FROM PAINTING BY URQUHART WILCOX

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FOURTH INTERNATIONAL CONGRESS ON SCHOOL HYGIENE

Died February 15, 1914

FOURTH INTERNATIONAL CONGRESS ON SCHOOL HYGIENE

BUFFALO, NEW YORK, U. S. A.
AUGUST 25-30, 1913

TRANSACTIONS

VOLUME II

Edited by Thomas A. Storey
with the assistance of Frederic A. Woll
and Julian Park

1914

Printed and Bound by
THE COURIER CO. OF BUFFALO
197-199 Main St., Buffalo, N. Y.

CONTENTS OF VOLUME II

Papers

SECTION I

THE HYGIENE OF SCHOOL BUILDINGS, GROUNDS, MATERIAL, EQUIPMENT AND UP-KEEP

SESSION I—SCHOOL BUILDