thing to feed to your pet animals, especially young ones? Why do not foot-ball trainers and physical directors permit their men who play in hard contests, to use tobacco? who finds it the most difficult to keep such a law?

Would it help the looks of ladies if they used tobacco as some men do? Since people who have not gotten their systems used to the poison of tabacco find tobacco smoke very offensive, is it fair to them to compel them to endure the sickening odor of tobacco?

How much do Americans spend anually for tobacco? For cigars? For public schools? (See Chapter VIII.)

Studying the Books (See also Grade V, Study 1.)

1. Why are tea and coffee drinks that injure? Con. I, 44; Je. I, 165; O-K. I, 132; Ri. I, 34
2. Why are alcoholic beverages drinks that destroy? Con. I, 45; Gu. I, 159; Hu. I, 75, 150; Je. I, 77, 83, 121, 127, 159; O-K. I, 135; Ri. I, 37, 105.
3. How does tobacco harm good athletes? Con. I, 69; Gu. IV, 141; Je. II, 78; O-K. I, 71; Ri. I, 56, 110.
4. How do cigarettes spoil quick thinking? Con. I, 69; Gu.. Gu. II, 63; O-K, I, 71; Ru. I, 110.

Writing up the Note Book (See also Grade V, Study 1.)

VI. MAKING THE BODY STRONG AND STRAIGHT.—Al. XII; Ban. I-XXVI; Dr. II; Ho. VII-VIII; Ly. II, 2; Te. VII, XX; Wa. V.

The Nature-Study Approach

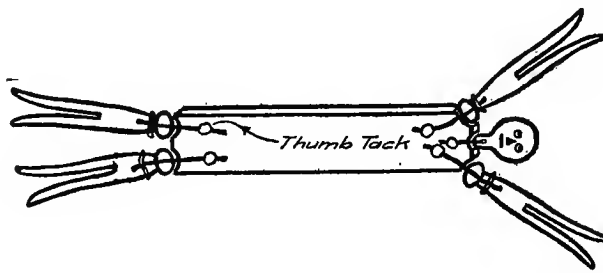
Aim.—To disclose some fundamentals about posture, play, work, and sleep.

1. Take a piece of rubber band about two inches long and a quarter of an inch wide and stretch to twice its first length. Now let the rubber come slowly back to its first length and watch how the band changes in thickness and width.
2. Take two such rubbers as that above and firmly tie in place on a clothes-pin as shown in Fig. 1.
   In the end of a piece of broomstick twice as long as the clothespin hollow out a rounded depression that will nicely take in the head of the clothespin made

round by whittling or filing to the piece of broomstick as shown in Fig. 2.

By shifting the position of one or the other of the thumb tacks, show how the clothespin can be made to take different directions.

3. If you want to make a more realistic showing of the way muscles work in the human body, take a piece of soft wood board an inch thick, two inches wide, and six inches long, and by cutting suitable depressions and attaching clothespins and a knob of wood in the same way as in Fig. 2, construct such a devise as that of Fig 3.



4. Straighten out your index finger and then make it point in various directions. While the back of the hand is kept motionless, now feel your forearm to see where the muscles (the "rubbers") lie that make the finger move forward and where backward. Decide where the ends of the muscles are fastened.
5. In similar way find out the places of attachments respectively of the muscles that produce movement at the elbow, the shoulder, the neck, the back, the knee, and the ankle and toes.
6. Let each member of the class see how many times he can chin himself (girls as well as boys). Now take the circular measure of the upper arm of each pupil both when the forearm is drawn up as much as it possibly can be, and when the arm hangs loose. See if there is any relationship between number of "chinnings" and increase of arm girth.
7. Consider how one can get bigger muscles by thinking

how the strong, big-muscled men of the community came to be so.

8. By referring to your wooden man, show what muscles must be strengthened to make one naturally stand straight and sit erect. Let each pupil think which of his own muscles need strengthening and what he can do to secure for himself the best of body postures.
9. Make a list of the things that are sometimes done in school, on the playground, and about home that tend to draw one out of good body shap. Make another list of the things that help to give one a good shape.
10. The ideal standing posture being relatively a straight line for the major axis of the head and neck, upper and lower trunk, thighs and legs, find out, by standing naturally near a vertical wall how much, if any, each section of the person bends away from a vertical line. Let the teacher make a straight (or crooked) line sketch of each pupil's sideview posture, in the pupil's notebook.
11. Since a forward protruding neck and head is so common a posture defect, let each pupil, while at home in the morning, preferably just after rising from bed, loosely fold the arms on the chest and arch the body by supporting it on the heels and the back of the head. The knees will have to be bent slightly but not very much, and the body and neck should then be arched as high as possible and allowed to drop back at once. Let each pupil report how many times, working continuously, he was able to do this act of "bridging", as it is called.
12. Let each pupil be provided with a piece of loose cotton that has been partly moistened with a half and half water and glycerine solution of chloride of iron (ferric chloride). Each of these should be wrapt in paper and taken home to use on the soles of the bare feet to take foot prints as follows: rub a thin coating of the iron chloride solution on the sole of one foot and then place the foot carefully on a piece of unglazed paper lying on the floor, throwing the full weight of the body on the foot. Remove the foot carefully, take a similar impression of the other foot, and lay the paper away to dry. Wash both feet without further delay. Later compare the assembled foot prints of the class with an ideal foot print found in the books. If it is desired to make the foot prints black, apply with a brush to the backs of each paper, a water solution of

tannic acid. The mixture of this with the iron chloride makes real ink.

13. Let the teacher take such a survey of the sleeping habits of the members of the class as is outlined on page 378 of Terman's Hygiene of the Child. Note that about ten hours is an average sleeping period for a fifth grade pupil. To the list of questions provided, add a question as to the usual posture of the pupil while sleeping. Emphasize the fact later that body posture can be improved by lying on one side or the other with the elbow thrown back of the trunk, and not in front of it.

Questions for Consideration

1. How do you think a muscle of the body gets shorter? What are two reasons for believing your answer?
2-3-4. How is any part of the body kept in position? Can you figure out how one manages to walk?
5. What muscles are most used when running? When throwing a ball? When jumping? When breathing?
6. Why can one pupil "chin" himself more than another? Would you like to try this out a month from now?
7. Why are some folks not so very strong? Why do you think it is worth while to be strong?
8. Can you show how you can make a limb of your wooden man take the same position in two different ways? For what two different reasons may some folks be round shouldered?
9. What are the things you are going to do and not do to give yourself a fine body shape?
10. If your standing posture is not ideal, what exercises do you need to take to make it such?
11. How many times can you "bridge" without stopping

to rest? If you get stiff and sore for a day or so after the first time you "bridged", what does that show?

12. Does your foot print show two good "arches" for your foot, and are the toe prints not crowded together too much? If not, how can you correct "flat feet" and cramped toes?
13. What improvements can you make in your sleeping conditions, and in your posture while sleeping?

Studying the Books (See also Grade V, Study 1.)

1. What are the best body postures? Con. I, 94-113; Gu. IV. 9; Hu. I, 5; Je. II, 1; O-K, I, 13; Ri. I, 82.
2. What are the best play and work habits? Con. I, 121; Je. I, 16; O-K, I, 41; Ri. I, 86.
3. What are the best feet for running? Con. I, 112; Hu. IV, 44; Je. II, 38; O-K. I, 187; Ri. I, 79.
4. What are the best sleep habits? Con. I, 148; Gu. I, 57; Hu. I, 166; Je. I, 47; O-K. I, 106; Ri. I, 50, 94.

Writing up the Note Book (See Grade V, Study 1.)

VII CARING FOR THE SKIN, NAILS, HAIR, AND SCALP—H.S. XI; Hu. XVII; Te. XV; Wa. X.

The Nature-Study Approach

Aim.—To discover some conditions favorable to the health of the surface of the body.

1. If a simple microscope is available, let each pupil make an examination of the skin of the hand to see how scaly it is. When the back or palm of the hand is sweaty, take a dull knife and scrape off some of the scurf. Use the microscope to discover what the scurf grew from and why one can never be freed "for good" from the accumulation of scurf.
2. Recall the smell of decaying meat, that is, of a dead cat, rat, or other decomposing animal. Think why clothing, especially that worn next the skin, sooner or later gets to smelling bad. Consider also why people sometimes do not smell very wholesome. Explain why a crowded room or a room that has just had many people in it is not likely to smell very well.
3. Sometime when your hands are not very clean, wash them in plain water, doing the best that can be done. Examine the hands carefully to see if they are quite clean and if there is any odor. Then right after that, use warm water and soap in re-washing the hands.

See if this has made any difference in the cleanliness and odor of the hands. Think what is the chief reason for bathing and honestly answer the question as to how often one ought to bathe the whole body.

4. Let each pupil now make a study of his finger nails to find out answers to the following questions:
   (a) How does a nail differ from the skin? What two reasons can you give for thinking nails steadily grow out from the root? (Nail-paring and the progress of a "black and blue" mark).
   (b) Does a nail grow thicker the farther out it gets from the root? (Determine by successive pressings with a dull pencil point).
   (c) How do the three parts of a nail differ in color, the "moon" rising from the root, the central part or body, and the outer part or free margin? Since the nail itself is not pink, as seen at the margin, why do you think the central part looks pink? If the margin of the nail ever really gets black, what makes it look black sometimes? Why could not one get along just as well without finger nails as with them?
5. Sometimes one finds the skin at the root of a nail wants to hang to the "moon" of the nail. It may even hang on so long as to be partly pulled away as the nail continues to grow out. This makes it look very ragged. Think what you could do to keep the skin from hanging on to the nail in this way, and how this can best be done without injury to skin or nail. Why is biting the nails a bad practice, both for the mouth and for the nails? What have you found to be the best thing to use in trimming the nails? What shape and how long or short should the nails be kept so as to look the best?
6. Secure a hair freshly pulled from someone's head and let each pupil examine it with a simple microscope, as the hair lies on a piece of clear glass. Is the hair smooth or is it scaley? How does the root seem to differ from the rest of the hair? Look closely at the hair of someone's scalp to see if it seems to come from "holes" in the scalp, or right from the surface of the scalp. What stuff do you find that makes you think of the scurf from the hand in No. 1?
7. Using your handkerchief, rub the back of your hand quite hard till the skin begins to get red. Remember-

ing that blood feeds the hair roots, what would be the advantage of thoroly brushing the hair and scalp about twice a day? What is the objection to wearing a very tight hat so far as the growth of the hair is concerned? What is a second important reason aside from making the hair lie right, for frequent brushing of the hair and scalp?

8. Often when one has a headache, one can get relief by massaging the scalp. The first time a headache comes, try rubbing the scalp well, and see if relief is secured. Headaches are due to poisonous stuffs in the blood of the scalp, and the rubbing helps this blood to flow along and take away the poisons. This poison usually comes from bad eyesight, failure to discharge the bowels daily, lack of sufficient red blood, loss of sleep and rest, and from eating things one ought not to eat. If the pupil has headaches often, the teacher should direct his attention to possible causes, and to the removal of the same.
9. In connection with the treatment of cuts, burns, and bruises, as these are studied in the books, let the "recitation" consist in a dramatization of the procedure, the teacher providing the necessary materials, and the pupils actually demonstrating the work.
10. Put some drops of oil on some water in a small bottle, and shake thoroly. Take a similar bottle and put very soapy water in it and some drops of oil on it as before. Now shake well and state what is the difference now in the appearance of the oil.

Questions for Consideration

1. Why cannot one free oneself entirely of scurf?
2. Why do some people smell less wholesome than others?
3. Why and how often should one bathe?

4-7. Answer the questions in No. 4-7 above.

8. Do you suffer with occasional headaches? If so, what do you think is the cause?

9-10. Since the poison of poison ivy is a volatile oil, why is the prompt use of soap likely to prove beneficial?

Studying the Books (See also Grade V, Study I.)

1. Why keep the skin clean? Con. I, 131; Gu. I, 114; Hu. I, 8; Je. I, 114; O-K. I, 162; Ri. I, 75.
2. How keep the nails nice? Con. I, 134; Fu. I, 101; Hu. I, 16; Je. I, 105; O-K. I, 178; Ri. I, 74.
3. How take care of the hair and scalp? Con. I, 128; Fu.

I, 108; Hu. I, 18; Je. I, 114; O-K. I, 176; Ri. I, 73.

4. What are the nature and treatment of a headache? Con. II, 333; Da. II, 45; Je. II, 176, 176; O-K. IV, 209; Ov. II, 235.
5. How treat cuts, burns, and bruises? Con. I, 84, 126, 200; Gu. II, 30, 52, 57; Hu. I, 137; Je. I, 186, 181, 184; Ri. I, 66, 127.
6. How care for poison ivy and other skin poisons? Con. I, 169; Gu. II, 82, 131; Je. I, 181; Ri. I, 129;

VIII. CARING FOR THE EYES AND EARS—Al. VII, VIII; Dr. XV, XVI; H-S. XXII; Te. XIII, XIV; Wa. XIII.

The Nature-Study Approach

Aim.—To develop important facts in the hygiene of the eyes and ears.

1. Take a card-board box (without lid) that is roughly an inch or more each way in size, and cover the open side of the box with tissue paper fastened on with paste. Make a good, clear hole with a darning needle in the center of the side opposite the tissue paper. Darken the room considerably and hold a burning match or candle an inch or two back of the hole in the paste board and observe the image of the flame on the tissue paper. Now make a hole in the pasteboard considerably bigger, at least a quarter of an inch in diameter and try the match experiment again to observe what happens now to the image.

   Next, lay the lens of a simple microscope over the hole in the pasteboard box and we have an artificial eye. Again try the match experiment, moving the match closer or farther away one gets such an image as near-sighted folk have of distant objects. Holding the match nearer ,one gets such an image as far-sighted folk have of near objects. Try some near-sighted and some far-sighted eye glasses on both these cases to see if the images can be made clear thereby.
2. While looking at one's own eyes in a mirror hold a strong light between the mirror and the side of the head. Now move the light out to right or left as far as possible and then bring it back close to the eye again, and while doing this back and forth watch the change in the size of the pupil of the eye (which is like the hole in the box, and lets light into the eye).
3. Try reading a book when a strong light is in front of

the eyes and also when the light is at the right or left back of the head. Consider how the eyes feel while doing this and what must be the condition of the pupil and the work of the eye under the two conditions.

4. Try writing with a pencil while a strong light comes over the shoulder, and also when it comes over the right shoulder and note especially the shadows made by the writing hand.
5. While the hands are very clean take a small and very clean pencil and, sitting before a mirror, try rolling the upper lid of an eye over the pencil, so as to see the under surface of the lid. Consider how one could now remove a particle from the eye with the corner of a clean handkerchief. Try putting the lower lid down without the use of the pencil.
6. The teacher should by all means make a test of the eye sight of all her pupils, using any ordinary eyechart and following the directions therein. If a chart has to be purchased, send 25c to the F. A. Hary Co., Chicago, for one of the Allport charts. The teacher could well saturate her consciousness with the contents of Chap. XIV of Terman's "The Hygiene of the Child."
7. Let the pupil adjust himself so that a strong light is shining into an ear canal, place a mirror on the same side of the head as the light is on, and with a hand mirror held in front of the eye but turned so it faces half way between the other mirror and the eyes. Now let the pupil, by a litle adjusting, learn as much as possible about his own ear canal, which leads into the head about an inch to the most important organs of hearing.
8. Let the teacher test the hearing of all her pupils, following the directions for the "whisper test" given in Terman's "The Hygiene of the Child," pages 237-239.

Questions for Consideration

1. How do glasses help some people to see better
2. Why is a very strong light objectionable? Why is a poor light objectionable, if one has to keep looking closely while working in it?

3-4. How should the light fall upon the printed page while one is reading? While one is writing? Does it make any difference in the two cases as to which side the light comes from?

5. Can you show how you could get a gnat or a cinder out of your eye?

6. What proportion of pupils in the class or school seem to have defective vision?
7. What has been learned about the ear canal from the mirror examination?
8. What proportion of the class or school seem to have defective hearing?

Studying the Books

1. When are spectacles needed? Gu. I, 75; Je. I, 75; Ri. I, 116.
2. What light is good for the eyes? Con. I, 160; Gu. I, 70; Hu. I, 61; Je. I, 70; Ri. I, 117.
3. How remove foreign bodies from the eyes? Con. I, 159; Fu. I, 69; Ri. I, 119.
4. How care for the outer ear? Con. I, 162; Gu. I, 90; Ju. I, 57; Je. I, 90; Ri. I, 125.
5. How treat earache and running ears ?Con. I, 201; Gu. I, 89; Hu. I, 57; Je. I, 98; Ri. I, 124.

IX. WHAT TO DO WHEN ACCIDENTS HAPPEN—Bai. I-XIX; Ly. III, 6.

The Nature-Study Approach

No special studies are offered here. What is recommended instead is that the pupils be set to work on the book study with the understanding that the "recitation" shall consist in an exhibition of just what and how to do in all the cases considered. Let bandaging materials, etc., be provided by the school for this exhibition.

The accompanying illustration shows a demonstration given by the Fifth Grade in the Peru Normal Training School to the Sivth Grade in the same school. The prospect of giving a public demonstration serves as an additional stimulus for careful work.

Studying the Books

1. How avoid the common accidents? Con. I, 198; Gu. II, 1; O-K. II, 270; Ri. I, 127.
2. How care for sprains and broken bones? Con. I, 114; Gu. II, 21; Je. I, 180, 187; Ri. I, 126.
3. How get skill in the art of bandaging? Con. I, 84, 204; Gu. II, 39; Hu. I, 137; Ri. I, 126.
4. How save life from drowning? Con. II, 159; Gu. II, 126; Hu. I, 144; Je. I, 185; Ri. I, 128.

Writing up the Note Book. (See Grade V, Study 1).

Dramatizing First-Aid Instructions

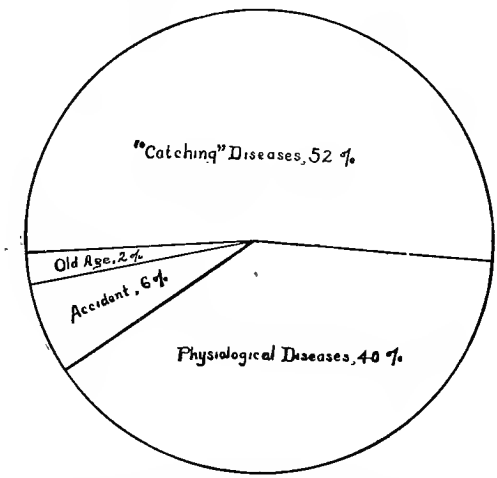
CHAPTER V.—GRADE VI, GERM HYGIENE

AMOUNT AND DISTRIBUTION OF TIME

It is intended that a half year shall be given to the study of hygiene in Grade VI, with recitations of fifteen minutes duration. Thus about eighty recitations should be given to the subject, either the first half or the last half of the year or in alternation with other subjects thruout the year. In case Grades V and VI are combined in one class, the fifth-grade course should come the first half of the year, to be followed by the sixth-grade course the second half.

THE AIM

It will be noted from the heading of the Course of Study



Note.—The proportions given in the above graph were estimated from the sections of the United States containing the most reliable records of deaths and their causes in 1910—Compiled by Abel J. McAlister, formerly Principal of the Atchison County (Kansas) High School.

for Grade VI that the dominant theme is acquaintance with germs. The same is also true for Grade VII. If half the child's hygiene time in school is, by this distribution, given to germ study, so also do half the people (52 per cent, see diagram) who die prematurely, succumb to germ diseases.

Conscious effort should be made in this grade to conserve the health practices presumably set up in grades I-V, or to establish them if wanting.

THE METHOD OF PROCEDURE

1. Preliminary consideration.—For the more extensive directions for presenting the hygiene lessons, see "Method of Procedure" under Grade V.
   A. Approach each new general topic by assigning some definite observation or project work.
   B. Have the pupils report in class the things previously observed, or conduct a class observation of an experiment or of concrete objects. Follow this up by specific questions that will bring out the desired hygienic points.
   C. Make text book and reference book assignments, distributing the latter among the pupils of the class, to be followed by a socialized recitation, or by an ordinary recitation, as may seem best.
   D. The final conclusion from the study, definitely drawn up according to some common outline or scheme, and record in the pupils' individual notebooks on hygiene followed by applications of the conclusions in practice.

SIXTH GRADE HYGIENE TOPICS—GERM HYGIENE

I. PLANT GERMS, OR BACTERIA.

1. What are the nature and habits of bacteria?
2. Are some bacteria beneficial—as cheese ripeners, nitrogen-fixers, scavengers, etc.?
3. Are some bacteria harmful—purification germs, etc.?

4. Are there bacterial germ diseases not readily contagious?

II. ANIMAL GERMS, OR PROTOZOA.

1. What are the nature and habits of protozoan germs?
2. Can you describe the protozoan germ diseases?

III. HOW THE BODY NATURALLY COMBATS GERM ENEMIES.

1. Does unbroken skin keep germs out?
2. Are the inside linings of the body a protection?
3. Is the nose a destroyer of germs?
4. Is the acidity of the stomach a germicide?
5. Are white corpuscles of the blood devourers of germs?

IV. HOW WE CAN HELP NATURE CONTROL GERMS.

1. How help by the use of disinfectants?
2. How help by the use of drinking fountains and individual cups?
3. How help by allowing only good foods and drinks, clean forks and spoons to enter the mouth?
4. How help by avoiding the spitting habit?
5. How help by suppressing dust in all forms?
6. How help by cooking of foods?
7. How help by not permitting alcoholic beverages to interfere with the work of the white corpuscles?
8. How help by cleanliness in all things?

V. VENTILATION IN RELATION TO GERMS AND TO BODY TEMPERATURE.

1. How is "crowd air" due to germs of decay in unclean bodies and clothing?
2. How does stagnant air sometimes cause us to feel warm?
3. How may ventilation give some relief for both these conditions?

VI. BATHING AS A GERM PROPHYLACTIC AND PROTECTOR FROM CATCHING COLDS.

1. Why is the surface of the skin an ideal home for germs?

2. Why is cleanliness the primary function of bathing?
3. How do cold baths keep one from catching colds?
4. What are the kinds of baths and how take a bath?

VII. CLOTHING IN RELATION TO GERMS AND HEAT.

1. What are the desirable kinds and use of undercloth-ing?
2. What are the desirable kinds and use of outer cloth-ing?
3. What are some general considerations about clothing?

NATURE-STUDY LESSONS AND TOPICAL REFERENCES FOR GRADE VI

Note.—It is to be understood that no attempt is here made to indicate how much work shall be assigned for each single recitation, as the length of the assignment will have to be determined by the length and number of recitations that the school gives to this important subject. The chapter references following the major (Roman-numbered) topics are for the teacher's especial use. The page references following the minor (Arabic-numbered) topics, are for the pupils' and teacher's use. The key to the books referred to is given in Appendix A. The teacher must know that it is not necessary to have or to use all the books referred to, but the more she can have both for herself and for her pupils the better.

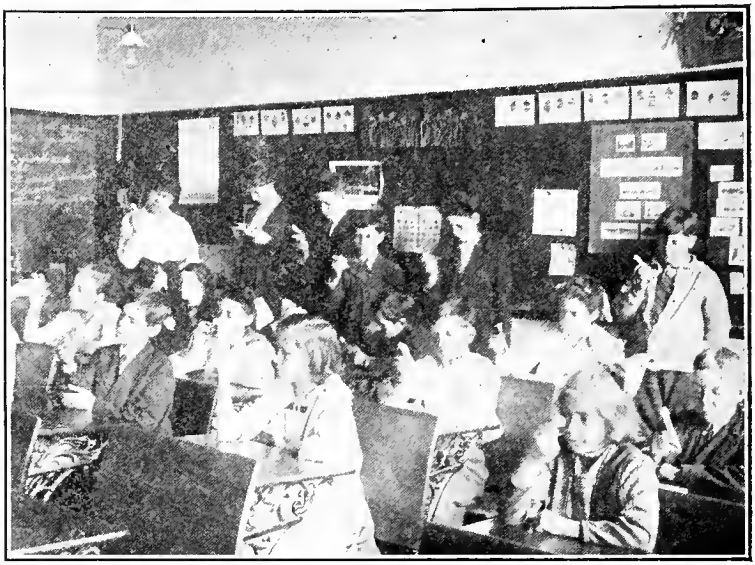
I. PLANT GERMS, OR BACTERIA.—Al. VI, IX; Co. VII, IX, XIV; Ho. IV; Hr. XI; H-S. XXX; Hu. XI, XII; Ma. XVI.

The Nature-Study Approach

Aim.—To learn the conditions favorable to the growth of germs.

1. Preparing a culture medium. The success of the study of germs here described, will depend in large degree on the skill with which the culture medium, or place for germs to grow, is prepared. The directions for two sorts of culture media are here given, the first being rather the more complex but also more satisfac-tory, and the second simpler, but workable where materials for the first medium are not readily avail-abl.

(a) First, prepare a half teacup of clear beef soup or



Children Examining Germ Culture

bouillon, add two cups of hot water and one teaspoonful of dextrose (ordinary brown sugar will do, but dextrose or glucose, is better). Second, to this substance add 2 per cent (by weight) of agar, if prepared for use in warm weather. If for colder weather, use 12 per cent of Knox gelatin instead. Now bring the whole to a boil, mixing in thoroly, then filter thru a funnel lined with wet absorbent cotton. Collect in a bottle large enough to hold what strains through, and stopper the bottle with a plug of absorbent cotton. Now set the bottle in a covered vessel, like a wash boiler, having several inches of water in it, and bring the whole to boiling for an hour on each of three successive days. This material will solidify on standing, and may be kept for some time. When ready to use, put the bottle in hot water again to melt the contents, and pour into at least a dozen test tubes or small vials, thoroly sterilized by heating in a hot oven, putting half an inch to an inch of the preparation in each bottle or tube. Carefully plug

each with a sterilized cotton plug. You are now ready to proceed with the experiments, after the contents of the tubes or bottles have been allowed to solidify by cooling when the tubes or bottles are standing at an angle of about 45 degrees.

(b) The alternatives medium, mentioned at first, consists in taking a healthy raw potato and from it cutting as many pieces an inch long and three-eighths of an inch square, as there are experiments, with a few extra to fall back on. Take an equal number of test-tubes or small bottles that will admit the piece of potato unbroken. Now place all in a covered vessel nearly full of hot water, and boil for three minutes.

Meantime, have at hand some clean, dry, and previously baked absorbent cotton, and remember to perform all directions here without stirring up any dust whatever, if possible. With a pair of pliers, or a wire bent double for the purpose (also boiled), take a test tube from the water, put in it (with the pliers), a piece of potato, add a drop or two of red ink, and insert a pledget of cotton into the mouth of the tube as a stopper, set aside, being careful not to let the water in the test tube touch the cotton. Similarly treat the remaining pieces of potato. Now boil the water in each test tube for one minute, not letting the water boil up against the cotton. These can be boiled by holding the lower ends in an alcohol or other hot flame, or lowering them into a boiling teakettle. A little common sense and ingenuity will help out. Set aside for twelve hours and boil each again for one minute, and so also at the end of another twelve hours. After this last boiling remove the cotton stopper, holding it so as not to touch any thing with the end that belongs in the test tube, pour off all the water you can, being careful not to "spill out" the potato, re-insert the cotton stopper, and your culture medium is now ready for use. If this has all been done carefully, there should now be no bacteria or mold or yeast in the test tubes and these may be kept for use any number of days later.

If test tubes and cotton are not available use jelly glasses with their lids, and a larger slice of potato. The red ink is used to color the potato and make it easier to see the little white patches of

bacteria that should appear in some of the experiments.

2. Making the experiments. No microscope is needed for this work. After starting the experiments as described below, the culture mediums should be examined for results in a day, two days, three days, and even four days. The results to be looked for are little white patches of bacteria colonies varying in size around that of a pin head. Sometimes mold develops on the potato, this being fluffy and the patches larger. This mold is to be neglected (and regretted).

   The experiments should be distributed among the members of the class, or, if the class is more numerous, additional sets should be prepared till all are supplied. A good time to give these out is on Friday so the return can be brought in on Monday.

   (a) Take a small, long knife or a sharp, clean stick and scrape the tongue with the end of it. Carefully pull out the stopper (holding it as explained above) from the test tube, convey the scrapings to the medium and reinsert the stopper at once. Set the test tube aside in a dark place but keep it all the time at a temperature between 90 and 100 degrees F. A warm thermos bottle would be ideal to keep the test tube in. Examine as explained above every day for three or more days and report what you see.

   (b) Treat as in (a) but keep in direct sunlight as much as possible.

   (c) Treat as in (a) but keep in a cold place, as a refrigerator.

   (d) Treat as in (a) but put in a drop of formalin before reinserting the stopper.

   (e) Stir up a dust in a room, remove the stopper and allow some of the dust to settle on the medium and reinsert the stopper. Set aside as in (a).

   (f) Set the test tube in a room where little or no dust is floating, remove stopper for half an hour, and then set aside as in (a). (Every dust particle generally has bacteria on it).

   (g) Sprinkle on the medium some dust from a dusty book and set aside as in (a).

   (h) Touch the medium with a bit of decayed fruit and set aside as in (a).

   (i) Touch the medium in several places with the end

of a pencil that somebody has had in his mouth, and treat as in (a).

(l) Take some scrapings from the rim of a common you see it walk on the medium, liberate the fly, and set the tube aside as in (a). (Two or three tubes may well be treated with flies).

(k) Take scrapings from the hand, transfer to the medium, treat as in (a).

(l) Take some scrapings from the rim of a common drinking cup and place them on the medium, and set aside as in (a).

Questions on the Experiments

After making a table of results from the twelve experiments, as reported by the pupils in class (they should have test tubes or bottles with them), follow up with questions such as the following: If one of our culture mediums had been perfectly dry would bacterial colonies have developed? What four conditions are unfavorable to the growth of germs? Name the various places in which you know germs may be found.

Tell what you think about the following practices, and what you mean to do about it hereafter; (a) spitting in public places; (b) promiscuous kissing; (c) putting pencils and other things in the mouth; (d) moistening the thumb to turn the leaves of a book; (e) "licking" court plaster to put it on a sore; (f) eating decayed fruit, etc.; (g) the carpeting of floors; (h) dusting furniture and books with a feather duster; (i) admitting sunlight to living and sleeping rooms; (j) exposing milk and other foods in dusty places; (k) drinking from public drinking cups; (l) exposing meats and other food to flies; (m) using disinfectants; (n) keeping the hands and body clean.

The Study of the Books. (See also Grade V, Study 1)

1. What are the nature and habits of bacteria.—Col. I, 11; Con. I, 169, 174; Da. I, 36; Gu. II, 30; Jc. II, 269; Ov. I, 17; Ri. II, 18.
2. Are some bacteria beneficial—as cheese ripeners, nitrogen-fixers, scavengers, etc.? Con. I, 171; Da. I, 38; Gu. III, 130, 179; Je. I, 30; O-K. IV, 218; Ov. I, 19; Ri. II, 19.
3. Are some bacteria harmful—putrification germs, etc.? Con. I, 171; Da. I, 39; Gu. III, 45; Je. II, 174; O-K. IV, 219; Ri. II, 19.
4. Are there bacterial germ diseases not readily contagious as those of tetanus, pus-formation, boils, tooth

decay, colds, pneumonia, appendicitis, etc.? Con. II, 48, 170, 364; Da. I, 62, 197; Je. II, 199, 334; O-K. IV, 223; Ov. I, 61, 54, 174; Ri. II, 21, 42.

Writing up the Notebook. (See Grade V, Study 1)

II. ANIMAL GERMS, OR PROTOZOA. Hr. XIII, XV, Hu. XV; H-S. XXXI; Ly. III, 7.

The Nature-Study Approach

Aim.—To get sense-acquaintance with one-celled animal forms.

Note.—Now that the pupils have a little first hand knowledge of microscopic plant life, it is desirable that they be given similar acquaintance with minute forms of animal life. While animal germs are larger than plant germs, it is possible, only under the most favorable circumstances, to see them with the naked eye. As no school room ought to be without one or more simple microscopes (costing about 50c each), it is assumed that at least the studies calling for the use of this instrument as well as those for the naked eye study, will be gone thru with. If the teacher knows how to use a compound microscope and can have the use of one in school, it will be found highly desirable to do so. The protozoan forms to be studied here are harmless, and are abundantly distributed everywhere.

1. To develop material for these studies, a hay infusion should be started by some pupil TEN DAYS OR TWO WEEKS BEFORE it is intended to enter on the class study of protozoa. To make this, have the pupil take a good double handful of pretty finely chopped hay and put it into a quart Mason jar. Now pour very warm water over it till the jar is two-thirds full. Then put the lid on loosely and set the jar aside in a warm place (for two weeks or so) till a white scum begins to form on the water. At first there will be myriads of bacteria and later (when the white scum comes) numerous little oblong, one-celled animals, called paramecia, will develop and feed on the bacteria. If it is possible to get a clam and let it decay in a Mason jar of water, a good supply of paramecia that are larger will develop.
2. When the teacher is ready to present the subject of protozoa, let a piece of black cloth or paper be laid on a table before the class, and on this, lay a pane of window glass. Now take drops of water in and near

the scum (also some of the scum itself) on the hay infusion, and transfer them with a pipette, or even a pencil, to various places on the pane of glass. Spread out the transferred drops of water as thin as possible on the glass, and look for extremely minute and numerous white specks swimming in the water. If the paramecia cannot be discovered with the naked eye, make use of the simple microscope.

3. Into one of the larger drops of water spread out on the glass in No. 2, put the tiniest grain of salt you can possibly get, and watch the behavior of the paramecia around the salt grain.
4. Put a drop of weak vinegar on a saucer or a butterette, and add 8 or 10 drops of water to the drop of vinegar. Now dip a fine needle into the vinegar thus weakened and transfer a tiny drop of it to a second spot of hay infusion in No. 2. Again watch the behavior of the paramecia in the neighborhood of the introduced vinegar.
5. Similarly dip a fine needle into some denatured alcohol and place in still another spot of hay infusion in No. 2. Observe what happens to the paramesia.
6. If a compound microscope, magnifying about a hundred diameters, is available, make a regular mounting of a drop of the infusion from No. 1. Study the behavior of the paramecia and discover, if you can, how they travel and why they go in so straight a course.
7. Again, if a microscope as in (6) is at hand, make mountings of water from horse troughs, standing pools, and places where there is green scum of any sort. Examine for various minute forms of protozoa.
8. If some person can be found whose teeth are affected with pyorrhea, and is willing to lend himself to the enterprise, have him take a tooth pick and take scrapings from between the gum and the root of the affected tooth. With this material make a smear mounting for examination under the compound microscope magnifying three or four hundred diameters. Some of the semi-transparent forms may be seen to change shape in ameba-like fashion.

Questions for Consideration

1. Where did the bacteria come from that developed in the infusion? Whence the paramecia and other protozoa, if any?

2. Can you suggest a reason why the paramecia should be more numerous near the top of the hay water? Why should this not be true for the bacteria also?
3. How did the paramecia behave around the salt? Why did they do this?
4. How differently did the paramecia behave around the vinegar drop than around the salt? Any reason for this?
5. Since white blood corpuscles are really one-celled animals doing important work in the body, what might be expected from getting even a small amount of alcohol in the blood?
6. Why do men make a coiled groove around the inside of a rifle barrel? How do you account for the fact that the paramecium swims in such a straight line? What makes it go at all?
7. Describe the different kinds of protozoa you may have seen in No. 6.
8. How does the pyorrhea germ differ in appearance from the paramecium? How does it differ in its motion? How do you suppose it devours its food? How do you think pyorrhea helps to make bad breath? Why is this germ so hard to get rid of? What is the connection of pyorrhea with rheumatism?

Studying the Books. (See also Grade V, Study 1)

1. What are the nature and habits of protozoan germs?—Col. I, 11; Con. I, 176; Da. I, 43; Ov. I, 20; Ri. II, 101.
2. Can you describe protozoan germ diseases, hydrophobia, pyorrhea (Rigg's disease), malaria and yellow fever, etc.—Con. I, 176; Da. I, 127; Gu. III, 234; Je. II, 327; Col. I, 132; Ov. I, 196; Ri. II, 101, 128, 207.

Writing up the Note Book. (See Grade V, Study 1)

III. HOW THE BODY NATURALLY COMBATS GERM ENEMIES.—Hu. I; Co. XV; Te. IX; Wa. XVI.

The Nature-Study Approach

Aim.—To discover some of the body's defenses against harmful germs.

1. Take an apple with unbroken skin and in one spot make a simple cut thru the skin with a knife. Put a drop of ink on the cut spot and also one on an unbroken spot of skin and let stand for a minute or two. Now thinly pare the skin from each of the inked spots and note the condition of the apple beneath.

2. Make an examination of several apples some of which have decayed spots in them and some of which do not. Note whether one group has broken skin and the other not.
3. Take a clean pin and examine the skin of the back of your hand to see if you can discover a layer of skin somewhat like that of the apple. Possibly you may be able to run the pin under the outer layer of the skin without pain.
4. Make a similar examination of the inner lining of the mouth, using a mirror and a very clean pin.
5. Now face your head away from a strong light, or the sun, and use a hand mirror in such away that you can examine the inside of your nose. You should see that deep in the nostril the inner surface is quite red and moist with a slightly sticky moisture.
6. Take two of the apples that have rotten spots about as big as a dime or a quarter each. After opening up one of these spots with a knife or splinter, pour into it several drops of hydrochloric (or muriatic) acid and mix this acid about with the apple decay. Now set the two apples aside for some days to see the effect of the acid on the decaying of the apple, in comparison with the decay on the other apple.
7. Put a spoonful of water in a shallow dish like a saucer. Dip a piece of blue litmus paper into the water and note that the paper remains blue. Now drop a few drops of muriatic (hydrochloric) acid into the water and try the litmus paper again to see how the paper looks now. Next put a drop of ammonia water into the water in the saucer and try a fresh piece of blue litmus paper to see if the paper again turns red. If it does, put a few more drops of ammonia water into the mixture and again try with blue litmus paper. Repeat if necessary till the paper no longer turns red. The acid has been neutralized, (fixt so it won't work) by the ammonia.
8. Take some rather fine dry bread crumbs, color them with red ink, and let them dry out again. Besides these crumbs there is needed for a good sized class of pupils, 5c worth of scales of shellac, 10c worth of oil of cloves, and 10c worth of denatured alcohol. Put a small quantity of the shellac in a small vial and complete the filling of the vial with denatured alcohol. When the shellac has dissolved in the alcohol, pour

some of it on a part of the crumbs of colored bread and allow to dry up as before. We are now ready for an interesting experiment to learn how white corpuscles "eat" germs.

Into a white saucer or dessert dish pour three teaspoonfuls of water and one of denatured alcohol. (Three or four pupils can work around one dish.) Float a small crumb of the red bread in the liquid, then, getting a drop of oil of cloves on the end of a pencil, float the drop in the liquid near the bread. Does the drop of oil "eat" the bread? Take a crumb of the shellacked bread and float it on the liquid and put beside it a fresh drop of oil of cloves. If all has worked well, the drop of oil will "eat" the bread. Put other drops of oil on the liquid and "feed" them grains of shellac directly.

Questions for Consideration

1. What seems to be the work of the skin of an apple?
2. Remembering that decay is caused by germs and that germs are everywhere, why do some apples decay and others not?

3-4. What resemblances between the skin of an apple and the surface skin of the hand and of the inner cheek?

5. Why do you think the nose is such a good germ destroyer?
6. Since the human stomach has hydrochloric acid in it, what is one of the stomach's important uses?
7. Germs in the human body sometimes do not destroy flesh but make a poison that injures it. How can the body counteract this poison?
8. How do the white blood corpuscles destroy germs? If these corpuscles do not "like" these germs, what may nature do to get them to eat the germs? How can a fellow sometimes easily get boils and at another time not get them so easily? (Let the teacher look up the subject of "opsonin" or "bacterin" in a good recent dictionary or cyclopedia.)

Studying the Books. (See also Grade V, Study 1)

1. Does unbroken skin keep germs out?—Con. I, 126; Da. I. 85; Gu. I, 37; O-K. IV, 276; Je. I, 37; Ov. I, 23, 167; Ri. III, 21.
2. Are the inside linings of the body a protection? O-K. IV, 276.

3. Is the nose a destroyer of germs—Con. I, 92; Da. I, 104; Gu. I, 132; Je. I, 133; O-K. IV, 276; Ov. I, 51, 153; Ri. III, 71.
4. Is the acidity of the stomach a germicide?—Con. I, 51; Da. I, 51; O-K. III, 284; Ri. I, 28. Ov. 178.
5. Are white corpuscles of the blood devourers of germs? —Con. I, 74; Da. I, 123; Gu. III, 88, 98; Je. II, 339; O-K. III, 284; Ov. I, 122; Ri. II, 11.

Writing up the Notebook. (See Grade V, Study 1)

IV. HOW WE CAN HELP NATURE CONTROL GERMS. Co. XVI, XVII; H-S. XXXI; Wa. XVII.

The Nature-Study Approach

Aim.—To make actual acquaintance with some common disinfectants, etc.

1. Deodorization.—Take a rotten egg, or other ill-smelling substance in process of decay, and divide it into three parts, placing each part in a dessert dish or can lid. On the first of these samples put several small pieces of charcoal bought directly for the purpose, or sifted out from wood ashes. On the second portion put a small quantity of pulverized quicklime (less than 5c worth). On the third portion put a small amount of "chloride of lime". A box of this "chloride of lime" might well be in every schoolroom collection of supplies.

   After these deodorants have been applied for an hour or so, determine the relative strengths of the disagreeable odors.
2. Fumigation with sulphur dioxide.—Secure 5c worth of "flowers of sulphur" from the druggist. Have at hand for a class experiment a pie-pan half full of water. In it put a valueless desert dish or lid to a Mason jar. Take a piece of absorbent cotton, or cotton batting, as big as your thumb, saturate it with coal oil or denatured alcohol, and lay it in the center of the dish or can lid. On this now pour a teaspoonful of flowers of sulphur. Permit the class to smell the fumes of the burning sulphur, called sulphur dioxide.

   Put some flies or other insects in a small net and hold the net over the fumes of burning sulphur. Observe what happens.

   Hold several samples of moistened calico, or other

colored cloth, or colored plant blossoms, over the fumes of burning sulphur, and see if they change color or not.

Hold an apple with a decayed spot so the fumes will penetrate the decay and set aside to see if decay continues, (as in No. 4 below).

See what the dictionary says the words fumigation and fumigate mean.

3. Fumigation with formaldehyde.—A chemical called formalin when mixed with water is called formaldehyde. As this comes from the drugstore, it usually contains 40 per cent formalin and 60 per cent water. Permit each member of the class to become acquainted with the appearance and odor of formaldehyde. If much of the fumes get into the eyes it will make them water, but this will not prove serious. Put some flies or other insects in a small net and hold the net over the fumes of formaldehyde. Observe what happens.

   Hold several moistened samples of calico, or other colored cloth or flowers, over the fumes of formaldehyde, and see if they change color or not.

   If the teacher cares to undertake the enterprise with the class, she can fumigate a room by using the apparatus for the purpose, such as physicians or druggists have. The directions will be found on the apparatus. A highly recommended solution is 10 ounces of formaldehyde with 10 ounces of potassium permanganate for every 1000 cu. ft. of room space.

4. Disinfection.—Have at hand for class demonstration six apples or other fruit having spots of decay on the surface. On each of the several apples put a quantity of the following disinfectants, mixing it well into the decay of the fruit: (a) hydrogen peroxide, (b) quicklime, (c) chorlide of lime, (b) 5 per cent solution of carbolic acid, (e) denatured alcohol, (f) formaldehyde (a 10 per cent solution). Set these aside for several days to observe the effect on the progress of decay.

   See the dictionary for the meaning of disinfection and disinfectant.

5. Sterilization.—Consider how fruit and other foods are treated when they are canned so they will not decay or "spoil".

   Recall how the cotton and bottles or test tubes

used in the first nature studies of sixth-grade hygiene were treated. (Give some reasons for this treatment.)

Find from the dictionary the meaning of sterilization.

6. Let each pupil make a sanitary drinking cup of paper, as shown in Chapter VIII.

Questions for Consideration

1. What is deodorization? A deodorant? Which of the deodorants used proved to be the most effective? Do any or all of the deodorants stop the decay by destroying the germs?
2. What is fumigation? A fumigant? Do the fumes of burning sulphur destroy insects? Discolor cloth? Destroy germs? How does a fumigant differ in effects from a deodorant?
3. In what respects if any is formaldehyde a better fumigant than sulphur dioxide?
4. What is disinfection? A disinfectant? Can you give any special advantages for each of the disinfectants made use of? What is the difference, if any, between fumigation and disinfection?
5. What is sterilization? How does it differ, if at all, from disinfection? What are the two most common methods of sterilization? Can you name the stuffs used as deodorants? As fumigants? As disinfectants?

Studying the Books. (See also Grade V, Study 1)

1. How help by the use of disinfectants?—Con. I, 182; Da. II, 200; Je. II, 335; Ov. I, 190; Ri. II, 156.
2. How help by the use of drinking fountains and individual cups?—Con. I, 176; Da. I, 177; Gu. III, 99, 125; Je. II, 267; O-K. I, 193; Ov. I, 95; Ri. II, 37, 51, 164.
3. How help by allowing only good foods and drinks, forks and spoons to enter the mouth?—Con. I, 175; Da. I, 22, 91; Gu. III, 149; Je. II, 269; O-K. I, 196; Ov. I, 72; Ri. II, 86.
4. How help by avoiding the spitting habit?—Da. II, 185; Je. I, 43; Ov. I, 54; Ri. II, 67.
5. How help by suppressing dust in all forms?—Con. I, 186; Da. I, 37, 108; Gu. III, 30, 39; Je. O, 38; O-K. I, 92; Ov. I, 34; Ri. II, 71.
6. How help by the cooking of foods?—Con. I, 171; Da. I, 30; Je. II, 164; O-K I, 141; Ov. I, 81; Ri. II, 82.
7. How help by not permitting alcoholic beverages to

interfere with the work of the white corpuscles?—Con. I, 69; Da. I, 123; Gu. III, 213; Je. II, 345; O-K. IV, 233; Ov. I, 121, 138, 179; Ri. II, 14, 58.

8. How help by cleanliness in all things?—Con. I, 132, 184, 191; Da. I, 44, 91; Gu. III, 149; Je. I, 34; O-K. III, 288; Ov. I, 23; Ri. II, 141, 164.

Writing up the Notebook. (See Grade V, Study 1)

V. VENTILATION IN RELATION TO GERMS AND TO BODY TEMPERATURE.—Dr. XI; H-S. XII; Te. X.

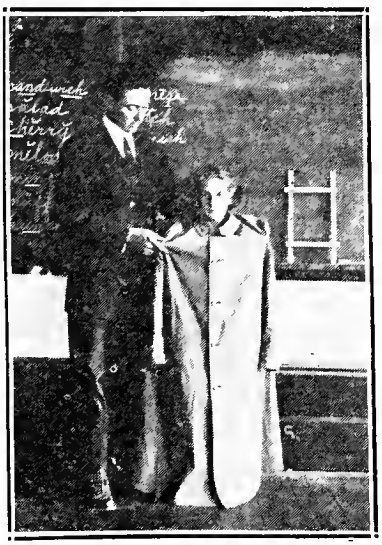
The Nature-Study Approach

Aim.—To discover the causes of "bad air" in living rooms.

1. Let each pupil study the back of his hand with a simple microscope, (such as should be in every schoolroom, costing about 50c). Look at the back of the wrist first and notice how rough and seemingly scaly it is. Note particularly where a hair comes out of the skin. If a good specimen is found ,note whether it seems to come out of a hole. Pulling a hair out so you can examine its "root" with the microscope may help to decide whether it was in a tiny hole or not.
2. Try running a pin under the outermost layer of the skin. If you proceed carefully, it will not hurt much, if any. This outer layer is dead stuff as you may guess from the fact that you can scrape it off without hurting, when your hand is quite sweaty. If you do not know this for certain, be sure to get your hand very sweaty and then scrape off some of the scurf.
3. Once more look thru the magnifier at the skin of the hand, this time on the palm. Notice the little ridges. Now look very sharply for tiny little depressions along the top of the ridges. These can more readily be made out if one is sweating a little, so that very tiny drops of perspiration will show up as shiny spots at each depression. This is because these are the outlets of the sweat pores of the skin. Similar depressions can be found all over the skin but they are not so easily made out elsewhere.
4. We know that moisture stands out over the skin when we are quite warm, but on colder days we are not so certain about the presence of moisture. To find out about it, we need a day or a place where the temperature is down to something near 50 degrees F. In such

a temperature let the pupil put his hand into a glass quart fruit jar, not allowing the skin to touch the jar, and stopping up the unoccupied part of the mouth of the jar with a handkerchief. Thrust a thermometer tube (a dairy thermometer would be excellent) into the jar without letting it touch the skin. Note that the temperature on the inside is still only about 10 degrees warmer than that on the outside. To be sure of the conclusion of our experiment, have at hand another glass fruit jar that has its lid on. After ten minutes examine the inner surface of one of the jars.

5. Turn back to the notes on Study I of the Sixth Grade series, and refresh the memory about the five conditions favorable to germ growth.
6. If a compound microscope with an oil immersion lens is at hand, and the teacher can make a stained mounting of scrapings from the skin, the presence of germs can be impressively demonstrated. If no staining is done, the germs may still be seen as very, very tiny quivering particles.
7. But there is another way to tell whether germs are in skin scurf, and that is to put some of the germs on a culture medium such as was described in the directions for the experiment referred to in Study I of



Grade VI, and to await the development of germ colonies.

8. There is still a third way, and this experiment ought on no account be ommitted. It calls for the use of an adult person's raincoat, as shown in the figure above. There will also be needed a frame to carry the coat on the shoulders of the pupil in a way to keep the coat out from the body of the pupil. A frame is shown on the ledge of the blackboard in the picture. Now let each pupil put on the rain coat of an adult quite a little bigger than the pupil, and stand for ten minutes or more till a sweat is developed. Incidently the teacher can develop the most fundamental need for ventilation by taking the coat (with the frame) by the shoulders and shaking the coat about so as to stir the air on the inside without letting any fresh air in. Perhaps the pupil could discover why this stirring of air gives him relief from the heat, tho this subject belongs more properly to the eighth grade. The main point of this experiment for this grade comes when the teacher unbuttons the raincoat at the neck only and slowly lifts the coat over the pupil's head, giving him a chance meantime to get the odor of the air that has been around his body.

Questions for Consideration

1. Do you find any place on the skin where germs could stay? If so, what would be the very best places in which they could develop?
2. Why do you think it does not hurt much to scrape off the scurf, or to run a pin under the outer layer of the skin?
3. Where does sweat come from and how does it get out? Since we do NOT sweat to get rid of waste matter, (as many people have supposed) why do we sweat at all, as you may gather it from the 8th grade part of No. 7?
4. Which jar had moisture in it and what does this show?
5. What are five of the conditions favorable to germ growth? Do these conditions all exist on the skin?
6. How much smaller are germs than the microscope shows them to be?
7. If white patches develop on your culture medium, what have you verified?
8. What is the character of the odor of decay generally? What do you suppose is the chief reason why the air of poorly ventilated school rooms smells so bad? What is one very important reason, accordingly, why in-

habited rooms have to be ventilated? What is the greatest reason why you and I should bathe frequently? Which is better, to use perfumes to hide odor or keep as clean as we can and thus keep down bad odors?

Studying the Books. (See also Grade V, Study 1)

1. How is "crowd air" due to germs of decay in unclean bodies and clothing?—Con. I, 104; Da. I, 111; Gu. III, 1, 10; Ov. I, 15, 9; Ri. III, 66.
2. How does stagnant air sometimes cause use to feel warm?—Con. I, 103; Da. I, 113; Ov. I, 163; Ri. III, 63.
3. How may ventilation give give some relief for both these conditions?—Con. I, 103; Da. I, 115; Gu. III, 16; Ov. I, 161; Ri. III, 60.

VI. BATHING AS A GERM PROPHYLACTIC AND PROTECTOR FROM CATCHING COLDS.—Ha. XII; Hu. IV; H-S. XXIV.

The Nature-Study Approach.

Aim.—To find out differences in baths and their effects.

Introductory.—Preliminary to the studies to follow, let the teacher take occasion to recall from prior studies that the surface of the skin is covered with dead skin cells, that it is warm, moist, non-acid, and for the most part protected from direct sunshine. It is accordingly an ideal place for germs of decay. The evidence that decay is going on, is found in the odors that arise from any part of the skin not thoroly cleaned for a few hours.

We wish now to have each pupil discover for himself certain important effects to be gotten from the various forms of bathing. The pupils readiness to co-operate in the enterprise must first be secured, for the baths will, of course, all have to be taken at home, preferably on successive days.

1. Let the pupil test with his nose the odor coming from his forearm, let us say, both before and after each of the kinds of baths. Let him, at the end, consider what is the primary purpose of and gain from all forms of bathing.
2. The first of the bathing should be a warm bath (90 to 95 degrees F.) lasting from 4 to 6 minutes, taken just before retiring,followed by a thoro rubbing with a rough, dry towel, great care being taken not to suffer chilling following the bath. After donning the night clothing, consider the change in the color of the skin

effected by the bath and the change in the pulse rate per minute (this necessitating the counting of the pulse both before and after the bath). Finally, press a cool inverted jelly glass over the fleshy part of the forearm or elsewhere, and note whether a film of moisture collects inside of the cup.

3. The next morning or on a following morning after counting the pulse, let a cold bath be taken (with water below 65 degrees F.) as follows: use only a basin of water, a wash cloth, and a drying towel. Let the bath be taken in a room not too cold but still cool. Remove the night clothing at first only from the left arm and shoulder. With the wash cloth saturated with the cold water, wash the left arm and shoulder and then rub dry quickly and thoroly. Now remove the clothing from the right arm and shoulder and pause to consider which arm now feels the warmer. Wash and dry the right arm and shoulder as you did the left. In the same way now proceed with the chest, then the back and so on, part by part, till the bath is completed. Consider again the difference in the pulse rate, and the appearance of any moisture on the inside of a jelly glass held for a minute as in study 2. (Exception might be made of this experiment in the case of a child with a weak constitution).
4. On the second or a following evening, proceed exactly as in No. 2 only this time let the water be as near the skin temperature as possible (between 80 and 90 degrees F.). Make the same observations as before.
5. On the second evening or a later one a cold bath may again be taken following the general details outlines in No. 3, but requiring that the bath be a plunge bath or a shower bath, if these are possible for the pupils. Make the same observations as in No. 3.
6. Finally, on the third or a later evening let some one or more of the hardier pupils try out the effects of taking a cold bath just before retiring and a warm or hot bath on rising, in each case making the same three observations as before, and also whether it is easier to go to sleep or not, and whether one feels so much like going to work in the morning.

Questions for Consideration

After discussing and answering all the questions that follow, come back to the question, What seems to be the primary effect of bathing? (It is to be hoped that

there will emerge from the study something more scientific than the ancient fiction about "opening the pores of the skin.")

2. What is the effect of a warm bath on the frequency of heart-beats? Why then should the skin get pinker or redder? Why does the face get redder when you hold it near a hot stove? Does the heart beat faster at such at time? Whence came the moisture that you saw on the inside of the jelly glass? How did the moisture get out of the skin? (Thru sweat-gland ducts, the only "pores" the skin has).
3. What is the effect of a cold bath on the frequency of heart-beats? How do you account, this time, for the increased redness and warmth of the skin? (The complete physiological answer to this question the pupils should not be expected to give.) How again do you account for the moisture on the inside of the jelly glass? Is it true, as used to be said, that a warm bath "opens the pores" and a cold one "closes the pores"? Since the sweat ducts open only when one perspires can you give a list of half a dozen conditions that will "open the pores" and as many that will "close the pores"?
4. How does a tepid bath differ from a hot bath and a cold bath in heart-beats, circulation and perspiration effects? What, then, is the important effect of a tepid bath? Would there be any serious objections to taking such a bath close to meal time, when considerably more blood is needed around the digestive organs? Would it not be a fine thing for the family in the home if every one who works amid necessarily dirty surroundings would take a tepid bath at the close of the day's work, just before going to supper?
5. How does a cold bath make one feel, anyway, after it is all over? Are you more ready to pitch into work, or play, or breakfast, or what not?
6. Is there any effect on your ability to go to sleep after taking a cold bath at night? On your enthusiasm for work after a warm bath in the morning? Why these results? When and what kind of a bath do you think thoroly healthy boys and girls should take? Why is it better to bathe once a day rather than once a week? To what do you think the bad odors of school rooms, concert halls, etc., are chiefly due?

Studying the Books. (See also Grade V, Study 1)

1. Why is the surface of the skin an ideal home for

germs?—Con. I, 126; Da. I, 176; Gu. I, 113; Ov. I, 26; Ri. II, 32, 165.

2. Why is cleanliness the primary function of bathing? Con. I, 132; Da. I, 91; Je. I, 117; Ov. I, 123; Ri. III, 87.
3. How do cold baths keep one from catching colds? Con. I, 133; Col. II, 120; Da. I, 180; Je. I, 118; Je. II, 20; Ov. I, 30; Ri. III, 78, 87.
4. What are the kinds of baths and how take a bath? Con. 132; Da. I, 91; Gu. III, 66; Je. I, 118; Ov. I, 29; Ri. III, 87.

Writing up the Note Book. (See Grade V, Study 1)

VII. CLOTHING IN RELATION TO GERMS AND HEAT H.-S. XXV.

The Nature-Study Approach.

Aim.—To discover some hygienic principles in the selection of clothing.

Note.—We need for our study a cotton, a linen, and a silk handkerchief or pieces of cotton, linen, and silk, weighing about the same. With these there should go a piece of as thin woolen goods as may be obtained and weighing no more than the cotton handkerchief or cloth. If scales weighing an ounce and fraction thereof, are not available ,take a light wooden ruler, stick a pin thru the center, pin the piece of cotton cloth to one end of the ruler and trim the woolen piece to a size that, when pinned to the other end of the ruler, will balance the cotton piece. Similarly the other samples of cloth may be made to balance the cotton piece. Of course if silk and linen are not at hand, these experiments can be run thru to advantage with cotton and woolen. There will be needed also for the experiments a common water glass one-fourth full of water, a flat-iron, a simple magnifying glass and a pan of water.

1. To study the relative power of the pieces of cloth to conduct heat, fold the larger pieces of cloth until they are about the size of the pieces of woolen. Now heat the flat-iron till it is not quite hot but still distinctly warm to the touch. Have a pupil place a piece of cloth over the end of the finger and apply to the warm iron. Take the other pieces of cloth similarly in turn, and compare the relative time it takes for the heat to be felt thru the cloth. The one that yields the heat sensation the quickest is of course the best conductor

of heat, and conversely. (If pupils are not acquainted with the word "conductor" the word should not be employed until after the experiment has been made.) The pieces of cloth might now be opened using only a thickness of each piece. It is said that if the textile could all be woven equally compactly and equally loosely, they would have about equal conductivity. The difference in conductivity is said to be due to the air enclosed in the meshes. Why then is woolen cloth one of the poorest conductors and cotton one of the best? Our next study should help us to understand this.

2. Examine a few of the finest fibres of each textile with a simple microscope. Which fibre is most crinkly and coarsest? Does this explain the difference in conductivity of cotton and wool? So far as conductivity is concerned, if cotton is woven with a loose mesh it is as valuable for underclothing for most people (invalids and old folks excepted) as woolen is.
3. We learned in our studies of the skin that we sweat in order to get rid of excess of heat, of the body, and that this may work to the best advantage, underclothing should be of such materials as will best take up and get rid of the sweat of the body. Let us therefore test our materials to find out their relative absorbing power for water. Hang the four samples of cloth so that one corner of each piece is in a pan of water and the opposite corner is pinned to some support above. After these have stood for half an hour or such a matter, examine to see which one has carried water the highest.
4. A further test my be made by immersing each piece in turn when dry in a glass one-fourth full of water. Mark with ink on the outside of the glass the level of the water before the cloth is put in and after it is taken out, allowing the cloth to drip as much water as it will. Be sure, too, that the cloth is given a chance to take in as much water as it will before removing it from the water. Refill the glass to one-fourth full, treat the second piece of cloth as the first, make the mark after removing it, and go on similarly with the remaining pieces. If the comparison of marks does not show which cloth takes up the most water the matter can be settled by comparing the doubtful ones on the balanced ruler used at first. Ordinarily the cotton will be found to take more water than the others

which shows that on the side of absorbing power it is the better for underclothing.

5. But we must now find out which one will give off its water fastest, for that is important also. We now take the four pieces of wet cloth and "hang them out to dry" as mother does with her washing and after a little while we must watch them to see which one gets dry first. The silk will usually have the advantage here because thinnest and most spread out. But note especially the cotton and wool.

Questions for Consideration

1. What is meant by "a good conductor of heat"? A "poor conductor"? Why does the cotton sheet of our beds in winter time feel so much colder than the woolen blanket? Why does a piece of iron out of doors in winter feel colder than a piece of wood?
2. How answer the questions in No. 2 above?
3. How do you find the textiles to compare in rate of water absorption?
4. What were the actual results of experiment No. 4?
5. What reason emerges from No. 5 for favoring the use of cotton underwear? What are all the reasons that can be given as shown by our experiments for preferring cotton underwear, by people who are active? Which suit of underwear would harbor germs best? Can you give still other reasons favoring the use of cotton underwear? Should people who live and work in warm houses in winter time wear very much heavier underclothing in winter than in spring or summer? If not, how should such people prepare for the cold when they have to go out into it? Why should one not keep on his overcoat, or cloak and overshoes when coming from the cold into a warm room to remain for a while before going out again?

Studying the Books. (See also Grade V, Study 1)

1. What are the desirable kinds and use of underclothing? Con. I, 135; Da. I, 97; Gu. IV, 217; Je. II, 204; O-K. I, 191; Ov. I, 41; Ri. III, 83, 87.
2. What are the desirable kinds and use of outer clothing? Con. I, 135; Da. I, 94; Je. II, 205; O-K. I, 181; Ov. I, 38; Ri. III, 83, 87.
3. What are some general considerations about clothing? Con. I, 135; Gu. IV, 217; Je. II, 204; O-K. I, 181; Ri. III, 83, 87.

Writing up the Notebook. (See Grade V, Study 1)

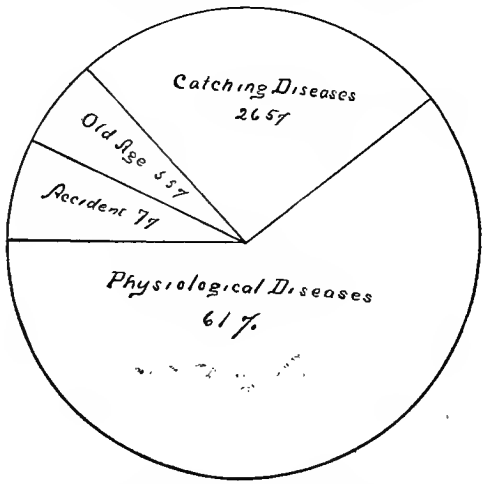
CHAPTER VI.– GRADE VII: COMMUNITY HYGIENE

AMOUNT AND DISTRIBUTION OF TIME

The time arrangement for this grade is intended to correspond with that in Grades V and VI, namely about eighty recitations (a half year's work) given in either half of the year, or distributed thru the whole year. The recitation period may well be twenty minutes in this grade. If it seems best to combine grades, the seventh should be joined with the eighth, taking both courses in order through the year.

THE AIM

The seventh grade pupil is beginning to get a sufficiently enlarged horizon to see himself in relation to community life. The study of germs in Grade VI has prepared him to



Causes of Death in Nebraska

Note.—The proportions given in the above graph were estimated from the Report of the Nebraska Board of Health for 1915. Compiled by Dr. B. L. Shellhorn, Peru, Nebraska.

understand how germs may become a community menace. In Grade VII the subject of germs is taken up under the head of community hygiene, the prior germ study being here turned to its largest use. Other aspects of community hygiene are also included in the course. The general aim may therefore be said to be the presentation of hygiene in a way to impress the pupil with his larger responsibility in matters hygienic.

While logic would say that the courses for Grades VI and VII might better be thrown together when two years' work are combined in one, good pedagogy will say that the pupil needs to hit the germ question two different times in his course, rather than give it one continuous treatment. A combining of Grades V and VI and of Grades VII and VIII for hygienic work, where the four courses are not kept separate, gives the child a chance at germ study in Grades V and VII, or in Grades VI and VIII, depending on how he happens to get started off.

SEVENTH GRADE HYGIENE TOPICS—COMMUNITY HYGIENE.

I. PURE AIR AND GOOD WATER AS COMMUNITY RIGHTS.

1. What are the character and sources of the water of the community?
2. How keep the water wholesome?
3. When is air good and when is it bad?
4. What are the peoples rights and duties as to air?

II. COMMUNICABLE BACTERIAL DISEASES.

1. Shall we review the nature of bacteria?
2. What are tuberculosis and the "rest cure"?
3. What are typhoid fever and its vaccination?
4. What are diphtheria and its antitoxins?
5. What are whooping cough, mumps, and acute rheumatism?
6. What are sore eyes and granulated lids?
7. What are the intestinal germ diseases?

III. COMMUNICABLE PROTOZOAN AND WORM DISEASES

1. Shall we review protozoan disease germs?
2. What are smallpox and vaccination?
3. What are hydrophobia and Pasteur Institutes?
4. What are measles, chickenpox and scarlet fever?
5. What are the intestinal worm diseases?
6. What are trichina and "mealy pork"?
7. What is the hookworm and how eliminated?

IV. QUARANTINING AND COMMUNITY CARE OF THE SICK.

1. What are the purpose and value of quarantining?
2. What are the quarantinable diseases in your state?
3. How are community hospitals controled and what is their value?

V. INSPECTION OF FOOD SUPPLY SOURCES.

1. What are the character and sources of your milk supply?
2. Are the slaughter houses, meat shops, and bakeries wholesome?
3. What dangerous occupations are in your community?

VI. MOSQUITOES, RATS AND PETS AS COMMUNITY MENACES.

1. What are the breeding places and life history of mosquitoes?
2. How are mosquitoes carriers of disease?
3. How control mosquitoes?
4. What are the dangers and control of rats?
5. Are pet animals disease carriers?

VII. THE HOUSEFLY AS A COMMUNITY MENACE.

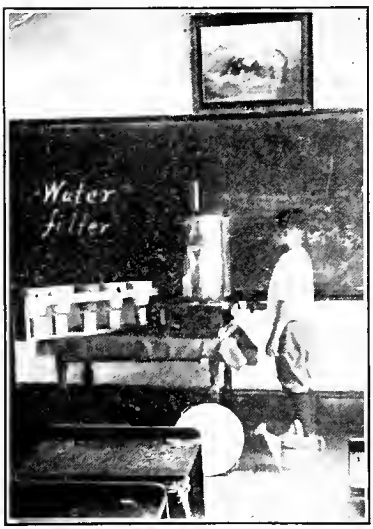
1. What are the breeding places and life history of the housefly?
2. Is the housefly a carrier of diseases?
3. Can a community be free of flies?

VIII. COMMUNITY DUTIES AND BURDENS.

1. How dispose of garbage and sewage?
2. What are the dangers from conflagrations?
3. What is the cost and harm of tobacco chewing and smoking?
4. What is the individual and community toll for alcoholic beverages?

NATURE STUDY LESSONS AND TOPICAL REFERENCES FOR GRADE VII

Note.—It is understood that no attempt is here made to indicate how much work shall be assigned for each single recitation, as the length of the assignments will have to be determined by the length and number of recitations that the school gives to this important subject. The chapter references following the major (Roman-numbered) topics are for the teacher's especial use. The page references following the minor (Arabic-numbered) topics, are for the pupil's and teachers use. The key to the books referred to is given in Appendix A. The teacher must know that it is not necessary to have or to use all the books referred to, but the more she can have both for herself and her pupils the better.



I. PURE AIR AND GOOD WATER AS COMMUNITY RIGHTS.—Al. I; Dr. VII, VIII, X; HE. XXIV; H-S. XXXII.

The Nature-Study Approach

1. Vaporization and boiling point.—These can be advantageously studied by putting a pint of water in a discarded linseed oil can, or other equally large can. By suitable means, bring this water to the boiling point, and with a cream thermometer, determine the temperature of the vapor and of the water by lowering the thermometer into a can with a string. That the can is practically filled with water vapor, if the water has been been boiling for several minutes, can be impressively shown by taking the can from the source of heat, stoppering it quickly and tightly and then sprinkling cold water over the outside of the can so as to cool the vapor within. Ordinarily the can will weirdly collapse with startling contortions (as seen in the picture), due to the removal of pressure from the inside to counteract that of the air without.

2. Freezing point of water.—This may be determined by taking the temperature of water that has plenty of ice floating in it. If weather conditions permit, a bucket of dirty water should be allowed to freeze over and the ice taken off later and some of it melted and poured into a clear water glass to see if there is any sediment deposited.

3. The solvent power of water.—Take two glasses of clear rainwater and dissolve a teaspoonful of salt in one of them. Submit to the class to tell "which is which" by mere appearance. Let the final determination be made by a pupil's tasting the two thru a straw. Now add to these glasses of water a third glass containing water from one of the wells of the neighborhood and allow all three to stand in a warm place till they dry up.

4. Power to absorb gases.—Fill a jelly glass with clear water that has been exposed to the air for some time. Fill another jelly glass with water that has just been boiled. Into each glass put a bright nail and cover each lightly with a lid. Examine both nails the next day, remembering that iron will not rust unless there

is some of that part of the air known as oxygen present along with moisture.

5. "Hard" water and "soft" water.—Prepare a "soap solution" by dissolving a small piece of soap in a bottle of hot rain-water. Get half a bottle of water that is called "hard" and another that is called "soft." Put a small quantity of the soap solution into each sample of water and shake thoroughly. Compare them after the shaking.
6. Filtration of water.—Put filter paper or white cotton in the bottom of a funnel successively as you try various samples of neighborhood drinking water to see if any substance collects on the filter paper or cotton. A very impressive illustration of the filtering power of soils can be made by taking several ordinary flower pots that will hold a quart or more and filling them respectively with different grades of soil, from garden soil, fine sand, coarse sand, and gravels fine and coarse. Pour a pint of very muddy water into each 'filter" and collect what goes through the hole of each pot, in a water glass. Compare results as to clearness.
7. Distillation.—If time permits, and the resources and interest of the class justify it, one or more pupils can be set to making a distilling apparatus, following the suggestion of pictures found in books on physics. With such an apparatus, an interesting demonstration of distillation can be given the class.

Questions on the Experiments.

1. What is the temperature of boiling water and of steam at your altitude? Do you think it to be different on mountain tops or at the sea-level? Was the can filled with water vapor only, at the end of your experiment? Why this conclusion?
2. What is the freezing temperature of water? Is the water in ice-water as cold as the ice? What do you think of the popular opinion that "freezing purifies water"?
3. What happens to substances dissolved in water, that is, is the substance destroyed ordinarily? Can you tell by looking at water whether it is good to drink? If you drink well water in your community, are you getting something besides pure water?
4. Water that has taken up some oxygen gas from the air is said to be aerated. Is there any difference in the taste of aerated and of recently boiled water? If you have seen fishes kept in an aquarium, have you no-

ticed that they stay close to the top when the water has not lately been changed? Why do they do this?

5. What do you think makes the difference in the effect of soap on hard and on soft water? Why is soft water so much more desirable for washing purposes? Why is cistern water not "hard"? Where does "hard" water get its "hardness"?
6. Why should finer soil and sand permit water to come thru more clear than the coarser sand and gravels? Is this water now pure? How could you discover whether or not this water has germs in it? If germs are here, how could the water be freed from them?
7. Do all liquids boil at the same temperature? Would the distillation of water free it from all other substances? Which is better for a community, to free its water from impurities at the source or at the point of delivery?

A Community Water Supply Survey.

The following studies of community water supply are modified from an original series drawn up and used in a village survey by Professor Hendricks, of the Peru Normal. If used judiciously, they will prove profitable and stimulating as a class activity.

(a) Well survey.
   1. Depth and diameter of well?
   2. How made—dug, drilled or driven?
   3. If dug, is it well walled?
   4. Depth in feet of water usually in well?
   5. What seems to be the source of the water?
   6. Is the water hard or soft?
   7. Is the water perfectly clear, odorless, and tasteless?
   8. How long since interior was last cleaned or examined?
   9. How is water drawn from the well?
   10. Is the well so covered as to exclude all surface water and debris?
   11. Is the well perfectly rat proof?
   12. Is there any danger of infection of water from house or outhouse drainage?

(b) Cistern survey.
   1. What is the capacity of the cistern?
   2. Is the cistern lined with concrete, or brick, or both?
   3. Does the cistern leak any?

4. For what purpose is the water used?
5. Is the water colorless, odorless, and tasteless?
6. Is the cistern covered so as to exclude everything but rain-water and air?
7. What kind of filter is used, or is none used?
8. Is the filter regarded as effective?
9. How is water drawn from the cistern?
10. How frequently is a cistern thoroly cleaned?
11. What is the character of the roof from which water for cistern is collected?
12. Are the eave troughs and conduits in good condition?
13. Is there any consideration as to what time of year the cistern is filled?
14. Is any care taken as to whether the roof is fairly clean when water is allowed to go into the cistern?
15. What provision is there for caring for the water from the roof when it is not entering the cistern?

(c) Central supply for a community.—If there is a pumping station and community reservoir, stand pipe, or water tower, a study can be provided fitted to the local situation. If source of water is from wells, the study for wells suggested above can be modified to fit the case. The report on the place of water storage is important in such a survey.

Studying the Books. (See also Grade V, Study 1.)

1. What are the character and sources of the water of the community?—Col. I, 42; Con. II, 32, 350; Da. II, 60; Gu. III, 89; Hu. II, 183; Je. II, 315; Ov. II, 184; Ri. II, 86, 179.
2. How keep the water wholesome?—Con. I, 42; Da. II, 61; Gu. III, 124; Hu. II, 189; Je. II, 310; O-K. II, 187; Ri. II, 89.
3. When is air good and when is it bad?—Con. II, 150, 353; Da. II, 95; Gu. I, 6; Je. II, 118, 303; O-K. II, 59; Ov. II, 134; Ri. II, 71; Ri. III, 60.
4. What are the peoples rights and duties as to air?—Col. I, 20; Con. II, 150; Da. II, 107; Gu. III, 1; Je. I, 1, 6; Ov. II, 144; Ri. II, 71.

Writing up the Notebook. (See Grade V, Study 1.)

II. COMMUNICABLE BACTERIAL DISEASES.—Al. VI; Co. XIV; F-B. 473, 478; Hu. VI, 10; H-T. IX; H-S. XXXI; Mo. III; Te. IX; Wa. XVI, XVII.

DRAMATIZATIONS.— It is difficult if not impossible to develop a suitable series of nature-study approaches to the communicable diseases to be studied at this point in the course. But to add a touch of reality and to motivate the study, a series of dramatizations have been successfully employed. By a dramatization is here meant an imitative reproduction of procedure. For example, let some pupil play he is "sick" with the disease being studied, and let one or more of the others "play" they are giving the "sick" one the proper treatment. For their information the pupils will have to be sent to the books, and the dramatization of the treatment will have to be associated with a discussion of the nature of the disease, its sources of distribution, its course, its dangers, etc. Doctors can furnish details of procedure in many cases. Do not be afraid to ask them. These dramatizations should, of course, accompany, and not precede the study of the books.

1. Tuberculosis.—Dramatize the "rest cure," with its abundance of good food, fresh air, and sunshine, and the care in regard to expectoration.
2. Typhoid fever.—Learn how vaccination for this disease is conducted, and how the procedure may be illustrated. Exemplify the procedure.
3. Diptheria.—Let one pupil behave as a diptheria patient does, and let another give an imaginary treatment of anti-toxin. The making of anti-toxin can be dramatized also.
4. Whooping cough, mumps, and acute rheumatism.—In so far as these diseases may be imitatively illustrated and "treated", let this be done.

Studying the Books. (See also Grade V, Study 1.)

1. Shall we review the nature of bacteria?—Con. II, 91;

Da. II, 13; Gu. III, 165; Je. I, 34; Ov. II, 35; Ri. II, 18.

2. What are tuberculosis and the "rest cure"?—Col. I, 29; Con. II, 173; Da. II, 208, 256; Gu. III, 192; Je. II, 302; Ov. II, 197; Ri. II, 53.
3. What are typhoid fever and its vaccination?—Col. 53; Con. II, 94; Da. II, 194; Gu. III, 124; Ov. II, 278; Ri. II, 77.
4. What are diphtheria and its antitoxins?—Col. 117; Con. II, 168; Da. II, 212; Gul. III, 178, 184; Je. II, 326; Ov. 278, 288; Ri. II, 36.
5. What are whooping coughs, mumps, and acute rheumatism?—Col. I, 123; Con. II, 167; Da. II, 190; Je. II, 333; Ov. II, 41, 290; Ri. II, 48.
6. What are sore eyes and granulated lids?—Col. I, 124; Con. II. 333; Da. II, 185, 231; Je. II, 335; Ov. II, 353; Ri. II, 96, 197.
7. What are the intestinal germ diseases —Col. I, 59; Con. II, 58; Gu. III, 119; Je. II, 308; Ov. II, 226; Ri. II, 83.

Writing up the Notebook. (See Grade V, Study 1.)

III. COMMUNICABLE PROTOZOAN AND WORM DISEASES.—Hr. XV; H-S. XXX; H-T. X, XI; Hu. XI; Wa. XVI, XVII.

Dramatizations, etc. (See Study II.)

1. Dramatize the vaccination process for smallpox.
2. Exemplify a patient's treatment for hydrophobia in a Pasteur Institute.
3. As far as possible dramatize the treatment of measles, chickenpox and scarlet fever.
4. The Peru Normal can temporarily loan preserved specimens of intestinal worms, trichina, and hookworms, if postage is sent, and prompt return assured. Perhaps local physicians can supply specimens of one or more of these worms.

Studying the Books. (See also Grade V Study 1.)

1. Shall we review protozoan disease garms?—Col. I, 12;

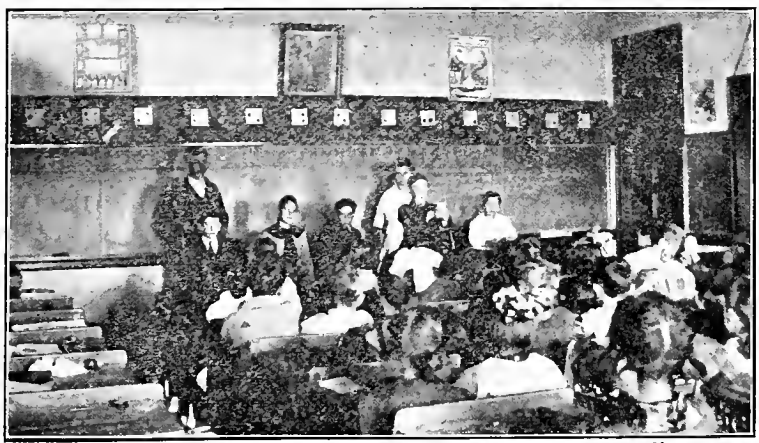
Con. II, 126; Da. II, 195, 204; Je. II, 322; Ov. II, 185; Ri. II, 101.

2. What are smallpox and vaccination?—Con. II, 270; Col. I, 127; Da. II, 211; Gu. III, 184; Je. 11, 324; Ov. II, 276; Ri. II, 117.
3. What are hydrophobia and Pasteru Institutes?—Col. I, 127; Con. Con. II, 268; Da. II, 222; Gu. III, 174; Je. III, 327; Ov. II, 208; Ri. II, 128.
4. What are measles, chickenpox and scarlet fever?—Col. I, 122; Con. II, 292, 269; Da. II, 223; Je. II, 323; Ov. II, 289; Ri. II, (Index).
5. What are the intestinal worm diseases?—Con. II, 19; Da. II, 194; Ov. II, 290; Ri. II, 135, 139.
6. What are trichina and "measly pork?—Col. I, 83; Con. II, 19; Ri. II, 82.
7. What is the hookworm and how eliminated?—Col. I, 253; Cob. II, 19,7; Da. II, 201; Je. II, 329; Ov. II, 291; Ri. II, 135.

Writing up the Notebook. (See Grade V, Study 1.)

IV. QUARANTINING AND COMMUNITY CARE OF THE SICK.—Al. XVIII, XIX; Co. XV, XVI; H-T. III; Hr. XXIV; B-H. IV (for Nebraska).

Dramatization.



The Plea of the "Prosecuting Attorney."

The accompanying illustration shows one scene from a very successful presentation of the subject of quarantining as worked out by Principal D. B. Kantor, of Fairbury, Nebraska. In order to bring out the method and value of the quarantine, he had his pupils develop the details of a mock trial of alleged violators of the quarantine regulations of the State of Nebraska. After studying the State Board of Health Regulations and consulting with local lawyers and judges, the pupils formed themselves into three groups and presented three mock trials before the pupils of three other grades, the latter acting as jurors. The "offender" in one instance was found guilty, and as a penalty, was required by the judges to read fifty pages of an old physiology book.

Studying the Books. (See also Grade V, Study 1.)

1. What are the purpose and value of quarantining?—Col. I, 224; Con. II, 351; Da. II, 215; Hu. II, 233; Je. II, 323; Ov. II, 285; Ri. II, 132, 177.
2. What the the quarantineable diseases in your state? B-H. (Nebr. p. 29)
3. How are community hospitals controlled and what is their value?—Con. II, 358; Da. II, 253; Gu. II, 244; Ov. II, 365; Ri. II, 178.

Writing up the Notebook. (See Grade V, Study 1.)

V. INSPECTION OF FOOD SUPPLY SOURCES.—Al. XXIII; F-B. 413, 692; Hr. XXIV.

The Nature-Study Approach.

Aim.—To get first hand information of certain food sources.

1. The teacher should ask as many pupils as will, to bring samples of fresh milk from home. Each sample should be taken from the bottom of the milk container. After having poured off the larger part of the milk, the last of it should be poured into the bottle to contain the sample. Once these samples have been

assembled by the teacher, she should put them into a different set of similar bottles or big test-tubes. When the samples have been thus changed so they cannot be identified by the pupils, the teacher can take each sample successively and pour its contents into a receptacle, all this, of course, in the presence of the class. Now take the series of pads and examine them for specks, sediment and colorations.

2. Take a floating dairy thermometer (costing about 25 cents, such as should well be in every school collection of apparatus) and try floating it in water. If it does not float erect, wrap some broom wire around the bottom of the thermometer and try again. Keep adding wire till the thermometer floats vertical but so the higher degree marks float a little above the surface of the water. Put the milk collected from Exp. 1 into a tall narrow vessel, like a flower vase, and float the thermometer in this milk. If it floats higher than it did in the water, the milk is heavier than the water, but if lower, the milk is lighter than the water.
3. For this experiment it will be necessary to call in the help of some enterprising pupil, or some sympathetic and intelligent dairyman or dairymaid (possibly the school teacher). The purpose is to get several samples of milk under controlled conditions and to discover the most favorable way to keep it the longest from souring, the souring, of course, being understood to be due always to the action of germs (bacteria). It will be necessary to have at hand fourteen perfectly clean scalded bottles or test-tubes, each holding about six ounces. Utilizing an ordinary cow under ordinary stable conditions and without washing the cow's udder or particular care with the hands, clothing, or other surroundings, fill a bottle three-fourths full of milk by milking directly into the bottle with the very first milk that comes out, the "fore-milk". Take a second sample from a second teat. Now continue the milking of these two teats till they

are about half exhausted and take two more samples as before. Continue the milking again till these teats are nearly exhausted and then take two final samples of the "strippings." Stopper all of the samples at once and set one of each in a place that will keep them at a temperature of 60 degrees F. or less, all the time, while the other samples are kept in a rather warm place. Label each sample carefully.

4. Following the above performance, see that the cow's udder and all neighboring parts are now thoroly washed and everything in the immediate surroundings made scrupulously clean. Let the milker's hands and wrists also be well washed and dried. Now with the two remaining teats repeat all parts of Exp. 3. Allow all samples to stand for a day or at least till souring of one or more samples begins. The samples should now be brought convenient to the school room, while still kept under the first conditions of warmth and cold. Now examine the samples once every hour or two and record when each is sour enough to be curdled. When the curdling is complete the records can be examined and a comparative study made of the conditions most favorable to the development and multiplication of germs.
5. This experiment can profitably be extended by taking a third sample of milk from each of the two middle milkings and stoppering the bottles as before. Place enough warm water into the pail to bring the water to the neck of the bottle. Heat the bucket and its contents on a stove till the water just begins to boil, then remove the bottles from the pails and cool as rapidly as possible. Milk thus treated is said to be Pasteurized. Treat these two samples as the pairs of other samples are treated.
6. If situated to employ a few simple chemicals, take a fourth set of samples from the middle milkings and into each put a few drops of formalin or formaldehyde. Treat as the other pairs of samples. Do not wait to

close out the experiment till these samples curdle. At the last, take one of these samples and any other and into each put a drop or two of the solution of ferrous chlorid. Now very carefully pour down the side of bottle (holding it away from other folks) some strong sulphuric acid. The ring of color in the one shows that the milk has been "preserved" with formalin.

7. Employ the questions found in Allen's "Civics and Health", pages 26-28, or those in Hoag and Terman's "Health Work in the Schools", pages 240-250, for a study of dairies of the community.
8. Use the suggested questions for a survey of the community bakeries found in Hoag and Terman, pages 245, and those on pages 244 for a survey of local butcher shops.

Questions for Consideration.

1. How do you account for the dirt in some of the samples of milk?
2. How could you discover whether a sample of milk has been watered by a dishonest dairyman?
3-4. What is the best way to keep milk from spoiling without putting in a poisonous preserver? What are the different ways that are favorable to the multiplication of germs in milk? What are the different chances milk may have for infection from cow to table? How can it be that milk is responsible for more sickness and death than perhaps all other foods combined.
5. Why does Pasteurization of milk largely free it from germs?
6. Why is formalin objectionable as a preserver of milk and how show its presence?
7. What kind of a showing does your local dairy make according to your survey?
8. Are the local butcher shops and bakeries up to a good standard of sanitation?

Studying the Books. (See also Grade V, Study 1)

1. What are the character and sources of your milk supply?—Col. I, 56; Con. II, 15; Da. II, 36, 264; Gu. III, 153; Je. II, 316; O-K. 190; Ov. II, 246, 253; Ri. II (Index).
2. Are the slaughter houses, meat shops, and bakeries wholesome?—Col. I, 74; Con. II, 30; Da. II, 215; Je. II, 284; Ov. II, 243; Ri. II, 152.
3. What dangerous occupations are in your community? —Col. I, 261.

Writing Up the Notebook. (See Grade V, Study1.)

VI. MOSQUITOES, RATS AND PETS AS COMMUNITY MENACES.—F-B. 450, 475, 567; Hr. XV; Hu. IX, XIII; H-S. XXXI; Wa. XVIII.

The Nature-Study Approach

Aim.—To learn the character and history of the mosquito in order to know how this menace can be controlled.

1. Some time in warm weather, when ponds or rain barrels abound with "wigglers", let each pupil be provided with a glass of wiggler-filled water. Make a

Studying Mosquitoes

study of the different sorts of "wigglers" to be found in the water. In general, two kinds should be found, a longer sort (the larvae) and a coiled-up sort (the pupae).

2. By the exercise of a little ingenuity select a number of the longer sort (mosquito larvae) and put them in a small bottle or test-tube of clear water. If the locality is very malarial, then it is possible that two sorts of these longer forms may be found, that of the common kind (Culex) having a big head, being more lively, staying under water more (to feed there), and when at the surface (to breathe there) hangs head down. The malarial mosquito (Anopheles) has a head only a little larger than the body, is less active, and lies horizontally at the surface most of the time, both to feed and to breathe. Learn all you can by observation about the behavior of one or both forms.
3. Now take a specimen of each of the kinds found in No. 2 (if both are present) and place with a drop of water on a piece of glass. Study with a simple microscope, looking to find the parts shown in the pictures of mosquitoes, found in the government bulletins or books of mosquitoes. Especially observe the differences between the common and the malarial kinds of mosquitoes.
4. By the exercise of ingenuity again, select from your original supply of "wigglers" a number of the coiled-up sort and put them in a small bottle or test-tube of clear water. Again look for the two sorts, common and malarial, the former lying more nearly vertical and the latter not being quite so coiled. Experiment with these in various ways to find out how mosquito larvae behave differently from pupae.
5. Make use of a simple microscope in examining specimens of pupae just as you did in the case of the larvae in No. 3, and note how pupae differ from larvae in appearance.

6. Set aside in a warm place or glass in which you had your original piece of glass or mosquito screening and examine it the next day to see if adult mosquitoes (imagos) have now appeared above the surface of the water.

   Along with this jar or glass place another with wigglers, and on this pour a little kerosene, but otherwise treat as you do the first glass. You can tell whether the mosquitoes from the first glass are culex or anopheles by the way their bodies stand at rest. If the body is horizontal to the surface on which the insect rests, it is a common one, but if the body is oblique to the surface, it is a malarial mosquito.

   Into a third glass of the pond scum, put a small fish or minnow if you can get one, and see what happens.
7. Take the mature mosquitoes (the imagos) from the first glass in No. 6 or take adult mosquitoes from any other source, and examine with the naked eye or with a microscope to distinguish males from females. The former have feathery hairs or antennae between the eyes and the latter have hairs that are not feathery. It is the female that carries the malarial germs, if it has had a chance to get them from a human being sick with malaria.
8. To make the life story of the mosquito complete, we need to discover some of the eggs, which may be found floating on the surface of quiet water in warm weather. The eggs of the mosquito are as long as a pin is wide, and only one fifth as wide as they are long. These stick together to make a little boat or raft if they are from the common mosquito, but merely lie along-side of each other if from the malarial mosquito.
9. If you can take the necessary time and care, a good way to find out the complete life history of mosquitoes, is to take one of these egg masses and keep in a favorable place, observing now and then to see the four successive stages of the mosquitoe's life.

The water on which the eggs are placed should have scum in it. In placing the eggs on the water, be careful not to "drown" them, for they are meant to stay on water much as a needle may be made to float.

Questions for Consideration

1. Why are "wigglers" given the name they have? What do you think "wigglers" live on? Why do they keep coming to the top?

2.-3. What difference between Culex and Anopheles larvae do you notice besides those named? Do you find that a larva can stay down in the water as long as a minute? If one were weak and could not wiggle up, would he drown?

4.-5. Do you notice any difference between Culex and Anopheles pupae other than those described? Do these forms seem to feed at all? Why do they stay at the top? If disturbed do they have to "wiggle" to get back to the top?

6. If no mosquitoes emerged from the glass containing the kerosene, why not? Do the mosquitoes that emerged from the first glass show any preference for resting on the banana? If you were fortunate enough to see a mosquito coming out of its pupa can you describe the process? Do fish like mosquito larvae and pupae?

7. How many legs and wings has a mosquito? Can you distinguish head, thorax, and abdomen of the adult mosquito? When a mosquito is at rest, how many legs does it use to support itself? What do you suppose swallows are after as they fly about in summer evenings?

8.-9. Writ out the complete life story of either the Culex or the Anopheles mosquito or both. In the light of what you know of mosquito history, figure out several things we could do to rid our homes of mosquitoes.

Studying the Books. (See also Grade V, Study 1.)

1. What are the breeding places and life history of

mosquitoes? Col. I, 140; Con. II, 126; Da. II, 195; Gu. III, 228; Hu. II, 223; Je. II, 329; O-K. II, 153; Ov. II, 202; Ri. II, 104.

2. How are mosquitoes carriers of diseases? Col. I, 138; Con. II, 126; Da. II, 214; Gu. III, 228; Hu. II, 223; Je. II, 328; O-K. II, 153; Ov. II, 202; Ri. II, 104.
3. How control mosquitoes? Col. I, 139; Con. II, 126; Da. II, 214; Hu. III, 223; Je. II, 329; O-K. II, 166; Ov. II, 204; Ri. III, 115, 203.
4. What are the dangers and control of rats? Con. II, 130; Dav. II, 219; Hu. II, 230; Ov. II, 208; Ri. II, 98, 175.
5. Are pet animals disease carriers? Dav. II, 240; Hu. II, 247; Ov. II, 209; Ri. II, 37, 76.

Writing up the Note Book. (See Grade V, Study 1.)

VII. THE HOUSEFLY AS A COMMUNITY MENACE.—F-B. 540, 679; Hr. XV; Hu. XIII; H-S. XXXI; Wa. XVIII.

Aim.—To learn the life history of a fly so as to be able to control the fly nuisance.

The Nature-Study Approach

1. Capture a good specimen of a live house fly and fix it to a small white card by running a pin down thru the rear part of the body (the abdomen). Using the thrust-thru pin as a handle, make an examination of the fly with the naked eye, and with a simple microscope, examine the fly's upper parts. Note the shape of the head with its big compound eyes, the narrow neck attaching it to the body. Look for the feather-like hairs between the yes. Count the black stripes on the back of the fly, for few other kinds of flies are marked exactly like this. See if there are hairs on the back also. Look for marks of veins on the wings and especially the veins at the rear next to the inside, and note the knee-shaped bend in this vein on each

wing. Only house flies have the vein thus bent. Pull the wings out (or off) and see the little knob-ended "balancers" just back of the wing attachments. These are all that is left of a second pair of wings that flies had long, long ago.

2. Fix another specimen of a housefly (or the same one) but this time pin him back down to the card, Note that the fly is made up of three main parts,—the head, the thorax, and the abdomen. Observe with the microscope the "proboscis" of the fly and determine if you can whether it suck or bites its food. See the hairs around the mouth.

   Note how many pairs of legs there are and the part of the body they fastened to. See whether there are hairs above the last pair of legs, for this is another way to tell a house fly from most other flies. If a strong magnifying glass can be used, look at a foot of a fly to see the fine hairs on the foot-pads that exude a sticky stuff so the fly can walk on glass or the ceiling.

   Now look at the abdomen and see if there are hairs on it also, and if so, where they are. Here too, is a way to tell a housefly from most other flies.

3. Examine a few other kinds of flies, if you can get them, as the stable fly, the blow fly, the horse fly, the bot fly, etc, and see how they differ in appearance from the house-fly. Particularly, make a close examination of a stable fly's mouth and see if it bites or sucks for its food.

4. Have a few flies in a small fly trap and study their habits. Discover, if you can, why the fly sometimes rubs his feet together, and whether there is any choice in his walking up or down the side of the cage. Make one side of the cage very bright and the other not so and see which the fly prefers. Make one side very dark and the other less so, and see what happens. Bring fly-food near and find out by what sense the fly recognizes the food. Make a cage entirely dark and see if food now attracts the flies.

5. Repeat the experiment given in the nature study approach to Study I, Grade VI, requiring the walking of a fly over a germ culture medium. Observe results after three or four days.

6. To find out the life story of a fly, put a piece of fresh meat out of doors, for blow flies, (or horse manure, for house flies) in the spring time until a deposit of flies' eggs are found on it. Now put the meat on some breakfast food or bran that fills a water glass two-thirds full. In the bottom of the glass should be a piece of cloth kept moist all the time. Keep in a warm place with a screen on the glass. The egg stage is the first stage, of course.

7. The second stage comes when, after about a day, the eggs have hatched out. This is the maggot, or larva stage, and it lasts about a week. Examine the development of the maggots from day to day and keep some moisture in the bottom of the glass all the time.

8. After the maggots are full grown they will pass to the bottom of the glass to enter their third, or pupal stage. They now look like small, imperfect grains of wheat, and remain seemingly quiet for nearly another week. Supplement the study of this stage by digging to the bottom of a pile of horse manure, and finding there a quantity of pupae.

9. If all has gone well, the adult fly, or imago stage, should now appear. Keep the glass screened at this time so as to be sure you have the flies of your own "raising."

Note.—Send 50c to the International Harvester Co., Chicago, Ill., for a set of their stencils for making charts about flies. A valuable booklet goes with it telling how to make the charts and giving a lot of valuable information about flies. It is a really wonderful set of charts that can be made and this would be an excellent thing for the school to have.

Questions for Consideration

1. How do flies differ from other insects in the number of their wings?
2. What are three ways in which a fly's abdomen differs from its thorax?
3. What are four ways in which a house fly differs from almost all other kinds of flies?
4. What habit of a fly does an ordinary fly trap take advantage of? Why do flies gather at the windows of darkened rooms? How could one best arrange to catch flies in a baited trap in a cow stable?
5. Why is the fly sometimes called the most dangerous animal in the world?

6.-9. In the light of what you have learned of the fly's life history, what are some ways you can think of to get rid of the fly nuisance?

Studying the Books. (See also Grade V, Study 1.)

1. What are the breeding places and life history of the housefly? Col. I, 145; Con. II, 97; Da. II, 201; Hu. II, 226; Je. II, 272; O-K. II, 143; Ov. II, 198; Ri. II, 145.
2. Is the housefly a carrier of diseases? Col. I, 148; Con. II, 96; Da. II, 205; Hu. II, 226; Je. II, 271; O-K. II, 134; Ov. II, 181; Ri. II, 145.
3. Can a community be free from flies? Da. II, 209; Hu. II, 244; Je .II, 275; O-K. II, 140; Ov. II, 197; Ri. II, 145.

Writing up the Note Books. (See Grade V, Study 1)

VIII. COMMUNITY DUTIES AND BURDENS.—Al. XXXIV; XXXVI; Dr. IX; F-B. 393, 447, 450, 463; Hr. XXIV; H-S. XX; Mo. II.

The Nature-Study Approach

Aim.—To intensify the sense of community responsibility for rubbish, garbage, sewage, tobacco and alcohol.

Note.—A very practical way to approach these topics

is to enter on a community survey, to learn how household wastes are specifically disposed of. If the teacher does not deem it wise to send the pupils out over the school district to take a census of the methods of taking care of rubbish, garbage, etc., she can have them hand in to her independently whitten reports of how these things are taken care of in the homes represented. In this latter case, and perhaps also in the former, the teacher can look the reports over in advance of the class work with the census, and then call on only those pupils to report who have some approach to desirable conditions upon which their report is based.

But if there is no danger of starting a neighborhood "row", a tabulation of the results of the census can very profitably be considered in class. If sufficient interest is developed, this study may yield results in the stimulation of the whole community to undertake a clean-up day or week. Following such a renovation period, a second survey could profitably be undertaken in order to measure the amount of progress actually achieved in the community. Indeed this second survey can be made to serve as a strong means of motivation for the community clean-up, especially if there is to be some public recognition of the ones who make the best showing.

1. Rubbish.—This term is here applied to the useless materials about the premises that go rather slowly into decay, if at all. Ashes, tin cans, old iron, etc., are samples. Since these things, in addition to being very unsightly, are apt to harbor rats and other vermin, if not properly taken care of they become a matter of vital community concern. We do not here incorporate questions on the way in which stable refuse is taken care of, but teachers who care to add some such questions may well do so, for when it comes to houseflies, nothing is more vital than the way in which manure heaps are prevented from becoming wholesale fly breeders.

   (a) What five stuffs make up most of the rubbish?

(b) Is all or part of it regularly thrown into an alley or otherwise off the premises belonging to the house?

(c) Is most of it thrown promiscuously about on the ground near the house?

(d) If thrown about in this way is there regular time for cleaning it up?

(e) Is the rubbish ordinarily thrown on a careless heap to harbor vermin?

(f) Is the rubbish kept in boxes, barrels or other common receptacles, making the place look neater, but still providing a haunt for rats?

(g) Is the rubbish kept regularly in a neat, rat-proof place?

(h) How often is the rubbish removed from the premises?

(i) By whom and at whose expense is the rubbish removed? What is done with it when it is removed?

2. Garbage.—This is understood to be the waste material of the kitchen and house, that is, subject to rapid decay. We shall here hold it to include dishwater and other kitchen waters, and the residue from preparing meals as well as that left after meals.

(a) Is the garbage or most of it thrown promiscuously about the place?

(b) Is all or a large part of it kept in barrels or garbage cans to be fed to hogs or other animals on the premises or elsewhere?

(c) If a swillbarrel or garbage can is used, is it well covered so as to keep out flies and other insects?

(d) If the receptacle is well covered, is there a large fly trap in connection with it to catch the flies that swarm about it?

(e) If the water is drawn off from the rest of the kitchen waste, what is done with it? Is it used to help breed flies?

(f) Is the solid stuff from the above dried and then thrown away?
(g) Is it burned either in a house stove or in a regular incinerator?
(h) Is it buried and well covered with soil?
(i) Is it set out to be collected by a garbage man?

3. Human excreta.—The teacher must use her judgment about giving the following questions. They touch upon some of the most vital questions that can be raised in matters of sanitation. If the teacher has a good hold on her boys and girls she may safely ask these questions, we venture to believe.
   (a) Is there an inside toilet in the house which is used by all?
   (b) If so, is it connected with a general sewage and water system?
   (c) If thus connected, how is the sewage disposed of finally?
   (d) If not thus connected, in which of the following ways is it treated:
      By distribution to a running stream?
      By surface distribution?
      By subsurface distribution?
      By a septic tank system?
   (e) If an outhouse is depended on, is it over an unprotected pit?
   (f) Is the outhouse provided with a protected but removable can?
   (g) Are the contents of the can frequently buried?
   (h) Is the outhouse stocked with dry earth, or slacked lime for covering purposes?
   (i) Is the outhouse equipped with a spetic tank device?
   (j) Is some effective plan used other than those listed?
4. Investigate the quantity and cost of tobacco and of alcoholic beverages used in your community. (See Chapter VIII.)

5. Secure from the U. S. Statistical Report the latest figures corresponding to those given on the diagram accompanying this study.

Studying the Books. (See also Grade V, Study 1.)

1. How dispose of garbage and sewage? Col. I, 252; Con. II, 352; Da. II, 273; Gu. III, 45; Hu. II, 190; Je. II, 279; O-K. II, 110; Ov. II, 177, 368; Ri. II, 147, 180, 203.
2. What are the dangers from conflagrations? Gu. III, 68; Ov. II, 106, 363.
3. What is the cost and harm of tobacco chewing and smoking? Con. II, 120; Da. II, (Index); Gu. III, 141; Je. II, 73; O-K. II, 235; Ov. II, (Index); Ri. III, 197.
4. What is the individual and community toll for alcoholic beverages? Col. I, 171; Con. II ,(Iindex); Da. II, (Index): Gu. III, (Index): Je. II, 186, 260; O-K. II, 240; Ov. II, (Index); Ri. III, 210.

Writing up the Notebook. (See Grade V, Study 1)

CHAPTER VII—GRADE VIII: HUMAN-BODY HYGIENE

AMOUNT AND DISTRIBUTION OF TIME

The time arrangement in this grade is intended to correspond with that in Grades V, VI, and VII, namely, about eighty recitations of twenty minutes each. This means a half year's work, which may be given to either the first or the last half of the school year, or distributed through the year in alternation with other subjects. If it seems wisest to join Grades VII and VIII for the work in hygiene, then of course the year's work would start in with the work for Grade VII and close with that for Grade VIII.

THE AIM

The fourteen-year-old boy or girl has reached a point in development in which, to a constantly enlarging social horizon, there is added an appreciation of the reasons for things. The facts of life must now begin to take shape in some system. This systematization of knowledge is still a crude one, but it must serve as a basis for the scientific structure in later years. It is exceedingly important, then, that the foundataion be laid on a concrete footing of actually observed facts and experiences.

This year's work should accordingly be so shaped as to lead up naturally to a study of elementary physiology in the High School. It should not, on the other hand, attempt the technicalities of the great and complex subject of physiology. Experience has abundantly shown that efforts of this latter sort are futile, not to say injurious. The aim, then, becomes one of leading the pupil as far in the direction of physiology as can be fully sensed and appreciated by him, and no further. The course is accordingly

organized as closely as possible around the fundamental functions and activities of the human body, while confining the study to those limits which the ordinary school room and home life afford opportunity for first hand studies. The teacher, of course, should be acquainted with elementary physiology, just to keep her from saying a lot of things that aren't so; but she should merely provide conditions for growth in the knowledge of the things that constitute the background for hygiene, and then she should give the pupil a chance to grow!

EIGHTH-GRADE HYGIENE TOPICS.—HUMAN-BODY HYGIENE.

I. FOODS, FEEDING AND BEVERAGES.

1. What are the different classes of nutrients and their uses?
2. How make a balanced ration from the common foods?
3. What is the value of thoro mastication?
4. What conditions favor good digestion?
5. How care for the teeth and mouth?
6. What are the desirable and undesirable beverages?

II. BLOOD AND LYMPH.

1. What constitute good blood and lymph?
2. How do we maintain a good supply of good blood and lymph?

III. THE CIRCULATION AND COMMON COLDS.

1. What is the pulse and its meaning?
2. How keep the heart sound and strong?
3. What are common colds and how avoid them?

IV. THE AIR, BREATHING AND SPEAKING.

1. When is air good and when is it bad?
2. How breathe to ventilate the lungs and interchange the gases?

3. What are five reasons for breathing through the nose?
4. What are adenoids and other obstructions to free breathings?
5. How make the voice-box an instrument for pleasing speech?
6. How keep the lungs sound and effective?

V. BODY WASTES, VENTILATION AND HEAT-CONTROL.

1. How do wastes and toxins arise in the body?
2. What is the importance of regularly eliminating wastes?
3. Why are the kidneys the most important organs of elimination?
4. How does perspiring aid in heat-regulation?
5. Why and how ventilate living rooms?
6. Why bathe for cleanliness and to countract colds?
7. How does the body naturally keep a nearly uniform temperature?
8. How does clothing serve as an artificial aid to heat regulation?

VI. BONES, JOINTS AND LEVERS.

1. How keep the bones in good condition?
2. How care for injured and broken bones?
3. How maintain good joints and care for sprains?

VII. MUSCLES, POSTURE, EXERCISE, FATIGUE.

1. What is the necessity of exercise in a healthy life?
2. How exercise to correct defects and maintain good postures?
3. What is body fatigue and how is it controled?

VIII. BEHAVIOR, BRAIN, NERVES, SENSES.

1. What is the nature of the brain as the home of the mind?
2. How guard the eyes from injury?
3. How guard the ears from injury?

4. How conserve the skin senses—heat, cold, pain, and touch?
5. How conserve the sense of smell and of taste?
6. How are good habits formed and bad ones avoided?
7. How develop an attractive countenance?
8. How control the passions?
9. How keep the mind in a healthy condition?
10. Why is sleep the great restorer?
11. What is the value of the after-dinner nap?
12. How may headaches be avoided?

IX. STIMULANTS, NARCOTICS, AND MEDICINES.

1. How does tobacco harm?
2. How does alcohol destroy?
3. Are patent medicines beneficial?

NATURE-STUDY LESSONS AND TOPICAL REFERENCES

Note.—It is to be understood that no attempt is here made to indicate how much work shall be assigned for each single recitation, as the length of the assignments will have to be determined by the length and number of the recitations that the school gives to this important subjects. The chapter references following the major (Roman-numbered) topics are for the teacher's especial use. The page references following the minor (Arabic-numbered) topics, are for the pupils' and teacher's use. The key to the books referred to is given in Appendix A. The teacher must know that it is not necessary to have for use all the books referred to, but the more she can have both for herself and for her pupils the better.

I. FOODS, FEEDING, AND BEVERAGES.—Al. XXXV; F-B. 34, 85, 121, 128, 182, 249, 293, 295, 298, 363, 413, 565; Hr. XIX, XX; H-S. VII, X, XIX, XX; Ly. II, V; Mo. II; Wa. VII, VIII.

The aim.—To obtain concrete acquaintance with the major kinds of foodstuffs, and to get sense-experience from a measurement of food values.

EXPERIMENTING WITH FOODS

1. The study of the pricipal nutrients, or primary foodstuffs.
   (a) Protein.—Typical examples of this important foodstuff (properly pronounced pro-te-in, with the accent on the first syllable) will need to be provided. This will call for a sample of dried beef, baked beans, cooked white of egg, scum from boiled milk, gum left after chewing grains of wheat, etc. After examining the specimens, the pupils should be required to burn a sample of each of the specimens provided, and to note whether there is an odor common to all.
   (b) Carbohydrates.—Here, too, some specimens of each of the two general varieties of carbohydrates will be needed. Some corn starch will serve to give the necessary sense-experience and provide material for the later study of the starches in foods.

   The test for starch is one that any eighth-grader can easily apply—the well-known tinc-

ture of iodine test. If any substance turns some shade of blue when the iodine is applied, the presence of starch is indicated. Pupils enjoy making such tests as these, and usable tabulations can be prepared by them.

The sugars are another form of carbohydrates, easily recognized by their taste. If samples of both cane sugar and of grape sugar can be provided, an interesting comparison can be made of the relative sweetness of the two varieties. Any of the carbohydrates, when burned, will yield a black residue of carbon.

(c) .Fats and Oils—These foods can be exemplified by samples of olive oil, butter and beef suet. The test calls for the use of a little ether. Take the specimen of food you wish to test, (as the yolk of egg, olive oil, crushed kernels of nuts, etc.), put it to soak in some ether and later pour the ether off on a piece of writing paper. If, after the ether evaporates, the paper still remains transparent, then oil or fat must have been present in the food.

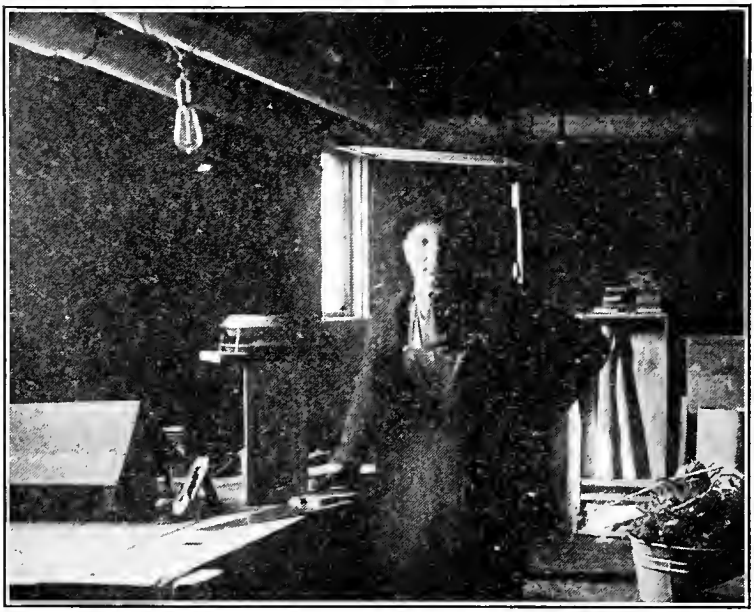
(d) The mineral foods are known by the fact that they cannot be burned. They can be illustrated by samples of salt and by pure water.

2. The fuel value of foods.

The following proposed tests the writer regards as especially important, keenly conscious though he is, that they are open to the criticism by punctilious scientists, of being crude and imperfect. These critics forget that the natural order for gaining knowledge is from the psychological, or imperfect, to the logical or more nearly perfect. While these tests will call for some enterprise in their execution, the labors can be much reduced by enlisting the co-operatiive services of the pupils, a thing that ought to be done anyway whenever possible. The accompanying illustration shows an eighth grade boy in his shop just after completing the home-made calorimeter described below, as a home project.

If the four tests snow to be described can be undertaken simultaneously by four pupils or groups of pupils, it will make an interesting contest—that of seeing which set of conditions can bring the water to the highest temperature.

(a) Preparation.—The purpose of the experiment is to measure roughly the relative heating power of the organic foods when they are burned. It is a crude kind of calorimeter we are describing.



Making a Homemade Calorimeter

There are needed for each of the tests three pie pans or pie tins of the larger size, a board about a foot square, some pieces of glass and four ten-penny nails. Lay the glass on the board (to keep the board from burning) and on the glass set one of the pans and drive the four nails at equal distances around the pan, into the board just enough to have them stand securely, each leaning in just a little over the pan. On the tops of these nails can now be set the rim of the second pan, and the third pan, turned up-side-down, can be used as a lid for the second pan. The "calorimeter" is now complete, except that a cream thermometer, a teaspoon and a tin cup are needed to supply the additional apparatus required.

(b) Procedure.—Take a piece of newspaper just the size of a pie pan, pour on its center a completely

filled teaspoon of kerosene and spread the oil around a circle area six inches in diameter. In experiment No. 1, you add nothing to the kerosene. In No. 2, you add just a quarter-ounce of either corn starch or sugar, letting the starch or sugar be distributed evenly over the oiled patch on the paper, and allowing it to become completely saturated with the oil. In No. 3 you distribute just a quarter-ounce of butter over the oiled patch. And in No. 4, you lay down just a quarter-ounce of thin slices of dried beef very thoroly dried out, and now soaked with the oil in the pan.

In each of these cases the next thing to do is to pick up each oiled paper and place under it bits of crumpled paper so that the oiled paper with its contents shall lie level with the top of the sides of the pan. With the parts to be burned now in readiness, place the second pan on the nail supports, pour into it just a pint (pound) of water, take its temperature, place over it the cover pan, and touch a lighted match to the contents of the fire pan below.

When the burning is complete, again take the temperature of the water in the pans, subtract the temperature value of pan No. 1 from that of Nos. 2, 3, and 4, and the results will be roughly the relative caloric value of proteins, carbohydrates, and fats, a bit of information that is basic in all food considerations.

Questions on the Experiments

1. Is there a characteristic odor to all the burned samples of protein foods? How determine whether a sample of mixed food has protein in it? How do you test for the presence of starch in a sample of food? Can you name half a dozen common foods having an abundance of starch? Which is the sweeter, cane sugar or grape sugar? Can you give a good reason for applying the name carbohydrates to the sugars and starches? (Look up the word carbohydrates in a big dictionary). Mention several common foods that have a good deal of sugar in them. Describe the test for fats and oils. Name several foods with fat and oil present. How would you find out what different foodstuffs are present in bread? Which class of foods, vegetable or animal, has starch commonly present?
2. Which of the foodstuffs tried out in the calorimeter

had the most heating power? How did the other two compare in heat value? What is a pound-Fahrenheit calorie? If the starch has been all thoroughly burned and none of its heat lost, let us suppose that it would have given three times as much heat. Now, if a man working moderately hard uses up 14,000 pound-Fahrenheit calories of heat a day, how much starch and sugar should a man eat in a day if five-sevenths of his food should be carbohydrates?

Turning to the Books

With some such concrete background of sense-experience as these studies will provide, the teacher may now fairly expect some real thinking and some sane interpretations, of the printed page of the textbook. The mere fact of actually measuring the quarter-ounce units of food called for will give the pupil a conception of quantities that few grown-ups possess, and an ideal daily ration of 15 oz. of corbohydrates, 3 of fats, and 3 of proteins, can now have a real meaning.

If the interest has been keen in the work outlined, it will be a comparatively easy matter to induce the pupil to weigh up his own average meals, and even, by the aid of data given in the textbooks, to calculate the weights of primary foodstuffs in the dry-weight equivalents of the foods devoured. The wasteful economy of Americans in their excess meat-eating becomes vitally apparent to the pupil instructed in these ways, and the background has been laid for an intelligent study of the books.

Studying the Books. (See also Grade V, Study 1)

1. What are the different classes of nutrients and their uses? Con. II, 5, 15, 21; Da. II, 27; Gu. IV, 144; Hu. III, 21; Je. II, 134; O-K. III, 15; Ov. II, 211; Ri. III, 135.
2. How make a balanced ration from the common foods? Con. II, 70; Da. II, 36; Gu. IV, 147; Hu. III, 21; Je. II, 131; O-K. III, 63; Ov. II, 238; Ri. III, 166, 243.
3. What is the value of thoro mastication? Con. II, 42; Dav. II, 56; Gu. IV, 153, 166; Je. II, 130; O-K. III, 60; Ov. II, 226; Ri. III, 155.
4. What conditions favor good digestion? Con. II, (Index); Da. II, 42, 50; Gu. IV, 166; Je. II, 144; O-K. III, 61; Ov. II, 222; Ri. III, 102.
5. How care for the teeth and mouth? Con. II, 47; Dav. II, 47, 229; Gu. II, 76; Je. II, 134; O-K. I, 181; Ov. II, 263; Ri. III, 182.

6. What are the desirable and undesirable beverages? Con. I, 32; Dav. II, 62; Hu. III, 69; Je. II, 164; O-K. III, 62; Ov. II, 48; Ri.

Writing up the Notebook. (See Grade V, Study 1)

II. BLOOD AND LYMPH.—Hr. XXI; H-S. IX, XXI; Wa. XI.

The Nature-Study Approach

Aim.—To learn about the parts of the blood, and especially the relation of blood and lymph to germs.

1. If it is at all possible, a good mounting of blood should be made and examined under the low power (x100) of a compound microscope. The reason for taking the low rather than the high power ,is because the pupils cannot do their own focusing, and the low power will fit all eyes more nearly than the high. With the low power the white corpuscles are not readily seen, or made out, and the teacher should give the information that about one in 400 of the little bodies observed is a white corpusle, or little living germ or protozoan. Nearly all the rest are the so-called red corpuscles, tho under the microscope they seem to be a pale rust color. Attention should also be called to the liquid, or plasma, in which the corpuscles float.
2. It is desirable that pupils have a first hand knowledge of the parts of the blood if one is to make clear the ways in which blood combats disease germs. To get this knowledge some fresh blood will be needed. Perhaps some pupil at whose house chicken is to be served in a day or two, would bring the chicken to school for decapitation. Before the teacher is ready for the class demonstration, two of the older boys (or the janitor) can take the chicken to the basement or coalshed and perform the needed amputation. The blood from the neck should be collected in a water glass or bottle. At once divide the quantity of blood into three equal parts by pouring into three other vessels such as teacups. Let one cup stand in a warm place, into a second pour a solution of epsom salts (magnesium sulphate), while the third is to be kept stirred constantly for several minutes, or till the threads of fibrin quit forming. Use a fork to do the stirring and wipe the threads from it occasionally if necessary. The blood in cups two and three should

not clot. Of course, all this preparation can be done out of school if deemed wisest.

3. The blood in cup one will serve to illustrate the common process of coagulation or blood clotting. That in cup two will show that by the use of chemicals blood will not clot. This will help make clear how a mosquito fixes things so the wound he makes is not closed up by a clot.

4. The blood in the third cup should be allowed to stand till the corpuscles and the plasma separate. Let it be explained that plasma is the basis of lymph, and that lymph is fundamentally plasma that has gotten out of the blood capillaries and found its way in among the cells of the tissues. Test the plasma or serum with litmus paper to tell whether it is acid or alkaline. To make these terms clear, there should be at hand a small bottle of hydrochloric acid and one of ammonia. Introduce a piece of paper back and forth in the acid and the ammounia and not the effects on the color of the paper. Ammonia is an akali.

   Recall what was learned in Grade VI about germs, namely, that most of them require a non-acid (non-sour) medium in which to grow.

5. In a third receptacle carefully mix a little acid with a little ammonia (never mind the white fumes) till the mixture does not change the color of either the red or the blue litmus paper. This mixture is said to be a neutral one, each substance counteracting the effect of the other.

6. It can now be more readily explained that the blood combats germs in at least three ways:
   (a) The white corpuscles eat the germs directly. (See Grade VI, Study III.)
   (b) Sometimes the white corpuscles will not eat the germs till a substance gets into the plasma and comes into contact with the germs and makes them "taste good" to the corpuscles. Such a substance is called an opsonin, and physicians often use bacterin to produce it. The corpuscles may be said to be like children who will not eat meat until mustard is put on it!
   (c) Again, the germs sometimes make toxin (poison) which gets into the plasma and is carried over the body to do harm to the organs. To counteract this poison a neutralizing agent, or anti-toxin,

must be either developed or put into the plasma. It acts against the poison somewhat as alkalis act against acids.

Questions for Consideration

1. About how big is a blood corpuscle, actual size? (Divide the size it seems to be by the number of times the microscope magnifies.) How do you account for the seeming differences in the shapes of the corpuscles since they are all (except the few white corpuscles) the same shape?

2-3. Do the corpuscles in Exp. 1 separate from the plasma? What makes blood clot as you judge from the behavior of that in cup 1 and cup 3?

4-5. How determine whether any liquid is acid, alkaline, or neutral? In which of these conditions is blood plasma? Can ordinary germs live and thrive in plasma or lymph?

6. What are the three ways in which the blood combats germs? What are three diseases which the blood has to combat in the three ways respectively?

Studying the Books. (See also Grade V, Study1)

1. What constitute good blood and lymph, and what do they do? Con. II, 125; Da. II, 78; Gu. IV, 87, 100; Hu. III, 109; Je. II, 88; O-K. III, 75; Ov. II, 88; Ri. III, 45.

2. How do we maintain a good supply of good blood and lymph? Con. I, 116; Da. II, 81; Gu. IV, 95, 96; Je. II, 88; O-K. III, 89; Ov. II, 99; Ri. II, 44.

Writing up the Note Book. (See Grade V, Study 1.)

III. THE CIRCULATION AND COMMON COLDS.—F-F. p272-280; Hr. XXI; Ho. XII; H-S. IX; XXI; Hu. IV; Wa. XI.

The Nature-Study Approach

Aim.—To study directly the pulse-beat, heart action and the cause of colds.

1. Attach to the outgoing end of a bulb of an ordinary syringe a rubber tube of the size of the tubing that goes with the syringe, but about two feet long. To the outer end of this long tube attach a nozzle that tapers down to a fine point or opening. Now put the receiving and the discharging ends of this remodeled syringe into a pan of water, sitting on a table, and cover the center portion of the long tube with a cloth or towel. Now start the syringe in action and have the

pupils one by one put their fingers on the cloth over the tube as the pulse waves of water are made to go by. By varying the action of the bulb see if you can develop a "strong pulse", a "weak pulse," a "sharp pulse". a "dull pulse", etc.

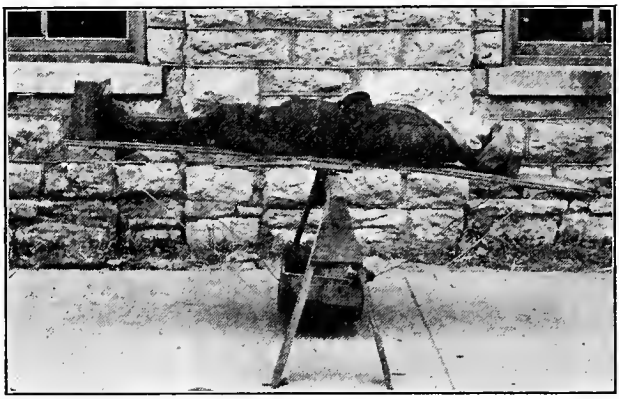
2. Compress the long tube considerably at its middle point and not the difference in the pulse-waves in the two halves of the tube.
3. Keeping exact account of the time it takes to do it drive the water thru the tube by strong, regular pulse-strokes till you have filled a water glass at the discharging end. Now take off the long rubber tube and replace it with a glass tube of similar diameter and length, and with the nozzle of the other tube transferred to the glass tube. Again timing the process, fill the glass and note the difference in effort and time.
4. Next, let each pupil for himself give attention to his own pulse-beat by laying the back of the left wrist in the palm of the right hand, bringing the ends of the second and third fingers around till they press over the artery just inside the outer end of the left bone of the left forearm. Consider the character of the pulse-beat, whether weak or strong, sharp and adrupt or flat and gradually swelling, regular or irregular.
5. Let each pupil count his own pulse-beats for a minute under the following conditions:
   (a) After sitting or reclining for ten minutes.
   (b) After standing erect for some minutes.
   (c) Just after running rapidly for a few minutes.
6. If possible get the pulse frequency of a babe and of an elderly person.
7. Also if possible discover the difference in the character and frequency of the pulse-beat of a tobacco smoker when he is smoking and when he has not smoked for several hours.
8. Locate five distinct points over the body, other than the wrist, where pulse-beats can be felt.
9. Sit with one lower limb crossed over the other so as to give the foot a chance to bob with the pulsations of blood sent there. Place the fingers of one hand over the big artery in the neck on either side of the voice-box, and note at which point the pulse-beat shows up first, foot or neck.
10. With the ends of the right hand fingers placed over the space between the fifth and sixth ribs at a point

about two inches to the left of the breast bone, locate the apex beat of the heart.

11. With the right hand still in the above position, place the finger ends of the left hand on the pulse of the wrist of the right arm, note whether heart-beat or wrist-beat comes first, and decide on the relation between heart-beat and pulse-beat.
12. While listening to the beating of someone else's heart, discover two points of difference in the two sounds that accompany each beat.
13. If at all convienent, get a sheep's, hog's or beef's heart, and cut it open to discover its structure. If you go to a butcher for such a heart, be sure to ask him for a heart "with all the pipes left on it."
14. Consider why people who do not exercise very much get "fainty" if they climb a long stairway or run for a street car. Boys and girls not used to running very much say they "get out of wind" when they try to run far or fast. Consider whether it is the "wind" or the heart that is in fault.
15. A race horse's heart is said to be 25 per cent larger than a work horse's heart. A Marathon racer's heart is said to be abnormally large also, and such athletes often do not live so long as other people who exercise moderately. Connect this with the Greek motto, "Nothing in excess."
16. Return to our own circulation, note the effect of placing an index finger across the face of the wrist of the opposite hand and while pressing on the wrist rub the wrist first down and then up. Repeat to discover which way the blood naturally flows in wrist veins. Discover if you can, why the blood can be made to go only in one direction.
17. We are wanting at this point to find out how heat and cold affect the distribution of blood in the body, in order to learn what lies at the basis of catching colds.

    This experiment calls for a piece of apparatus, such as is pictured below, and such as eighth-grade boys will take pleasure in making as a piece of project work. The apparatus involves the use of a carpenter's "saw horse" and a balancing board about six feet long and fifteen inches wide, more or less. On the under side of the balancing board, at each border, and running the long way of the board there is required a piece of iron fastened to the board, with a broad notch filed at the center of the face opposite the board.

Then on the top of the "saw horse" there must be fastened down two three-cornered files to form a "knife edge" for the balancing board. When the board is in position there must be hung, by wires from each corner of the board, a box to contain bricks or iron enough to bring the center of gravity just below the knife edge when the pupil is lying on the board.



When the apparatus is ready for use, we must first put in a warm room (the warmer the better) and let a good healthy boy or girl who does not easily catch cold, balance himself or herself on it as shown, at the same time using the foot block to mark the exact place of lying. This block can be held in place in various ways,—by driving nails into it below, if no other convenient way offers. Put a corresponding block at the head of the pupil, and secure any final balancing by the addition of small weights at either end. At best, there will be a slight teetering due to breathing, the diaphram thrusting the abdominal contents back and forth somewhat.

This done satisfactorily, take the whole apparatus out of doors on a cold day and let the same pupil lie there till he gets appreciably cold. If the apparatus meanwhile gets out of balance, use a spring hand scale to pull it into balance, placing the hook on one side of the board at a point just opposite the center of the breast bone of the pupil. Note the reading of the scale when the board is just brought into balance.

What has happened is that the blood that was in the skin and near the surface of the body has partly left the surface and collected in the large blood vessels around the heart and in the lungs, as well as elsewhere in the deeper parts of the body. Find out the meaning of the word "congestion" from your dictionary.

Possibly it might work out better to first balance a boy or girl who comes to school cold and then to bring the apparatus on the inside and get the warm balance later.

18. If you have ever had (or now have) a boil or other similar sore spot, consider whether it was (or is) warmer than other corresponding spots. Consider whether the spot was (or is) puffed out or swollen more than common, and redder as well as more painful than usual. Get from your dictionary a good difinition of the word inflammation. Carefully note the pronunciation of the word, also.

    Remembering that inflamations are generally due to the presence of germs, consider why nature should bring a good deal of blood to the infected spot.

19. As a background for the undertaking of colds we need to know the difference between what is known as active congestion and what is known as passive congestion. To understand the first, take an ordinary syringe bulb and pump it very fast and see how the delivery tube becomes congested. To understand the second, pump slowly this time, but narrow the outlet of the delivery tube by pinching it down to a cmall opening near the end.

20. Cold drafts or chilling surroundings are the means by which active internal congestion is set up in the human creature. If germs for colds are present in the breahting passeges, the abundant blood straining the capillaries makes easy the coming of a lot of white corpuscles to the surface of the air passages. These, in turn devour the many germs and develop the matter that stuffs one up when one has a cold. To counteract this sort of cold, one needs to have one's system trained to throw back the blood to the surface. Consider the effect of cold baths in the morning, of exercise, of exposure to varying temperatures thru the day for such a training.

21. Passive congestion in the human body is caused by an unusual accumulation of germs along the air passages. As the white corpuscles now travel out to devour the

germs, they impede the flow of blood in the capillaries, and secure a congestion of blood in a passive way. Presently the same condition results as in No. 20.

Questions for Consideration

1. How are the pulse-waves in arteries to be explained?
2. Why are there practically no pulse-waves in veins?
3. How does Exp. 3 show that "hardening of the arteries" increases the work of the heart (raises blood-pressure) and often results in paralysis from broken blood vessels in the brain. Since the four S's (stuffing, strain, spirits, syphilis) are common causes of hardened arteries, how could many people prolong their lives and their usefulness?

4-7. What different conditions may account for difference in the rate of people's pulse-beats?

8. Where are five or more spots where pulse-beats may be counted?
9. How account for the facts observed in Exp. 9?
10. What makes the heart kick out against the chest in its apex beat? (Consider the heart's relation to the aorta, and why a garden hose tends to straighten out when forced full of water.)
11. How does Exp. 11 show the heart as the cause of pulse-beat?
12. How account for the two different sounds made by the heart?
13. What are the important parts of the heart and what is the course of the blood thru it?
14. What is the real difficulty when one seems to "get out of wind" thru exertion?
15. Why not try to become a Marathon racer?
16. In what direction does the blood naturally flow on the surface of the wrist? Why can it not go the other way?
17. If cold on the surface of the body drives blood in, what shold be the effct and the value of inhaling cold air? Since alcoholic drinks drive blood to the skin, how can they temporarily benefit colds? Is not the cure ultimately worse than the disease?
18. What are the four characteristics of an inflammation? Since an inflammation is called an "itis", what is rhinitis, laryngitis, trachitis, bronchitis, pulmonitis?

19.-20. What do the syringe bulb and the delivery tube correspond to? The narrowed outlet of the delivery

tube? What causes active congestion? Passive congestion? Why do one's cheeks get so red on a cold day? Why does not the whole body get red similarly?

21. Why may one readily get a cold if he patronizes badly ventilated and crowded halls? How should the continuous breathing of air that is warm and dry affect the mucous lining of the air passages, and what would naturally happen if one is exposed to germs of cold? Why are those people whose nasal passages are somewhat stopped up by adenoids or irregular bones, more liable to colds than other people? How is it that if one works in a very dusty place, as around a threshing machine, he is particularly liable to colds?

Study the Books. (See also GradeV, Study 1)

1. What is the pulse and its meaning?—Con. II, 109; Da. II, 88; Gu. IV, 81; Hu. III, 115; Je. II, 48; Ov. II, 97; Ri. III, 42.
2. How keep the heart sound and strong?—Con. II, 119; Da. II, 81; Gu. IV, 62; Hu. III, 120; Je. II, 53; O-K. III, 83; Ov. II, 95, 101; Ri. III, 46.
3. What are common colds and how avoid the?—Con. II, 248; Da. II, 129; Gu. IV, 209; Hu. III, 154; Je. II, 199; O-K. III, 64; Ov. II, 357; Ri. III, 79.

Wrinting up the Notebook.—(See Grade V, Study 1.)

IV. THE AIR, BREATHING, AND SPEAKING.—Ai. V; F-F. I; Hr. XXII; H-S. X; Ly. I, 5; Te. XII, XIX; Wa. VI.

The Nature-Study Approach.

AIM.—To gain sense-experience from studies of air and breathing.

1. With a good thermometer take the temperature of the air of the room and then, with the mouth well opened, exhale air from the lungs on the thermometer bulb, and note which way the mercury column moves.
2. Exhale the breath as in above case, but this time against a piece of window glass or mirror.
3. Fill a washpan, or other shallow pan, half full of water and on it float a flat cork that is about two inches across and half an inch thick. Insert the broken end of a half match in the center of the cork so that the match head will ride about an inch above the cork.

Hold an inverted water glass (the less sloping the sides the better) in one hand near the match head, and with a lighted match in the other hand, set fire to the floating match and instantly cover the floating cork and match with the glass, its rim resting on the bottom of the pan. After the flame dies out, raise the glass till its rim is just under the surface of the water in the pan, cover the mouth of the glass with a piece of pasteboard by passing it under the water and pressing it snugly up against the rim of the inverted cup, and now turn the cup right side up, still keeping the pasteboard lid closely on. Ordinary air is a mixture of several gases, that now in the cup being mostly a gas called nitrogen. Note the relative quantities of water and of nitrogen in the glass. The flame used up a gas called oxygen that was in the cup at first, and the water came in to take its place.

4. Slip the pasteboard off the glass of nitrogen and water, and insert a burning match again and see what happens. Replace the pasteboard cover.
5. Put a grasshopper or other insect under the pasteboard and keep the card tightly held down for a few minutes. Take another glass with just as much water in it and cover with pasteboard after introducing a cork such as in the first glass. Put a similar insect in the first glass also. Watch results for several minutes. If the insect in the first glass "keels over", take it out at once and see what happens if it is kept in good air for a while.
6. Repeat Exp. 3 but before covering the flame of the floating match, see that the glass is filled with exhaled air. It can be kept in by holding a cardboard over it till just ready to cover the flame. Compare the water that came in this time with the quantity which came in during Exp. 3. Let stand for Exp. 7.
7. Slack some fresh lime in a big bottle of cistern water and let stand till there is clear lime water on top. Deftly pour this clear lime water into a bottle by itself. Now take two clear bottles holding about a pint each and fill one with ordinary air and the other with exhaled air. Now put a teaspoonful of limewater in each of these bottles, shake and note the color of the water in each. A gas called carbon dioxid is the only ordinary gas that will turn lime-water milky white.
8. Take a small bottle and put a little lime-water in it.

Now insert a glass tube and blow thru it, making "bubbles" in the lime-water. See if by keeping up the blowing you can clear up the milky water that first resulted.

9. Take two saucers of water and put a small piece of stick sodium hydroxide in the center of each. The piece should be about as big as the last joint of the little finger. Over one saucer invert a glass with ordinary air in it and over the other invert a similar glass with exhaled air in it. Potassium hydroxide absorbs or takes up the gas carbon dioxid, and water comes in to take its place.
10. If the teacher has studied chemistry, she may well make a carbon dioxid generator and collect some pure carbon dioxid. This gas can now be studied as to its appearance, its ability to extinguish a burning match, to make an insect "keel over" if introduced into the gas, etc.
11. In undertaking this experiment it will be necessary to provide a lung tester or spirometer, such as is described in the first of the nature-study lessons in Grade V, and shown also in the accompanying zinc etching. The pupil should note that after taking in an ordinary breath (Tidal air) he can still take in more air (Complemental air.) He should not further that after giving off an ordinary breath, he can give off still more air (Supplemental air). These three capacities make up what is known as one's Vital capacity. Even after expelling all the air one can, there are still about 100 cu. in. of air left in the lungs (Residual air).
12. Fill the lungs as full as possible and then exhale into a lung-tester (spirometer) all one can. Read and record the volume of your vital capacity.
13. Just after taking in an ordinary breath, exhale into the spirometer all one can. Record this result and subtract it from the result in Exp. 12. Determine which of the capacities this gives one.
14. Just after giving off an ordinary breath exhale into the spirometer as much as can possibly be done. Record the volume and decide on which capacity this gives one. Now subtract this volume from that gotten in Exp. 13 and decide on which of the capacities this gives.
15. With a tape line take the circumference of the chest when all the air possible has been expelled from the

lungs. Take the measurement again when the lungs have been fully inflated. Find the difference between the two measurements and record it.

16. Take a pint or a quart bottle with its bottom broken out and stopper removed. Place this bottle so that its bottom is just under the surface of the water. Hold a burning match at the bottle's mouth as you thrust the bottle farther down in the water and as you quietly bring it up again. Discover from this what makes the air come into and go out of the lungs.
17. Breathe by using the muscles of the lower half of the trunk only (diaphragm and abdominal muscles) inhaling and exhaling several times as you consider the nature of what is known as Abdominal Breathing.
18. Breathe by using the muscles of the upper half only of the trunk (the rib muscles) inhaling and exhaling several times while considering the nature of what is known as Chest breathing.
19. If one wants to increase one's lung capacity appreciably, it can be done best by combining the two methods of breathing just described.
20. By careful observation discover the number of times one breathes per minute (a) while sitting quietly, and (b) just after running or climbing stairs, etc.

Questions for Consideration

1.-2. How does the temperature of inhaled air compare with that of exhaled air? The moisture?
3. Why did the match burn as long as it did under the glass and why did it at last go out? Why did the water rise in the glass? What proportion of oxygen does your experiment show to be in air? What proportion or nitrogen? Of course this experiment is not an accurate one because the air around the flame was highly heated and as it cooled it let more water up in the glass than the oxygen alone would account for. When carefully done experiment shows that there is one-fifth of oxygen in the air and four-fifths of nitrogen, or nearly so.
4. Why did not the match burn in this experiment?
5. Why did the insect "keel over" in the one case and not the other?
6. Why do you think the flame went out quicker this time and why did less water enter the glass?

7. Does exhaled air contain carbon dioxid? Inhaled air?
8. Since milky water like that in this experiment can be cleared up by mixing carbon dioxid gas with it, what additional evidence have we here that exhaled air has carbon dioxid in it?
9. How much carbon dioxid does this experiment show to be in inhaled air?
10. Adapt question to suit. Now sum up by giving four respects in which exhaled air differs from inhaled air?

11.-14. How do your various breathing capacities compare with those of your class mates?

15. How does your chest measure and expansion compare with those of your class mates?
16. How do we breathe, that is, get air into and out of our lungs?

17.-19. Why should the mixt type of breathing be the best type?

20. Why is it necessary for one to breathe oftener when exercising?

Study the Books.—(See also Grade V, Study 1.)

1. When is the air good and when is it bad?—Con. II, 150; Da. II, 98, 103; Gu. I, 6; Hu. III, 135; Je. II, 118; O-K. III, 113; Ov. II, 134; Ri. III, 46.
2. How breathe to ventilate the lungs and interchange the gases?—Con. II, 139; Da. II, 96; Gu. IV, 126; Hu. III, 139; Je. II, 110; O-K. III, 125; Ov. II, 116; Ri. III, 30.
3. What are five reasons for breathing through the nose? —Con. II, 132; Da. II, 96, 104; Gu. I, 134; Je. I, 134; O-K. III, 125; Ov. II, 263; Ri. III, 70.
4. What are adenoids and other obstructions to free breathing?—Con. II, 133; Da. II, 109, 178; Je. II, 114; O-K. III, 127; Ov. II, 156; Ri. III, 71.
5. How make the voice box an instrument for pleasing speech?—Con. II, 135; Da. II, 100; O-K. III, 134; Ov. II, 120.
6. How keep the lungs sound and effective?—Con. I, 147; Da. II, 103; Gu. IV, 124, 186; Hu. III, 139; Je. II, 116; O-K. III, 123; Ov. II, 144; Ri. III, 58.

Writing up the Notebook. (See Grade V, Study 1.)

V. BODY WASTES, VENTILATION AND HEAT-CONTROL.—Dr. XI, XIII, XIV; F-F. III; Hr. XXII; H-S. X, XI, XII, XXIV, XXV; XVIII; H-T. VII; Ly. II, Wa. X.

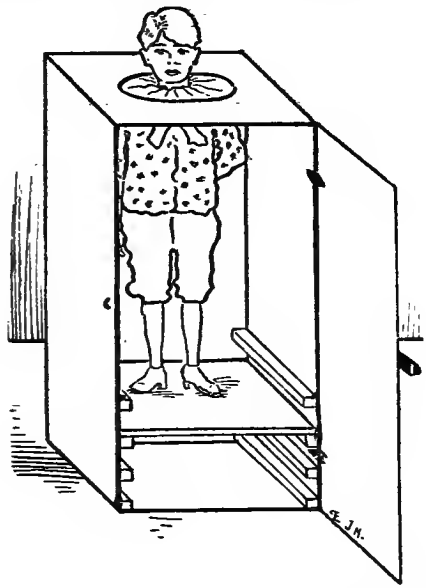
The Nature-Study Approach

Aim.—To gain insight into the fundamentals of body-wastes, ventilation, and heat-control.

1. The forms of body wastes.
   a The major forms of waste,—carbon dioxid, water and urea.
      Make the will known limewater test for carbon dioxid in breath. Expel the breath against a cold looking glass. Secure for examination a commercial sample of urea (nitrogenous waste formed in the liver and sorted out of the blood by the kidneys), or boil down a sample of urine till it gets somewhat thick and then let stand till crystals of urea form. Strain out and dry.
   b The minor forms of waste,—bile and feces.
      Examine a specimen of bile from a chicken's liver (bile is part waste). Refer to waste from undigested food stuffs in the alimentary canal which is fed upon by myriads of bacteria, especially if excess protein is eaten, and converted into body toxins (poisons).
2. Waste elimination.
   a Recall the lesson of the pupil's experiences in Study IV, Exp. 7.
   b Consider how concretions and crystals may form in the bladder unless bladder elimination is complete.
   c Headache being usually due to toxins in the blood, consider how these may arise in case of constipation.
3. Secure a specimen of a hog's or beef's kidney, cut it in halves the flat way, and examine its interior to see pyramids made of numerous little drainage canals that carry the water and other wastes off from the blood. See also the outlet of the kidney that leads off to the place of storage for kidney secretions (to the bladder).
4. Because the human body perspires only when it needs to get rid of heat, the study of the evaporation of moisture becomes important. Take two saucers or

other like shallow vessels, put two or three drops of water in each, keep them in a moderately warm room, fan one of them so as to keep the air in motion over it, and note the time it takes the water in each to evaporate.

5. To study an important effect of evaporation, take an ordinary dairy thermometer and insert its mercury bulb in a 10c bottle of ether, and let stand for a few moments. Now take the themometer out and take its reading quickly and thus watch what the mercury column does while the ether evaporates from the bulb after removing it from the ether, noting the difference in the rate of movement of the mercury column. Now pour some ether on the hand and see what you experience as the ether evaporates.



6. For this and the following experiments there will be needed some such appartus as the ones shown in the accompanying picture and zinc etching. The box cabinet should not be too big, that is, the sides of the box should be reasonably close up to the body of the pupil. Let a pupil adjust himself as shown, take a palm leaf fan in with him, and close the door. Of course the box should be as nearly air-tight as is conveniently possible. If the general room temperature

is 68 degrees F., and the pupil remains in for ten minutes, the temperature should come up to 75 degrees, or such a matter, (as shown by a thermometer thrust thru a suitable hole in the cabinet) and the pupil now reports discomfort. At this point let some one fan his face for a minute, to be followed by his fanning his body vigorously on the inside of the cabinet, being careful to pull the clothing as much as possible to keep it from sticking to his body. Consider the relief afforded by the two fannings respectively, while carefully taking the temperature of the inside of the cabinet again. Consider further why the second fanning makes it cooler on the inside than it really is. Make very sure that the pupil gets a good chance to smell the air of the cabinet as he ducks his head into it on his way out, and decides on the source of the odor, namely, unclean bodies and clothing.

Ventilation Experiments

7. After airing the cabinet out thoroly let a pupil reenter the cabinet but this time let him get entirely on the inside of it, the head hole having been covered with a board. When he has staid in there as long as he reasonably can, that is, till it seems very uncomfortable, let him again fan the air vigorously, and then see what difference it makes in his ability to stay longer.
8. After again airing out the cabinet, lay it on its side and arrange some sort of a cot for the pupil to lie on

so he can stick his head conveniently into the cabinet this time, his body being on the outside, and the room temperature not being over 68 degrees or 70 degrees. Keep track of the time till the pupil really finds it uncomfortable to breathe the air in the cabinet. Calculate the volume of the cabinet in cubic feet and also that of the room, and then determine how long the boy could stay in the schoolroom without a change of air, and how long all the pupils could stay there similarly, that is, till they have put in carbon dioxid and taken out oxygen as long as they can stand it.

An even more convenient device is to take a pasteboard box about a foot each way, provide a hole for the neck on one side, and place over the head, as shown on one of the pupils in the accompanying illustration.

9. Take an empty cigar box with its cover still on, bore two holes in the lid, an inch or more apart, and each an inch in diameter. Place a short lighted candle under one of the holes, close the lid tightly, and then over each of the holes set a separate lamp chimney, or a pasteboard tube an inch or so in diameter and six inches long. Now by means of smoke from an extinguished match, discover which way the air is moving at the top of the chimney.

   Similarly, if the weather is cool outside, open the window sash two inches at the bottom and as much at the top, and try smoke at each opening to see which way the air currents run.

10. Recall or renew the studies of the ventilation cabinet to make clear that the surface of the body is a great scavenger field for germs of decay.

    Recall or renew the balanced board study for colds to show the effects of various baths on the circulation of the blood and upon the training of the heat-regulating mechanism of the body.

11. Uniform body temperature.
    (a) How the body gains heat.
    Recall the effect of muscular exercises on body temperature. Carefully pour some sulphuric acid into a test tube of water to show how chemical action results in the liberation of heat. All glandular and muscular action are chemical action.
    (b) How the body looses heat.
    Illustrate with experiment how heat is trans-

ferred by conduction.
Illustrate by experiment how heat is transferred by convection.
Illustrate by experment how heat is tranferred by radiation.
Recall or reproduce the ventilation study with ether to show how evaporation is a cooling process.

(c) Keeping the temperature uniform. (See H-S's great chapter on "Thermal Phenomena.")

12. Recall or renew the studies of clothing in Grade VI.

Questions for Consideration

1. What are the character and appearance of the forms of body waste respectively?
2. Why is it important that each of the forms of waste respectively should be eliminated from the body?
3. What are the reasons for regarding the kidneys as the most important of the organs of elimination?
4. What have you learned from Experiment 4? How would it affect that rate of evaporation if the air of the room were already damp? Why does one feel warmer on hot damp days than on hot dry days?
5. What is the effect of evaporation on the temperature of the surroundings? Why does the fanning make the mecury column fall faster?
6. Why does the pupil get warm and sweaty in this experiment? Why does the fanning help at all? Why does the body fanning ordinarily help give relief even more than the face fanning? Why did the second fanning seem to make it cooler than the thermometer really showed? Suppose one staid in the cabinet till the air inside all became saturated with sweat, would the fanning then give relief? Whence came the bad odor of the cabinet air?
7. If the pupil can stay in the cabinet still longer because of his fanning the air, what does this show as to the first need for ventilating a room? On account of the odor of the room or cabinet, what is the second most important reason for ventilating a room? Why should people bathe?
8. What do you learn from Experiment 8 is the third important reason that a living room should be ventilated? How long could all the pupils stay in your unventilated

school room till the air would just have to be re-renewed? Why should one be careful to have a bedroom window open at night?

9. Can you explain how the air may be made to circulate in a room? Under what condition would the air of the room need only to be stirred? Under what condition is it necessary to have the air renewed?
10. What lessons in skin hygiene come from the experiments referred to?
11. How does the body gain and how lose heat? Since the liver is the warmest organ in the body (107 degrees F.), how must its chemical work compare with that of other organs? How does the body keep to 98 degrees F. normally when the surrounding air is over 100 degrees F.? When it is between 98 and 70 degrees? When it is 70 to 60 degrees? When it is below 60 degrees?
12. Why is properly woven cotton underwear better than woolen underwear for folks who are active?

Studying the Books. (See also Grade V. Study 1)

1. How do wastes and toxins arise in the body? Con. II, 227; Da. II, 113; Gu. IV, 160; Hu. III, 18; Je. II. 152; O-K. IV, 191; Ov. II, 166; Ri. III, 154.
3. Why are the kidneys the most important organs of elimination? Con. II, 229; Da. II, 21, 114; Gu. IV, 146, 178; Hu. III, 199; Je. II, 172; O-K. IV, 187; Ov. II, 173; Ri. III, 159.
4. How does perspiring aid in heat-regulation? Con. II, 242; Da. II, 127; Gu. IV, 206, 216; Je. II, 197; O-K. III, 159; Ov. II, 24, 154, 164; Ri. III, 85.
5. Why and how ventilate living rooms? Con. II, 150; Da. II, 107; Hu. III, 144; Ri. III, 60.
6. Why bathe for cleanliness and to counteract colds? Con. II, 247; Da. II, 119; Gu. III, 66; Hu. III, 184; Je. II, 201; Ov. II, 166; Ri. III, 78, 87.
7. How does the body naturally keep a nearly uniform temperature? Con. ,, 238; Da. II, 117; Je. II, 202; O-K. III, 159; Ov. II, 152; Ri. III, 84
8 How does clothing serve as an artificial aid to heat regulations? Con. II, 252; Dav. II, 127; Hu. $II, 171; Je. II, 204; O-K. III, 165; Ov. II, 155; Ri. III, 87.

Writing up the Notebook. (See Grade V, Study 1)

VI. BONES, JOINTS, AND LEVERS.—Dr. II; Ho. VIII; Hr. XVIII; H-S. V; Ly. II, 2; Te. V.

Aim.—To learn from the body and from specimens some important facts about the skeletal system

1. By feeling the parts, find out how many different bones in each of the following organs: (a) fingers and free part of thumb, (b) palm of the hand, (c) the forearm, (e) the shoulder, (f) the head, (g) the chest, (h) the hips, (i) the thigh, (j) the leg, (k) the arch of the foot, (i) the toes.
2. By a re-examination distinguish the four different shapes of bones to be found in the body and which sort is most numerous and which least so.
3. If possible obtain from the butcher a fresh bone of the form that is several times longer than wide, and saw it in two lengthwise. Obtain a similar dry bone and saw it in two likewise. (Chicken bones will do, but larger bones will be better.) From an examination of these specimens be able to describe the following parts; covering, compact bone, spongy bone, red marrow, fatty marrow, and medullary cavity.
4. Into a wide-mouthed bottle, put a piece of limestone or marble and pour over it a 20 per cent solution of muriatic acid. Into another bottle put a reasonably fresh drum stick of a chicken and cover it also with a 20 per cent solution of muriatic (hydrochloric) acid. Let both stand for a day. Upon re-examining both experiments, decide what has happened to the chicken bone.
5. Obtain a hip joint of a pig or other animal from the butcher. If the outer sheath-like covering (capsular ligament) is still on, examine it to see how the point is protected. Now remove the capsular ligament and note the smooth coverings of the bone ends. Examine the cartilage to see how it differs in at least three ways from compact bone. Let the pupil further verify one of these differences by superficially experimenting with the cartilages of the nose and ears.
6. Find in the above specimen certain white cords (ligaments) that help to tie the bones together. Separate one of these out and see how a ligament differs from cartilage and from bone. Also find any similar white cord (tendon) that was fastened at one end to the bone and at the other to a muscle. Let the pupil feel

behind his own knee to discover two such tendons, and to make out what they are for.

7. We are accustomed to describe different kinds of joints by the motions they permit. If the motion is like a hinge, as in the knee, it is called a hinge joint. If it is two nearly flat surfaces that slip over each other, as in the knee cap, it is a gliding joint. If it turns on a pivot, as in the neck, it is a pivot joint. If it permits a cone-like motion, and also lets one bone rotate or twist on the other, as in the shoulder joint, it is a true ball-and-socket joint. If it permits a cone-like motion but does not let one bone turn or twist on another, as in the wrist joint, it is a false ball-and-socket joint. Now proceed to find over the body other examples of these joints, as follows:
   (a) 22 hinge joints.
   (b) 48 gliding joints.
   (c) 2 pivot joints.
   (d) 21 false ball-and-socket joints.
   In attempting to find these joints, note that there is a joint between the wrist ends of the arm bones, and two different kinds of joints at each elbow. Also examine two dry specimens of immediately neighboring vertebrae to find where so many gliding joints can come in.
8. If teacher and pupils are particularly ambitious, it is possible to illustrate many important facts about the frameworke of the body by using the skeleton of a cat or other small animal. "To prepare the skeleton, kill the mammal by chloroforming it, skin it, remove the "insides" with out injuring the breast bone, and cut off all the flesh possible with knife and scissors. Then boil the animal for a short while in the following mixture: water, 2 quarts; ammonia, 2 ounces; saltpeter, one-half ounce; laundry soap, 3 ounces. Boil the skeleton until the muscles have softened but the ligaments still hold together. It might be well to take the head and limbs off before boiling. To prevent the vertebral column from going to pieces, the vertebrae should have a wire run thru where the spinal cord is before the boiling has proceeded very far. With patience any pupil may make an excellent preparation of a skeleton."—Hartman.
9. Study the different forms of levers shown in Chapter VIII, and find other examples of each kind of lever in the human skeleton.

Questions for Consideration

1. How many bones do you discover in each of the organs which you were directed to study?
2. What and where are the four sorts of bones as to shape?
3. What is your description of bone covering, compact bone, spongy bone, red marrow, fatty marrow, and medullary cavity?
4. What part of the chicken bone was dissolved by the acid and why did it not all dissolve?
5. What are the important parts of a joint and how does it work so easily?
6. How does a ligament differ from a tendon, from bone, and from cartilage?
7. What are the locations of the joints called for above?
8. How does your animal skeleton differ from a human skeleton?
9. Where in the human skeleton are all the examples of the three classes of levers you can locate?

Studying the Books. (See also Grade V, Study1.)

1. How keep the bones in good condition?—Con. II, 200, 213; Da. II, 133; Gu. IV, II, 37; Hu. III, 229; O-K. III, 126; Ov. II, 164; Ri. III, 16.
2. How care for injured and broken bones?—Con. II, 199; Da. II, 139; Gu. II, 39; Je. I, 186; Ov. II, 72; Ri. III, 23.
3. How maintain good joints and care for sprains?—Con. 213; Da. II, 140; Gu. II, 39; Hu. III, 238; Je. II, 271, 92; Ov. II, 65; Ri. III, 225.

Writing up the Note Book. (See Grade V, Study 1.)

VII. MUSCLES, POSTURE, EXERCISE, FATIGUE.—Ban. I-XXVI; F-F. IV; H-S. V, XVII; Mo. II; Te. VII; Wa. IV, V.

The Nature-Study Approach

Aim.—To secure direct acquaintance with the fundamentals of the general topic.

1. Secure a whole muscle with its tendons from a chicken or other small animal, and let each pupil discover the difference between the body of the muscle and its tendons, and how the tendon connects with both the muscle body and the bone.
2. Take a specimen of boiled beef and examine its make up of bundles of muscle tissue about as big across as

a match stem. Now take one of these bundles and pick from it the tiniest possible thread, at least as small as a fiber of cotton or wool. Such a thread, if examined under a microscope would be found to consist of several still finer threads called muscle fibers.

3. The teacher should send to the American Posture League, So. Church St., New York City, for a chart of postures. She should then apply to all her pupils the "tripple test" for postures as described in Miss Bancroft's "The Postures of School Children". Now make out a posture diagram for each pupil and devise exercises for correcting the imperfections, if any. Follow out Miss Bancroft's suggestions for stimulating the class to continue improvements. See also Grade V, Study 6.
4. After having been comparatively quiet for a time, count your pulse beat and breathing frequency per minute, and take note of your temperature, blood distribution, perspiration, and the quantity of air you naturally breathe at a breath. Now make a quick run for a tenth to a fifth of a mile, or around a city block, and then at once re-examine yourself on all points listed above.
5. Observe the veins on the palm side of your wrist. Across the wrist next to the palm, lay the index finger of the other hand and pressing on the wrist, move the finger toward the elbow so as to force the blood in the veins that way. Note how the veins seem to have been emptied of blood. Now place the finger at the middle of the fore arm and try to force the blood slowly back to the palm. Note how the blood backs up and in a few spots seems to form knot-like appearances in the vein (the places of valves).
6. Having at hand a wash basin full of water, place in it two wash cloths or sponges that have just been soaked with dirty water. Squeeze one of these repeatedly and then remove both and compare the cleanliness of the two.
7. In the accompanying illustration is a picture of a fatigue apparatus and in Chapter VIII is a diagram of the apparatus, which any enterprising eighth grade boy can make. Part 1 is a board 6 x 18 inches and a half to a whole inch thick. Part 2 is a similar board to which a paper is fastened with thumb tacks on which the fatigue record is to be made. Parts 3, 4,

5, and 6 are sticks 1 x 1 x 18 inches nailed to part 1 as shown. Part 7 is a stick 1 x 8 inches to carry a recording pencil running thru a hole in No. 7, and a slot in No. 1. It carries a small potato on its upper end to give weight enough to make a mark. Part 8 is a board 1 x 3 x 8 inches set up edgeways and pivoted at the right-hand end, the other end being tied to neighboring parts so as to hold the back of the hand in the right position for taking the fatigue record. Part 9 is a spool serving as a pulley to carry the bucket of pound weights (part 10). Part 11 is a little windlas apparatus made of very heavy wire for winding a string that runs thru a steeple on part 1 and to the outer end of part 2. While the experiment is in progress the windlass is to be slowly turned so as to cause part 2 to move slowly under part 1.

Fatigue Apparatus In Use.

In the experiment itself, the one whose record is to be taken sits by the apparatus, his right hand between parts 3 and 8, his elbow resting along part 3. Tie part 8 snugly up against the back of the hand and run the middle finger thru the leather or cloth loop (No. 12) which in turn is tacked to the left hand end of part 7. Tie the index finger back to part 8.

Now put two pounds of weight into the bucket and have the experimenter lift the weight with his middle finger only, as far as he can, every second, keeping track of the time by counting rapidly:one, two, three, four, five, six; one, two, three, four, five, six; one, two, three, four, five, six; one, etc. Meantime, some one else will have to be turning the windlass slowly. If the record that is made in a minute (60 strokes) is not like the one shown in the figure, put on more weight or less, as may be needed. The idea is to see what is the heaviest weight one can carry and just run down in 60 seconds. Let each pupil file his records in his note book. Read Chap. V. in H-S.

Questions for Consideration

1. How do the parts of a muscle differ from and connect with each other?
2. About what is the diameter of a single muscle fiber?
3. How can your personal posture be corrected or improved?

4.-6. What are eight important effects of exercise? Can one succeed in living well without exercise? Can automobile riding take the place of exercise? Can medicine?

7. What makes your finger give out in lifting its load? Could you find a load which you could lift about the same height every time and for a long time? If so, what makes this possible?

Studying the Books. (See also Grade V, Study 1.)

1. What is the necessity of exercise in a healthy life?—Con. II. 213; Da. II, 147; Gu. Iv, 14, 18; Je. II, 230; O-K. III, 197; Ov. II, 81, 100; Ri. III, 48.
2. How exercise to correct defects and maintain good postures?—Con. II, 218; Da. II, 148; Gu. IV, 18; Hu. II, 243; O-K. Iv, 187; Ov. II, 84; Ri. III, 30.
3. What is body fatigue and how is it controlled?—Con. II, 216; Gu. V, 112, 119; Hu. III, 241; Ri. III, 103.

VIII. BEHAVIOR, BRAIN, NERVES, SENSES.—Al. XI; Dr. XXV, XXVI; Ho. V; Hr. XXIII; Hu. XVII, XVIII; H-S. VII, XIV, XVIII, XXII; Mo. V; Te. XIII-XX; Wa. XII-XV.

The Nature-Study Approach, with Questions

1. Forms of behavior.

(a) Recall your behavior on touching something very hot. Did you have to think about jerking your hand back? If you tickle someone's toes while he is asleep, will he move before he awakes? What is a reflex act? Give other examples of such an act.

(b) Recall your behavior when you were badly scared. Did you have to know there was something to be scared of before you did what you did? Did you have to think at all while you were scared? Was your behavior simple, or were there a lot of things going on at the same time? What is an instinct and how does it differ from a reflex act?

(c) Play a game of "Simon-says-thumbs-up". Consider how you get your hands to do just what they ought to do. What is it you have in mind when your hands come up at the time they should stay down. What is really in mind when the hands stay down both when they ought to and when they ought not to? What seems to precede every voluntary or willed act? How does such an act differ from a reflex and from an instinctive act?

(d) Whistle or sing and draw a picture at the same time. Which of the acts do you think about the more? What is a habitual act? How do habitual acts get started and how perfected? How does such an act differ from the other three forms of behavior mentioned?

2. Examining the brain and nerves.

(a) Get a butcher to secure you as complete as possible a specimen of a beef's, sheep's, hog's, dog's, or cat's brain with as much spinal cord still attached as possible. Wash the specimen thoroly and put it to soak for several days in a 10 per cent solution of formalin. When ready to study it, remove and wash thoroly in water again. Examine the specimen till you become reasonably well acquainted with its more important parts, such as the cerebrum or larger portion, with its parts side by side; the cerebellum lying just back of and partly under the cerebrum; ("back of" and "under" here mean in the sense of the brain's being in its original position in the animals) the medulla lying back of and under the

cerebellum and connecting directly with the spinal cord, the part that was in the backbone. On the under side of the center of the cerebrum find the roots of the optic nerves; under the medulla find the roots of several other nerves.

(b) Now place the brain before you so that if it were still in the animal it would now be facing you. You have already found a long fissure separating the two halves of the cerebrum. With a sharp knife cut down thru the brain squarely across this fissure, and a third of the way from its rear end. Note the gray surface of the cerebrum, known as the cortical or "gray matter". This gray stuff is believed to be the seat of the thinking part of the brain, and you should find two circular masses of "gray matter" each called a thalamus. The thalami are supposed to be the seat of agreeable and disagreeable feelings, and of instinctive actions. The cerebellum has a good deal to do with habits, it is believed, while the medulla takes care of the reflex acts, as does also the spinal cord. The nerves, of course, carry nerve messages.

3. Learning about the senses.

(a) To find out what are the four different kinds of sensations connected with the skin make use of a pencil and pin as follows. Warm the pencil and with its point explore the back of the hand to find tiny spots that seem warmer than other places. Make the pencil cold and hunt for simi-cold spots. Have the pencil neither hot nor cold and try this time to find spots that are more sensitive to touch than other parts. Using the pin point gently, hunt for places a little more sensitive to pain than other places.

(b) Put the open hand behind the head but not touching it. It will be known of course, what shape the fingers are in, but now stiffen the fingers and see if there is a more complete knowledge of the position of the hand and fingers. What one gets is a strain sensation coming from the contraction of muscles. This will introduce one to one of the most important of all the senses, the muscle sense.

(c) Let the teacher put some odorous substance in a

cloth covered pasteboard box and let the pupils in turn see how near they have to come to be able to say what the odor is. Let this be a "race with noses" for the class, to see who has the best smeller.

(d) To get the experience of the four tastes the tung can distinguish, put some sugar or candy in the mouth to find where the tung can best tell sweetness. Similarly try sour stuff like "sour drops" of candy. salty stuffs like common salt, and finally bitter stuffs like quinine.

(e) Following the directions given in some of the books, make a test of the acuteness of hearing of each of the pupils. Also have each pupil make the best examination he can of the auditory canal by means of a good light and two mirrors.

(f) Again using the tests for acuteness of vision given in the books, test the vision of each of the pupils.

If opportunity permits, secure an eye of a beef or other large animal, and dissect it to discover its important parts and the reasons for great care in protection of the eyeball. (See Chapter VIII)

Writing up the Note Book. (See Grade V, Study 1)

1. What is the nature of the brain as the home of the mind?—Con. II, 302; Da. II, 161; Gu. V, 10; Hu. III, 216; Je. III, 213, 242; O-K. IV, 121; Ov. III, 318; Ri. III, 93.
2. How guard the eyes from injury?—Col. II, 254; Con. II, 332; Da. II, 174; Gu. V, 154; Hu. III, 259; Je. II, 247; O-K. V, 254; Ov. II, 249; Ri. III, 109.
3. How guard the ears from injury?—Col. II, 258; Con. II, 337; Da. II, 244; Gu. V, 162; Hu. III, 226; Je. II, 249; O-K. III, 250; Ov. II, 337; Ri. III, 122.
4. How conserve the skin senses—heat, cold, pain, and touch?—Col. II, 239; Con. II, 343; Da. II, 236; Je. II, 236, 259; O-K. IV, 239; Ov. II, 337; Ri. III, 129.
5. How conserve the sense of smell and of taste?—Col. II, 244; Con. II, 341; Gu. V, 154; Hu. II, 253; Je. II, 236, 250; O-K. V, 244; Ov. II, 339; Ri. III, 129.
6. How are good habits formed and bad ones avoided?—Con. II, 299; Da. II, 166; Gu. V, 84, 213, 220; Hu. III, 19; Je.II, 235; Ov. II, 332; Ri. III, 99.
7. How develop an attractive countenance?—Con. II,

213, 247; Dav. II, 147; Gu. V, 135, 91; Ov. II, 83, 100; Ri. III, 106.

8. How control the passions?—Col. II, 211; Con. II, 208; Gu. V, 134; Hu. III, 239; Je. II, 255; O-K. IV, 142; Ov. II, 325; Ri. II, 106.
9. How keep the mind in a healthy condition?—Con. II, 305; Da. II, 167; Gu. V, 18, 27, 173; Je. II, 256; O-K. IV, 136; Ov. II, 321; Ri. III, 102.
10. Why is sleep the great restorer?—Con. II, 309; Da. II, 233; Gu. V. 123; Hu. III, 232; O-K. IV, 232; Ov. II, 329; Ri. III, 103.
11. What is the value of the after-dinner nap?—Con. II, 259; Ga. V, 27; Ri. III, 103.
12. How may headaches be avoided?—Col. II, 209; Con. 333; Da. II, 45, 169; Hu. III, 235 ;Je. II, 176, 247; O-K. IV, 209; Ov. II, 235; Ri. III, 102, 154.

Writing up the Note Book (See Grade V, Study 1.)

IX. STIMULANTS, NARCOTICS, AND MEDICINES.—Al. XXXVIV, XXXVII; F-F. III, Appendix IV, V; Ho. XVII; H-S. XX; Te. I-XIV; Wa. VIII, XIX.

The Nature-Study Approach

1. Recall or reproduce the experiment with tea, coffee, alcohol ,and tobacco in Grade V, Study 5. See also Chapter VIII.
2. In case any pupil is afflicted with the cigarette habit try the following prescription recommended by Dr. J. F. Slater, Supervisor of School Hygiene, Houston, Texas.

   Use a 10 per cent solution of silver nitrate. It can be prepared by any competent druggist. Apply this solution with a camel's hair brush to the tip and edge of the tongue every two or three days for two or three weeks. Make these applications often enough to prevent the patient from using tobacco with any amount of pleasure. The combination of silver deposited on the tongue, with the products of tobacco in the saliva of the mouth result in a very bitter taste not unlike that of copper or brass.

   Moral forces should also be used. The patient should be told that the effect of his treatment is only temporary and that he must use his will to stop the habit from the beginning of the treatment if he expects a permanent cure. In other words, this silver nitrate merely aids the will by temporarily taking away the pleasure from the use of tobacco. It has a good affect to allow him

the use of tobacco once immediately after the treatment.

3. Verify in whole or in part the percentage quantities of drugs in the following classification of patent medicines.
   A. The "ethical preparations".—More or less beneficial.
   B. Fraudulent but not injurious or dangerous "remedies."
      (a) The cures, if any, are mentally induced.
      (b) They usually serve only to delay proper treatment.
   C. "Remedies" more or less dangerous but forming no drug habit.
      (a) Hair "restorers" containing sugar of lead.
      (b) Cosmetics containing corrosive sublimate.
      (c) Blood "purifiers" containing iodide of potassium.
      (d) Consumption "cures" containing chloroform.
   D. Dangerous to life and usually forming a drug habit.
      (a) "Remedies" whose chief element is alcohol; for example:
         Chamberlain's Diarrhoea Remedy 58 per cent ethyl alcohol.
         Hostetter's Bitters, 39 per cent ethyl alcohol.
         Common American Whiskey, 35 per cent ethyl alcohol.
         Peruna, 18 per cent ethyl alcohol.
         Lydia E. Pinkham's Vegetable Compound, 18 per cent ethyl alcohol.
         Hood's Sarsaparilla 18 per cent ethyl alcohol.
         Warner's Safe Cure, 15 per cent ethyl alcohol.
         Pond's Extract of Witch Hazel 15 per cent ethyl alcohol.
         Hall's Catarrh Cure, 14 per cent ethyl alcohol.
         Jayne's Expectorant, 13 per cent ethyl alcohol.
         Wakefield's Blackberry Balsom, 12 per cent ethyl alcohol.
         American Red Wine, 9 per cent ethyl alcohol.
         Mrs. Winslow's Soothing Syrup, 5 per cent ethyl alcohol.
         American Lager Beer, 4 per cent ethyl alcohol.
         Castoria, 3 per cent ethyl alcohol.
      (b) "Remedies" containing opium and its derivatives.
         (a) Forms.—Pure opium, laudanum, paregoric, morphine.
         (b) Examples.—Soothing syrups, Shiloh's "Cure," etc.

(c) "Remedies" containing cocaine, e. g., catarrh cures etc.
(d) "Remedies" containing acetanilid (a powerful heart depressant, used in practically all headache medicines).
(e) "Remedies" containing chloral hydrate.
(f) "Remedies" containing cannibas indica (hashish).

Studying the Books. (See also Grade V, Study 1)

1. How does tobacco harm?—Con. II, 313; Dav. II, 50; Gu. V, 145; Hu. III, 103; Je. II, (Index); O-K. IV, 165; Ov. 279, 331; Ri. III, 197.
2. How does alcohol destroy?—Con. II, 213; Da. II, 234; Gu. V, 95, 203, 54; Hu. IV,, (Index); Je. II, (Index); O-K. IV, 148; Ri. III, (Index).
3. Are patent medicines beneficial?—Col. II, 89; Hu. III, 237; Je. II, 287; O-K. IV, 179; Ov. II, 62.

Writing up the Note Book. (See Grade V, Study 1)

A PROPOSED EIGHTH GRADE HYGIENE TEST

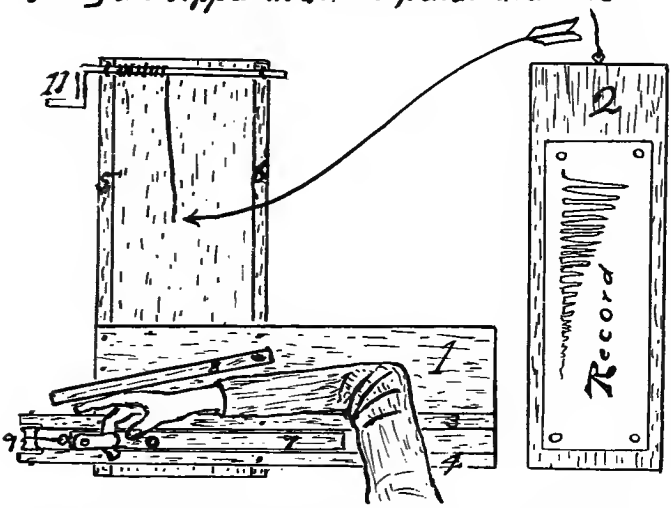
Does the pupil have a good sitting posture?
Does he carry his head and shoulders well when standing?
Can he exert himself without easy exhaustion?
Does he take regular and vigorous exercise in work or play—enough to get up a sweat and lead to deep breathing, the only kind worth while?
Does our pupil ordinarily breathe thru the nose?
Is he particular as to the air he breathes?
Does he provide for fresh air in his bedroom?
In the feeding act are the bites small and the chewing abundant?
Is his sub-maxillary exercise taken only on food and not on gum?
Does he eat only a limited amount of meat and other proteids and thus avoid auto-intoxication and general malaise?
Does he drink generously at meal time but not merely to help swallow the food?
Is the liquid he drinks confined to water, milk, and cocoa?
Is he regular in the discharge of alimentary excreta?
Has our pupil taken on the tooth-brush habit at night before retiring?
Does he refrain from putting into his mouth everything except water, food, a fork, a spoon, a tooth brush, and dental thread?
Does he regularly consult a dentist once a year and keep his teeth in the best condition?

Is he properly trained to turn the leaves of a book, affix postage stamps, and apply court plaster?
Is he entirely free from the spitting habit?
When he coughs or sneezes, does he turn his face away from others, or cover it with a handkerchief?
Is this pupil wholesome looking and inoffensive to smell?
Has he developed the habit of daily bathing, either a cold bath on rising, or an indifferent one before supper on coming in from a day's work amid dirty surroundings?
Are his fingernails habitually in mourning, or only occasionally so?
Does our pupil read writing on the black board easily from his seat?
Does book print not blur for him, nor do his eyes occasionally smart?
If his eyes are myopic, hyperopic, or astigmatic, does he wear properly fitted glasses?
Does he hear common conversation without straining, and is he alert to the sights and sounds about him?
Is he free from headaches, colds, and tendencies to cough?
Is the pupil happy, aggressive, buoyant, courageous, enthusiastic, enterprising, and can he find contentment in wholesome play and work?

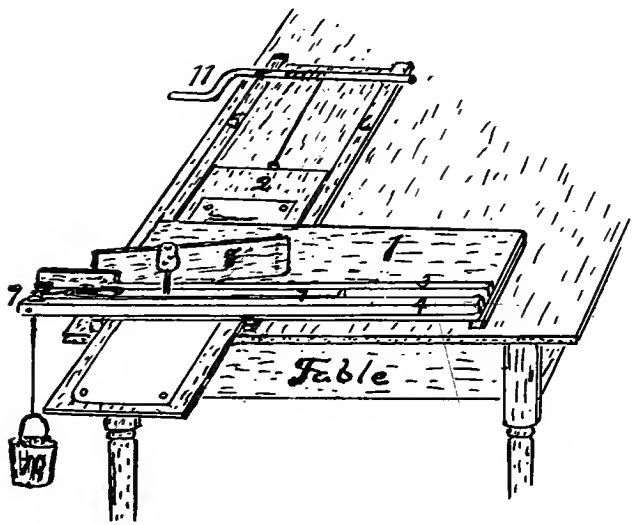
CHAPTER VIII.—BLACKBOARD SKETCHES, ETC.

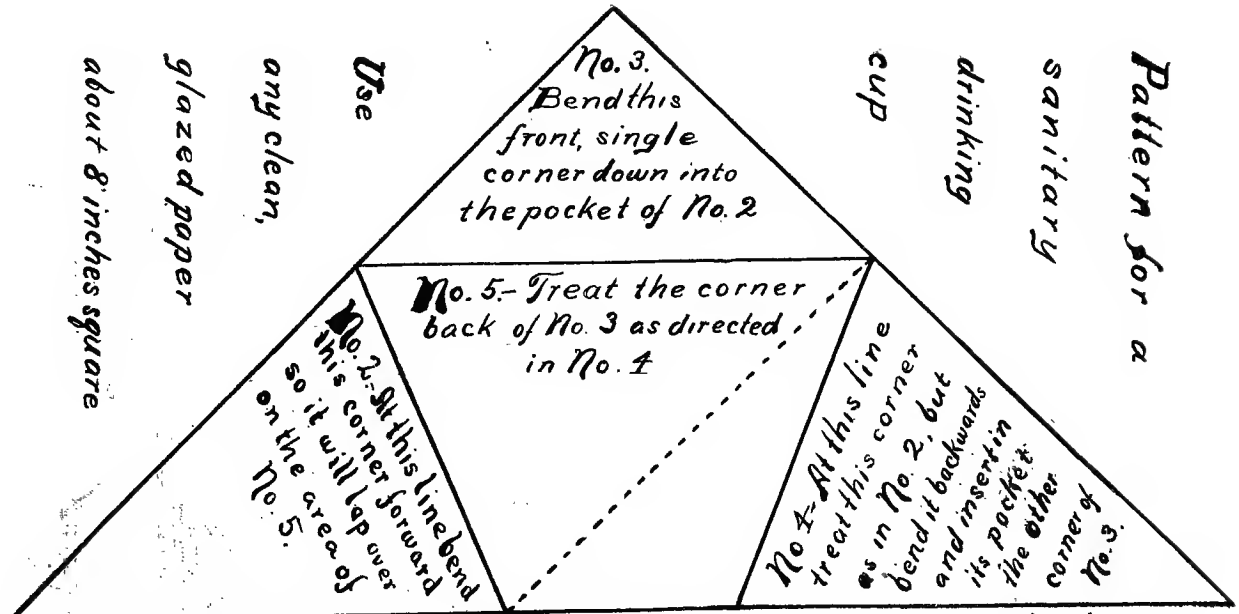
(See second page of preface.)

Fatigue Apparatus. Perpendicular View

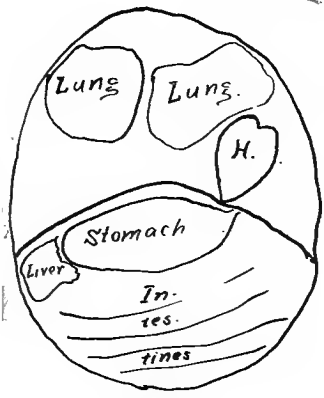


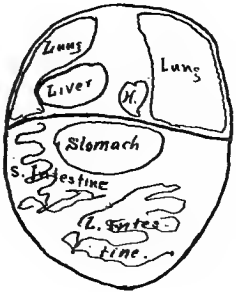
Oblique View of Apparatus on a Table.

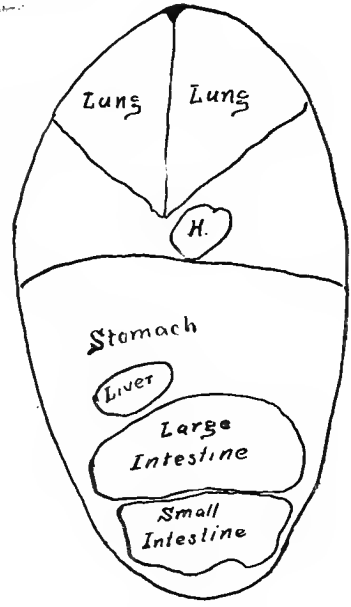


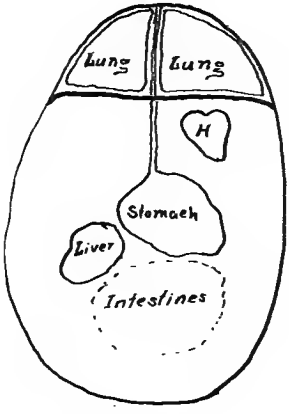

Pattern for a sanitary drinking cup
No. 3. Bend this front, single corner down into the pocket of No. 2
No. 5.- Treat the corner back of No. 3 as directed in No. 4
No. 2.- At this line bend this corner forward so it will lap over on the area of No. 5.
No. 4.- At this line treat this corner as in No. 2, but bend it backwards and insert in its pocket the other corner of No. 3.
No. 1.- Fold the square paper from its lowest corner up on this line.
Use any clean, glazed paper about 8 inches square

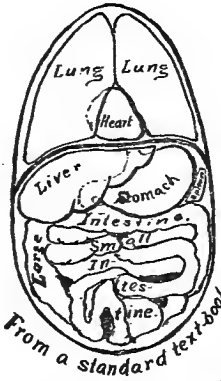
Reproductions from the Work of Tenth-grade Pupils from Seven Nebraska Schools.



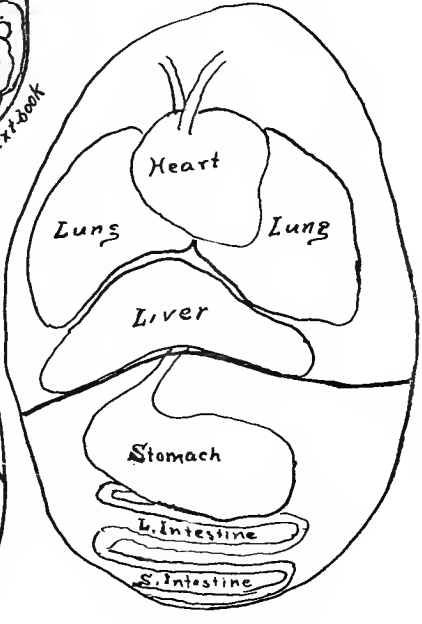


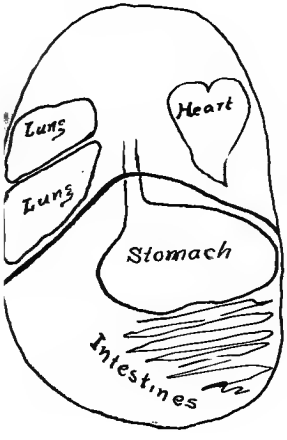


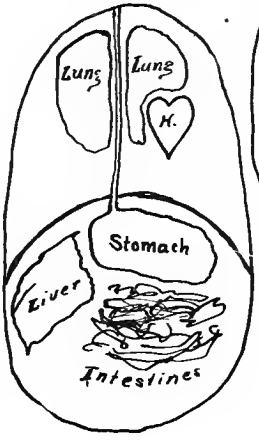




From a standard textbook







Parts and Functions of Fresh Blood

Parts

Plasmo, 54% (The liquid part of the blood)

- Water, 90% (Water composes 80% of all the blood.)
- Waste, 0.5%
  - Nitrogenous waste (ūrē-a, etc.), 0.3%
  - Carbon dioxid, a gas in solution.
  - Other waste in minute quantities
- Foods, 9.5%
  - Fats, in minute droplets, 0.1%
  - Dĕx-trōse (grape sugar), 0.2%
  - Salts, 0.9%
    - Common salt, 0.6%
    - Other salts, 0.3%
  - Prō-tē-ĭds, 8.3%
    - Serum albumen, 4%.
    - Serum globulin, 4%.
    - Fibrinogen, 0.3% Fibrin

Corpuscles, 46%. (Numerous small bodies in the blood)

- Red corpuscles, about 98%
  - As seen flatways:- 
  - As seen edgeways:- 
  - As seen in rouleaux:- 
- White corpuscles, more than 1%.
  - Parts of the cell
    - Body
    - Nucleus 
  - Typical shapes at intervals of a minute:- 
- Blood platelets, less than 1%.—Minute irregular bodies.

Sĕ-rŭm + Blood clot = Parts of Clotted Blood

Functions

Plasma

- Carries foodstuffs to the various parts of the body.
- Removes carbon dioxid and other waste from the various parts of the body.
- Acts as a vehicle or carrier for the blood corpuscles.
- Carries in solution a substance (fibrinogen) important in coagulation.
- Distributes over the body the heat coming chiefly from muscles and glands.

Red corpuscles.—Distribute oxygen from the lungs to the various parts of the body.

White corpuscles

- Destroy, or endeavor to destroy, disease-producing bacteria.
- Aid in the healing of wounds.
- Aid in the coagulation of blood.

Blood platelets.—Probably form centers from which coagulation of blood begins.

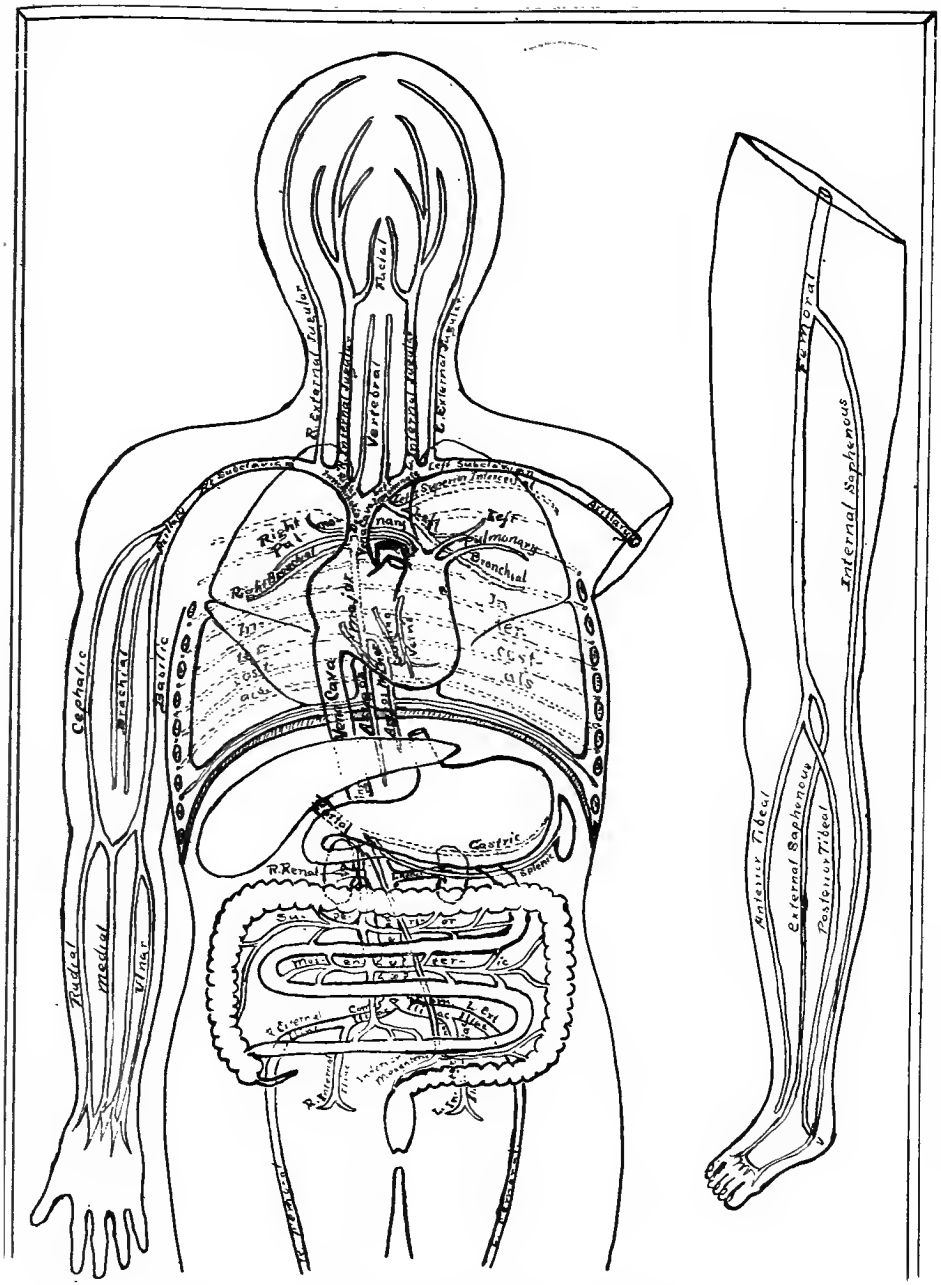


Diagram of Veins—Systematic and Pulmonic

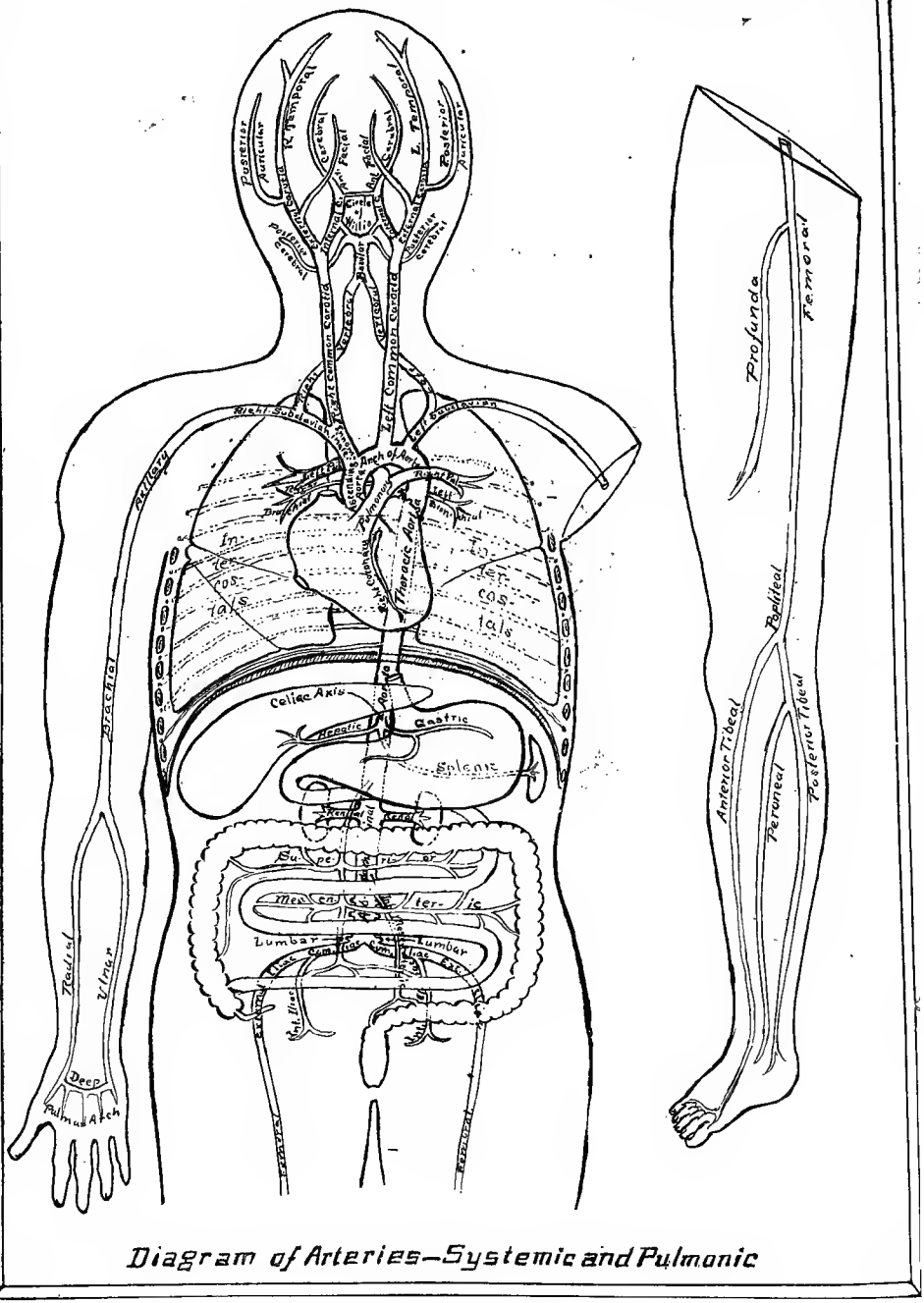


Diagram of Arteries—Systemic and Pulmonic

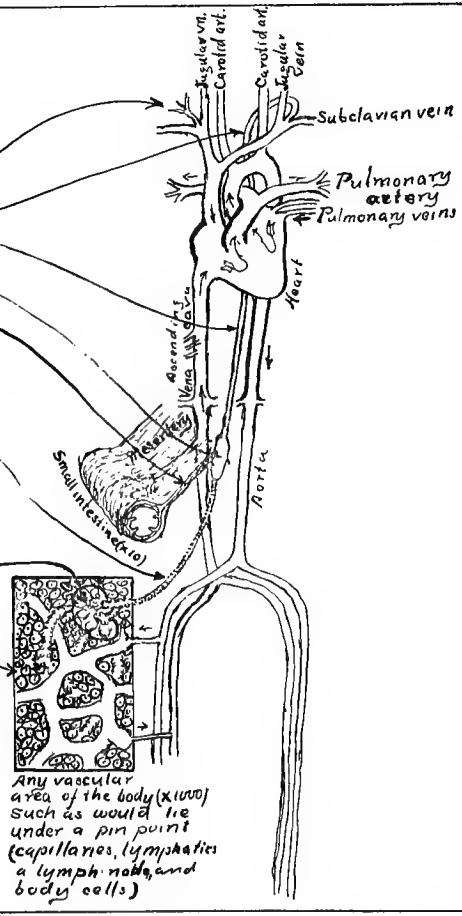
Blackboard Study of the Lymphatic System.

1. **Lymph** – The "juice" of the body, found everywhere among the cells of the body, and in the lymph vessels, and lymph nodes

2. Lymph vessels
   - Main trunks
     - Right lymphatic duct
     - Thoracic duct
       - Tube
       - Receptacle
   - Lymphatics
     - Lacteals – Arising from small intestine
     - Other lymphatics – Arising from among the body cells and found all over the body where there are blood capillaries

3. Lymph nodes or glands – Found pretty generally where there are lymphatics, and concerned in making white blood-corpuscles and in removing certain injurious substances from lymph.

4. Lymph spaces
   - Intercellular – Among the cells of the body.
   - Cardiac. – Around the heart in the pericardium
   - Pleural – Around the lungs in the pleurae
   - Arachnoidal. – Around the brain between its outer and inner coverings



Any vascular area of the body (×1000) such as would lie under a pin point (capillaries, lymphatics a lymph node, and body cells)

Studies in Respiration

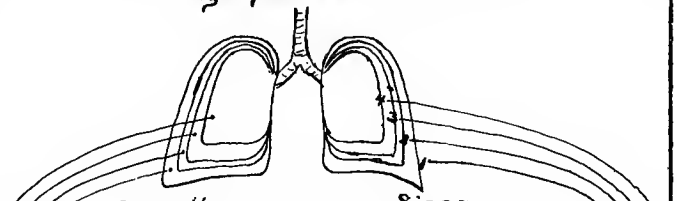
A Homemade Spirometer

Changes in the air passing thru the lungs

Inspired air:		Expired air:	
Nitrogen, 78%	79%	Nitrogen, 78%	79%
Inert gases, 1%		Inert gases, 1%	
Carbon dioxide, .04%		Carbon dioxide, 4.6%	
Oxygen, 20.96%		Oxygen, 16%	

What gas does the air lose and what gain in the lungs?
What are the two important purposes of breathing?

Lung Capacities and Sizes



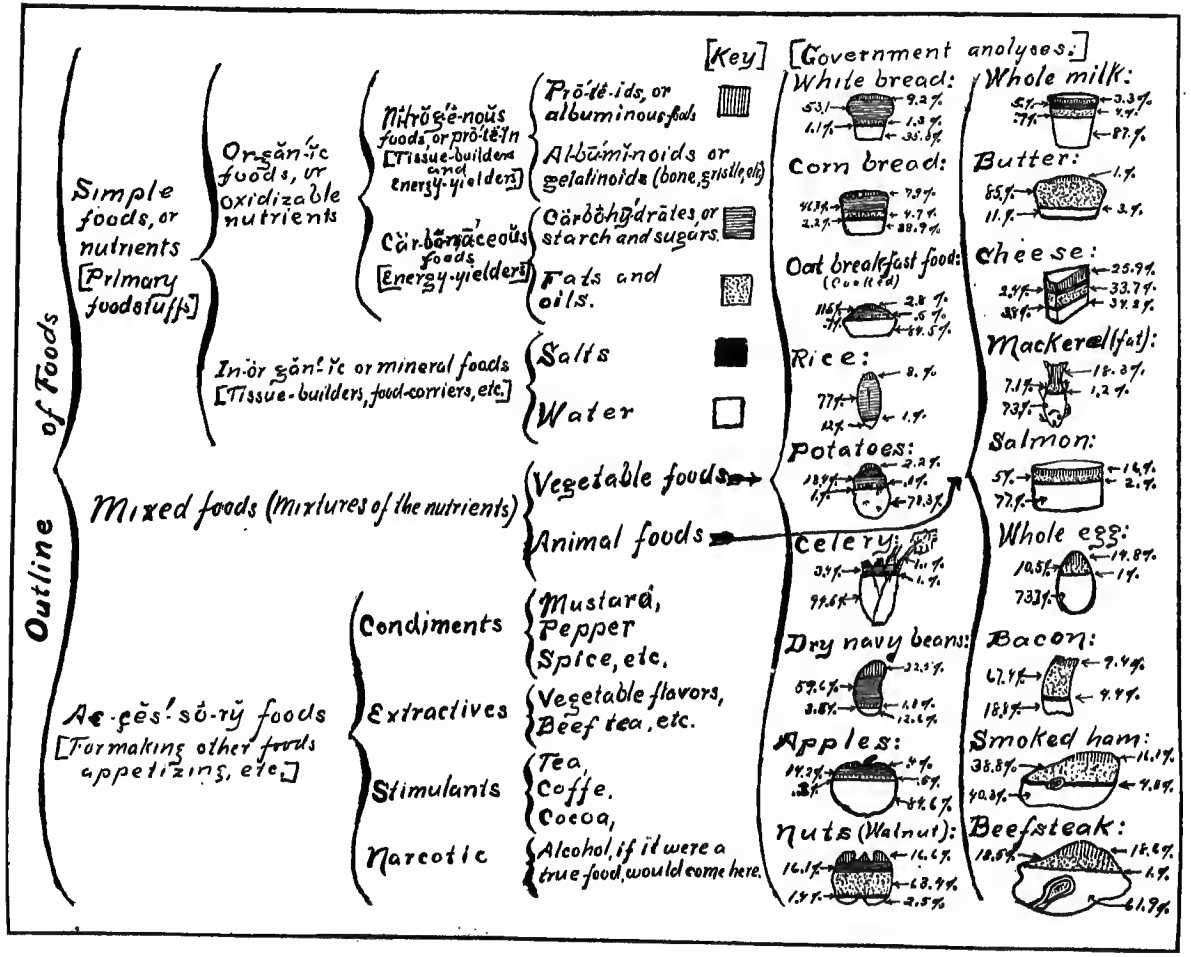
Capacities	Sizes
Complemental air, 120 cu. in.*	At greatest Inspiration
Tidal air, 30 cu. in.	At ordinary inspiration
Supplemental air, 100 cu. in.	At ordinary expiration
Residual air, 100 cu. in.	At greatest expiration

* These values are for a good sized adult. For an average 8th grade pupil the values are only about half as great.

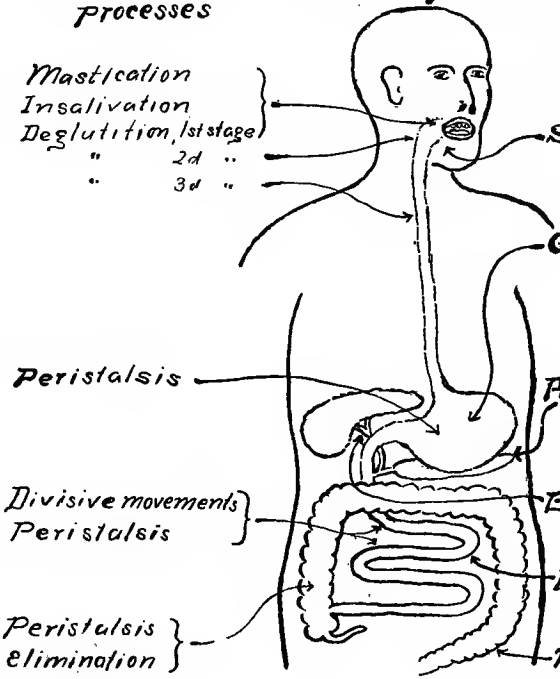
Changes in the blood passing thru the lungs.

Gases in 100 volumes of blood going to the lungs:	Gases in 100 volumes of blood going from the lungs:
Carbon dioxide, 47.5 vols.	Carbon dioxide, 38 vols.
Nitrogen, 2 volumes	Nitrogen, 2 volumes
Oxygen, 10 volumes.	Oxygen, 20 volumes.

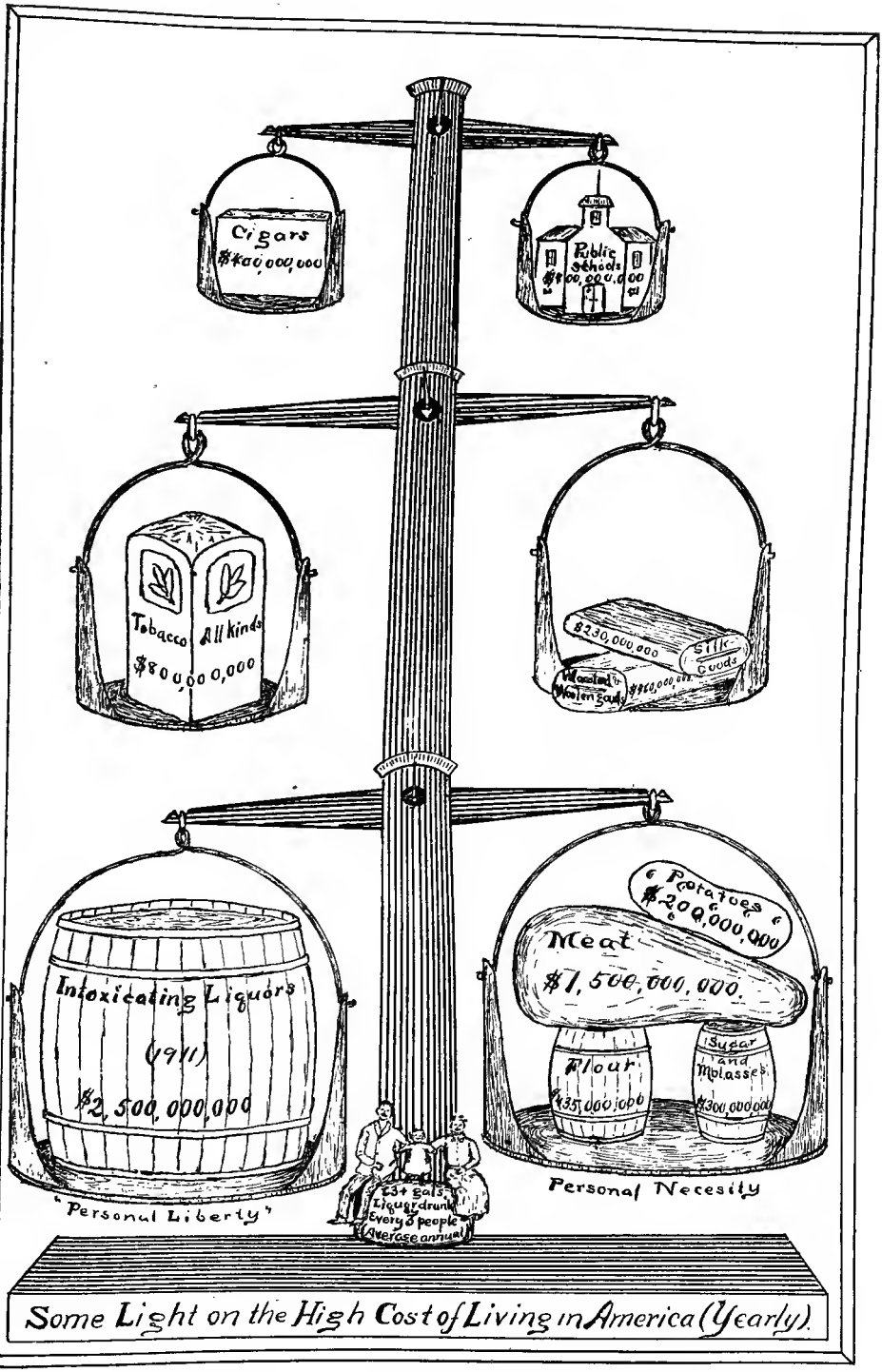
Compare quantity of oxygen in blood going to and from the lungs.
Compare quantity of oxygen and of carbon dioxide in blood from lungs.


Outline of Foods
Simple foods, or nutrients [Primary foodstuffs]
Organic foods, or oxidizable nutrients
Nitrogenous foods or proteïn [Tissue-builders and energy-yielders]
Proteids, or albuminous foods
Albumin-noids or gelatinoids (bone, gristle, etc)
Carbonaceous foods [Energy-yielders]
Carbohydrates, or starch and sugars
Fats and oils
Inorganic or mineral foods [Tissue-builders, food-carriers, etc.]
Salts
Water
Mixed foods (mixtures of the nutrients)
Vegetable foods
Animal foods
Accessory foods [For making other foods appetizing, etc.]
Condiments
Mustard, Pepper, Spice, etc.
Extractives
Vegetable flavors, Beef tea, etc.
Stimulants
Tea, Coffe, Cocoa,
Narcotic
Alcohol, if it were a true food, would come here.
[Key]
[Government analyses:]
White bread:
53.1
9.2%
4.1%
1.3%
35.5%
Corn bread:
41.3%
7.3%
2.2%
4.7%
38.9%
Oat breakfast food: (Cooked)
11.6%
2.8%
.5%
.7%
84.5%
Rice:
8.%
77%
12%
1.%
Potatoes:
2.2%
18.9%
.8%
1.%
78.3%
Celery:
3.4%
1.%
.7%
94.8%
Dry navy beans:
22.3%
59.6%
3.8%
1.8%
12.6%
Apples:
14.2%
.4%
.3%
.6%
84.6%
Nuts (Walnut):
16.1%
16.6%
63.4%
1.4%
2.5%
Whole milk:
.5%
3.3%
.7%
4.%
87.%
Butter:
85.%
11.%
1.%
3.%
Cheese:
2.5%
25.9%
33.7%
38.%
34.2%
Mackerel (fat):
7.1%
73%
18.8%
1.2%
Salmon:
5%
72.%
14.%
2.%
Whole egg:
10.5%
73.3%
14.8%
1%
Bacon:
47.1%
18.3%
9.4%
9.7%
Smoked ham:
38.8%
40.3%
11.1%
7.8%
Beefsteak:
18.8%
18.6%
1.%
61.9%

Processes of Digestion



Mechanical processes	Place of occurrence	Digestive fluid	Ferment or ĕn'-zīme	Action on foodstuffs
Mastication Insalivation Deglutition, 1st stage				
" 2d "				
" 3d "				
		Saliva	Plȳ'-à-lĭn	Changes starch to sugars
		Gastric juice	Rĕn'-nĭn	Curdles milk.
			Pĕp'-sĭn	Renders albuminoids soluble. Renders part of the proteid soluble.
			Hydrochloric acid (Not a ferment)	Aids in dissolving certain salts.
Peristalsis		Pancreatic juice	Trȳp'-sĭn	Renders nitrogenous foods soluble.
			Am-ȳ-lŏp'-sĭn	Changes carbohydrates to sugars.
			Stĕ-ăp'-sĭn	Emulsifies fats and oils.
			Milk-curdling ferment	
Divisive movements Peristalsis		Bile	None	Aids pancreatic digestion.
		Intestinal juice	Invertin	Reduces various sugars to grape sugar
Peristalsis elimination		None	None	Continues work of small intestine.

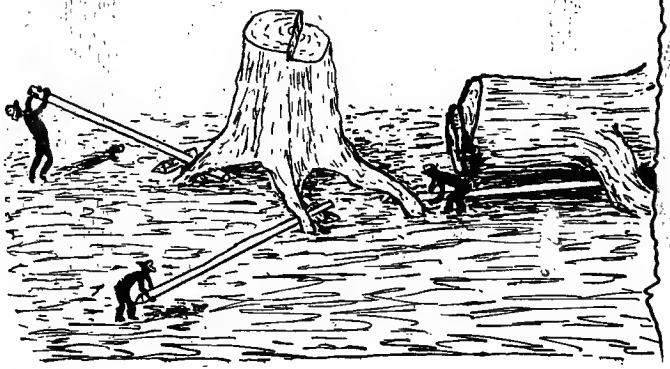


Some Light on the High Cost of Living in America (Yearly).

Classes of Levers

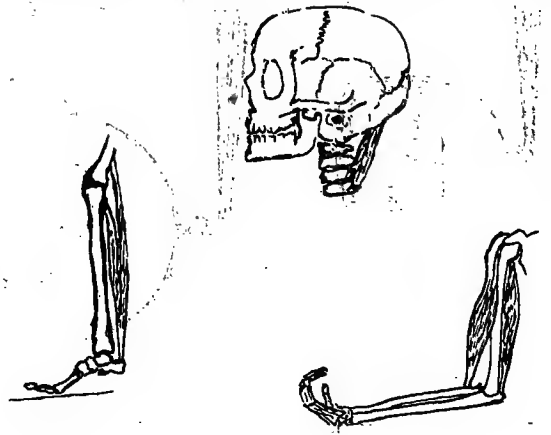
First class Power - Fulcrum - Weight
Second class: Power - Weight - Fulcrum
Third class Weight - Power - Fulcrum
What President's initials were F.W.P.?

In the illustrations below, what in each case is the lever, the power, the fulcrum and the weight? Name the class of lever represented by each case. With which form, other things being equal, could one lift the greatest weight? With which could one produce the fastest motion?



Application to the Human Body

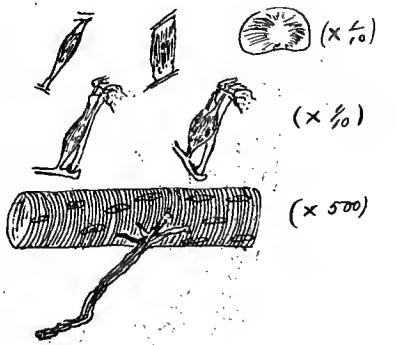
Point out the lever, the power, the fulcrum, and the weight in the cases illustrated below, and name the class of lever each case illustrates. What advantage comes from each arrangement, in the special work done in each case here illustrated? Find other illustrations in the body of the various kinds of levers and be able to show how they work.



Blackboard Physiology — Kinds of Muscle

1. "Voluntary" or striped muscle

1. Generally attached to one or more bones.
2. The muscle mass assumes various forms.
3. The muscle generally has tendons.
4. Contraction of the muscle complex and complete.
5. Rate of contraction may be slow or rapid.
6. The muscle cells coalesce to form fibers.
7. The cells are very complex in structure.
8. Cells striped in microscopic appearance
9. Fibers supplied with cerebro-spinal nerves
10. May be controlled by the will, tho it may also be reflexly (involuntarily) controlled.

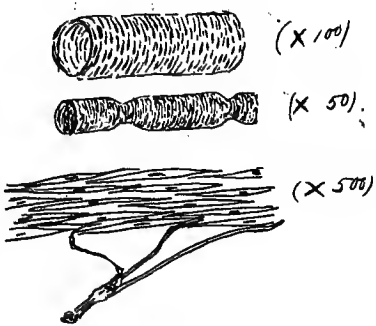


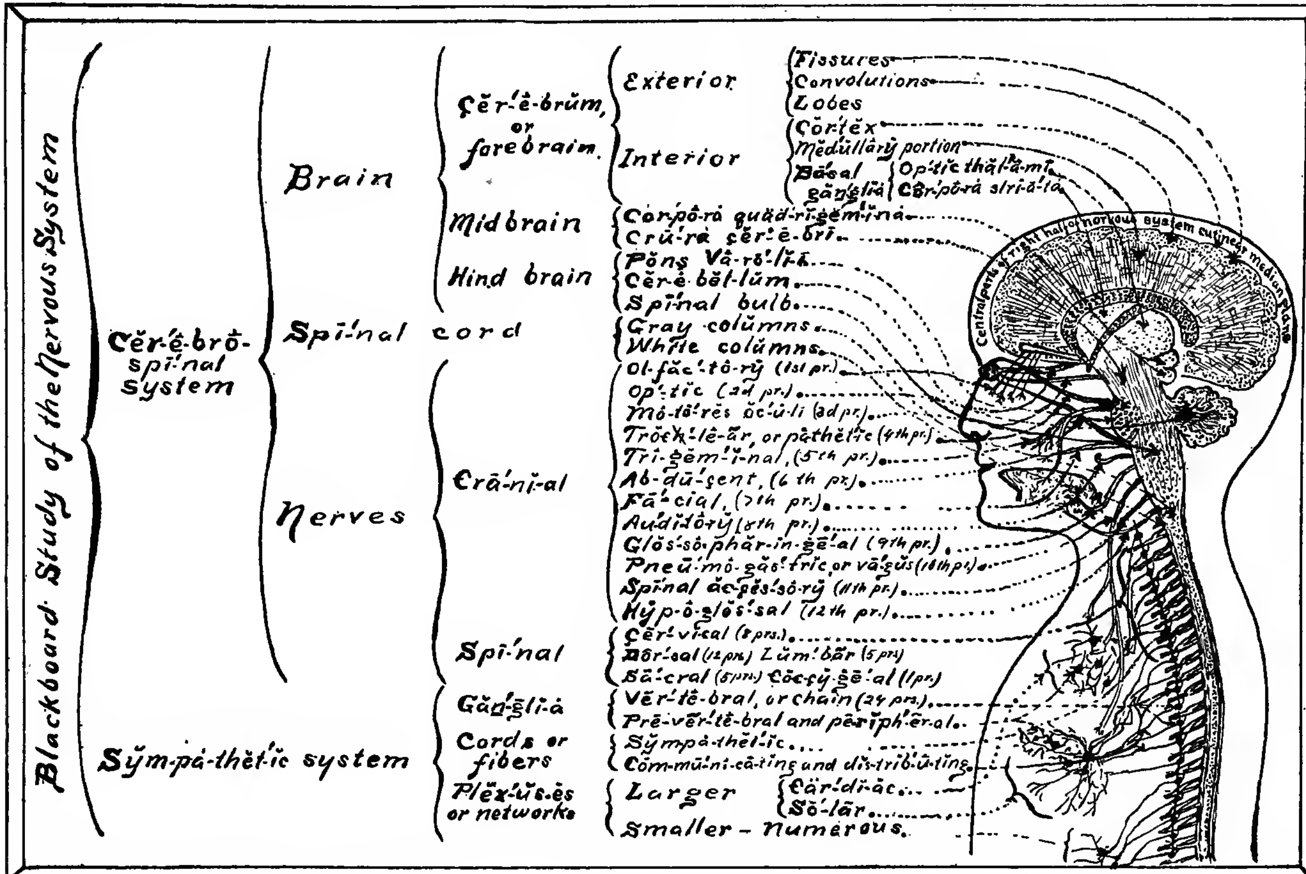
2. Heart muscle

1. Found only in the heart
2. Cells distinct, branched, and striped
3. Not directly under the control of the will.

3. "Involuntary" or unstriped muscle.

1. Located around hollow organs
2. Not provided with tendons.
3. Generally form expanded membranes
4. Method of contraction simple and peristaltic
5. Rate of contraction always slow.
6. Cells spindle-shaped and distinct from each other
7. Cell structure relatively simple.
8. Cells unstriped in microscopic appearance
9. Supplied with sympathetic nerves
10. Controlled by reflex (involuntary) action only




Blackboard Study of the Nervous System
Cĕr-ē-brō-spī-nal system
Brain
Cĕr-ē-brŭm, or forebrain.
Exterior
Fissures
Convolutions
Lobes
Interior
Cŏr-tĕx
Mĕdŭllary portion
Băsal găn-glĭ-a
Op-tĭc thăl-a-mī
Cŏr-pō-ra strĭ-ā-ta
Midbrain
Cor-pō-ra quad-rĭ-gĕm-ĭ-na
Crū-ra cĕr-ē-brī
Hind brain
Pŏns Vā-rō-lĭ-ī
Cĕr-ē-bĕl-lŭm
Spī-nal bulb
Spī-nal cord
Gray columns
White columns
Nerves
Crā-nĭ-al
Ol-făc-tō-ry (1st pr.)
Op-tĭc (2d pr.)
Mō-tō-rēs ŏc-ū-li (3d pr.)
Trŏch-lē-ăr, or pathĕtĭc (4th pr.)
Trī-gĕm-ĭ-nal (5th pr.)
Ab-dū-cent (6th pr.)
Fā-cial (7th pr.)
Auditory (8th pr.)
Glŏs-sō-phăr-in-gē-al (9th pr.)
Pneū-mō-găs-trĭc or vă-gŭs (10th pr.)
Spīnal ăc-cĕs-sō-ry (11th pr.)
Hȳp-ō-glŏs-sal (12th pr.)
Spī-nal
Cĕr-vi-cal (8 prs.)
Dŏr-sal (12 prs.) Lŭm-băr (5 prs.)
Să-cral (5 prs.) Cŏc-cȳ-gē-al (1 pr.)
Sȳm-pa-thĕt-ĭc system
Găn-glĭ-a
Vĕr-tē-bral, or chain (24 prs.)
Prē-vĕr-tē-bral and pĕrĭph-ĕr-al.
Cords or fibers
Sȳm-pa-thĕt-ĭc
Cŏm-mū-nĭ-cā-ting and dĭs-trĭb-ū-ting.
Plĕx-ŭs-ēs or networks
Larger
Cär-dĭ-ăc
Sō-lăr
Smaller – Numerous.
Central parts of right half of nervous system cut near median plane

The Tegumentary System

Skin

Parts

- **Epidermis or Cuticle**
  - Modifications
    - Nails
    - Hairs
      - Shaft
      - Follicle
      - Root papilla
  - Layers
    - Horny layer
    - Pigment layer
  - Papillary layer
- **Dermis or Cutis**
  - Reticular layer
    - Connective tissue
    - Blood and lymph vessels
    - Erector muscles
    - Nerves and end-organs

Glands

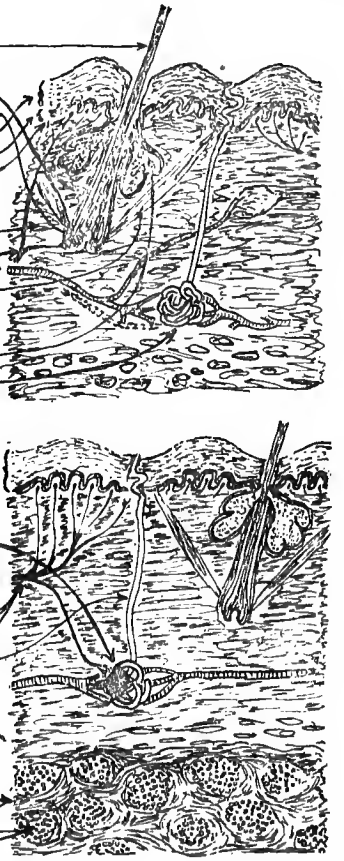
- Sebaceous, or oil glands
- Sudoriferous, or sweat glands

Functions

- **Primary, or Essential**
  - Protection
    - From evaporation of lymph
    - From disease germs
    - From mechanical injuries
    - From chemical injuries
  - Regulation of body temperature
  - Seat of cutaneous senses.
    - Touch, or pressure.
    - Heat and cold
    - Pain
- **Secondary, or Incidental**
  - Elimination of body waste
  - Absorption (very slight)
  - Respiration (1 to 2 % that of lungs)

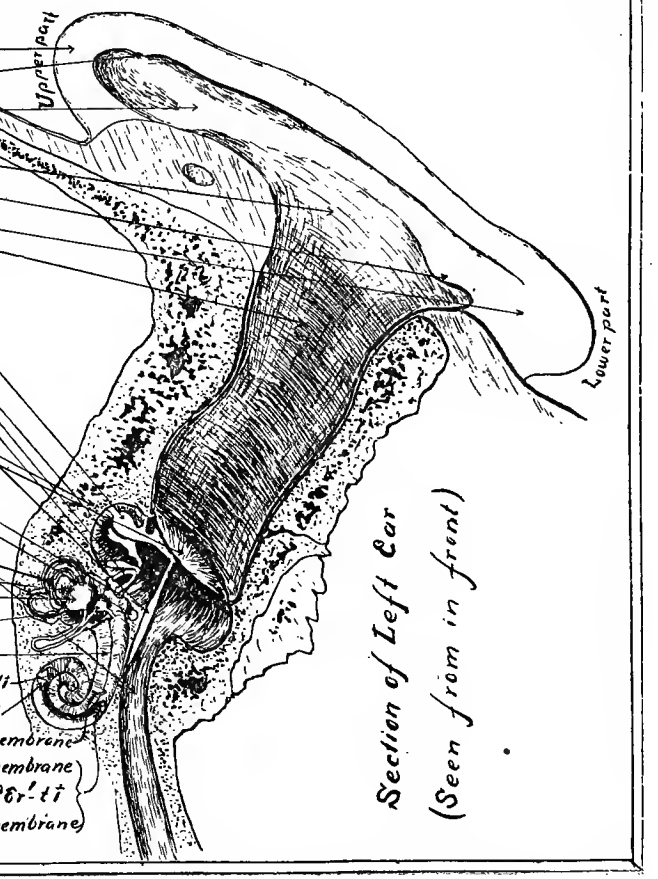
Subcutaneous tissue

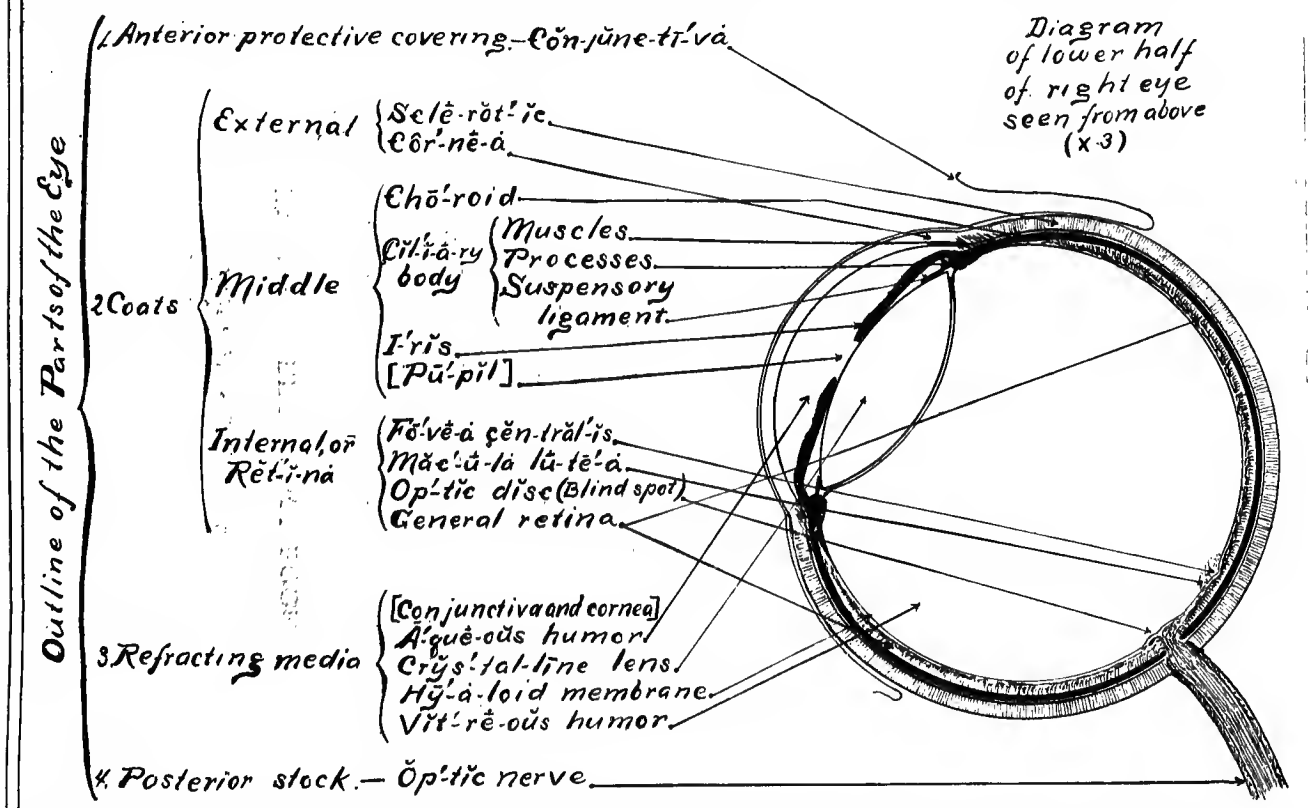
- Structure. — Areolar and adipose tissue
- Functions
  - Connect skin to parts beneath
  - A storage place for fats
  - Check the conduction of heat



Outline of the Parts of the Ear

- **External ear**
  - Pĭn'-nà or ạu'-rĭ-cle
    - Hē'-lĭx
    - Dar-wĭn'-ĭ-an tū'-bēr-cle
    - An'-tĭ-hē'-lĭx
    - Cŏn'-cĥà
    - An'-tĭ-trā'-gŭs
    - Lŏb'-ŭle
  - Au'-dĭ-tō-rў canal or mē-ā'-tŭs
- **Middle ear** or tўm'-pà-nŭm
  - Os'-sĭ-cles
    - Măl'-lē-ŭs, or hamer
    - In'-cŭs, or anvil
    - Stā'-pēs, or stirrup
  - Muscles
    - Stă-pē'-dĭ-ŭs
    - Tĕn'-sōr tўm'-pà-nĭ
  - Boundories
    - Tĕm'-pō-ral bone
    - Tўm-păn'-ĭc membrane
    - Ō'-val fō-rā'-men
    - Round fō-rā'-men
    - Cŭ-stā'-cĥĭ-an tube
- **Internal ear** or lăb'-ў-rĭnth
  - Vĕs'-tĭ-būle
    - Semicircular canals (bony and membranous)
    - Bony (with pĕr'-ĭ-lўmph)
    - Membranous (with ĕn'-dō-lўmph)
      - U'-trĭ-cle
      - Săc'-cŭle
  - Cō-cĥ'-lē-à
    - Bony cŏcĥ-lē-à
      - Spiral shelf
      - Scā'-là vĕs-tĭb-ū-lī
      - Scà'-là lўm-pà-nī
    - Membranous cŏcĥ'-lē-à
      - Vĕs-tĭb'-ū-lār membrane
      - Tĕc-tō'-rĭ-al membrane
      - Organ of Cŏr'-tī
      - Bă-sĭ'-lăr membrane




Outline of the Parts of the Eye
1. Anterior protective covering.—Cŏn-jŭne-tī'vă.
2 Coats
External
Sclē-rŏt'ic.
Cŏr'-nē-ă.
Middle
Chō'-roid.
Cil'-ĭ-ă-ry body
Muscles.
Processes.
Suspensory ligament.
I'rĭs.
[Pū'-pĭl]
Internal, or Rĕt'-i-nă
Fŏ'-vē-ă çĕn-trăl'-is.
Măc'-ū-la lū-tē'-ă.
Op'-tic disc (Blind spot).
General retina.
3. Refracting media
[Conjunctiva and cornea]
Ă'-quē-oŭs humor.
Crўs'-tal-līne lens.
Hў'-ă-loid membrane.
Vĭt'-rē-oŭs humor.
4. Posterior stock.—Ŏp'-tic nerve.
Diagram of lower half of right eye seen from above (x 3)

APPENDIX A

KEY LIST OF REFERENCE BOOKS

1. For Teachers.
   - Al.—Allen's "Civics and Health," Ginn and Co., Chicago.
   - Bai.—Bailey's "Sure Pop and the Safety Scouts," World Book Co., Yonkers-on-Hudson.
   - Ban.—Bancroft's "The Postures of School Children," The Macmillan Co., Chicago.
   - Co.—Conn's "Bacteria, Yeasts and Molds," Ginn and Co., Chicago.
   - B-H.—Laws, Rules, and Regulations, State Commissioner of Health, your State Capital.
   - Dr.—Dressler's "School Hygiene," The Macmillan Co., Chicago.
   - F-B.—Farmer's Bulletins, Dept. of Agriculture, Washington, D. C.
   - F-F.—Fisher and Fiske's "How to Live," Funk and Wagnall's, New York City.
   - Ho.—Hoag's "Health Index of Children," Whittaker & Ray-Wiggin Co., San Francisco.
   - H-S.—Hough and Sedgwick's "The Human Mechanism," Ginn and Co., Chicago.
   - H-T.—Hoag and Terman's "Health Work in the Schools," Houghton Mifflin Co., Boston.
   - Hr.—Hunter's "Civic Biology," American Book Co., Chicago.
   - Hu.—Hutchinson's "Preventable Diseases," Houghton Mifflin Co., Boston.
   - Ly.—Lyster's "School Hygiene," Warwick and York, Baltimore.
   - Mo.—Moore's "Keeping in Condition," The Macmillan Co., Chicago.
   - Te.—Terman's "The Hygiene of the Child," Houghton Mifflin Co., Boston.
   - To.—Town's "Habits that Handicap," The Century Co., New York City.
   - Wa.—Walter's "Principles of Health Control," D. C. Health and Co., Chicago.

Note—For information regarding the "socialized recitation," teachers are referred to a sixty-cent book by Whitney, entitled, "The Socialized Recitation," and published by A. S. Barnes and Co., New York.

2. For Pupils.

Col.—Coleman's Series, The Macmillan Co., Chicago.
I. "The Peoples Health."
II. "Hygienic Physiology."

Con.—Conn's Series, Silver, Burdette & Co., Chicago.
I. "Physiology and Health," Book I.
II. "Physiology and Health," Book II.

Da.—Davidson's Series, American Book Co., Chicago.
I. "Health Lessons," Book I.
II. "Health Lessons," Book II.

Gu.—Gulick Hygiene Series, Ginn & Co., Chicago.
I. "Good Health."
II. "Emergencies."
III. "Town and City."
IV. "The Body at Work."
V. "Control of Body and Mind."

Hu.—Hutchinson's Health Books, Houghton Mifflin Co., Boston.
I. "The Child's Day."
II. "Community Hygiene."
III. "Handbook of Health."

Je.—Jewett's Two Book Series (Gulick revised), Ginn and Co., Chicago.
I. "Health and Safety."
II. "Physiology, Hygiene, and Sanitation."

O-K.—O'Shea and Kellogg's Series, The Macmillan Co., Chicago.
I. "Health Habits."
II. "Health and Cleanliness."
III. "The Body in Health."
IV. "Making the Most of Life."

Ov—Overton's Hygiene Series, American Book Co., Chicago.
I. "Personal Hygiene."
II. "General Hygiene."

Ri.—Richie-Caldwell Series, The World Book Co., Yonkers-on-Hudson, New York.
I. "Primer of Hygiene."
II. "Primer of Sanitation."
III. "Primer of Physiology."

APPENDIX B

A DECALOG OF GOOD HEALTH

1. Nutriment.—Thou shalt select thy diet on a basis of six parts of starchy food, one part of fat, and one of albumin food; avoid thou an excess of purin yielding foods if thou wouldst escape many bodily ills.

2. Feeding.—Thou shalt eat thy two or three sufficient meals under conditions of good cheer and shalt masticate solids till they become as pea soup, that thou mayest not abuse thy food canal nor eat excessively.

3. Exercise and perspiration.—Thou shalt bring into daily activity all thy more important muscles up to the point of vigorous sweating, so that thou mayest introduce into thy blood sufficient fatigue stuff to insure recuperative sleep, and mayest exercise thy heat-regulating mechanism enuf to prevent thy taking colds.

4. Respiration.—Thou shalt give thy chest and trunk free breathing play, and shalt provide thyself with an abundance of wholesome air; whatsoever deep breathing thou indulgest in let it be done naturally in connection with thy daily vigorous exercise, and not as an artificial performance apart from thine other forms of exercise.

5. Cleanliness.—Thou shalt avoid all needless contact with pathogenic germs, and shalt not make thy mouth a "happy hunting ground" for these thine enemies; that thy presence may not be offensive to thine associates, thou shalt take a daily bath in the early morning only if thou workest amidst clean surroundings, and in the evening only if thou toilest where thou canst not remain immaculate.

6. Relaxation.—Thou shalt give thyself daily opportunity for approximately eight hours of quite slumber, and if possible a fifteen-minute siesta midway of thy daily tasks, that thou mayest be ever fresh and optimistic in all thy waking hours.

7. Elimination.—Thou shalt observe all the conditions that favor a regular and natural discharge of all the waste materials from thy body, lest thou store up poison in thy system that shall do thee harm.

8. Medicine and drugs.—Thou shalt abstain from the unnecessary use of drugs generally, and when thou partakest, thou shalt do so only under the direction of a wise physician. If thou wouldst be sane thou wilt employ water alone as thy satisfying beverage, and if thou wouldst be wholesome, thou wilt refrain from the use of all narcotics.

9. Clothing.—Thou shalt employ as thy clean and sufficient raiment only a good absorber and nonretainer of perspiration next thy body, such as meshwoven cotton, and shalt adapt thine attracive and serviceable outer garments according to thy varying thermal surroundings.

10. Mental hygiene.—Thou shalt suppress all useless forms of nervous activity; thou shalt practice cheerfulness all thy days and shalt never hate; thou shalt not indulge in self-pity nor dream for a moment that thou are the exclusive "it"; thou shalt regard thyself as counting for something in this world, but shalt consider others that thou mayest do them good, and that thy days may be long and cherished in the land.

So shalt thou be physically efficient mentally strong, and morally good.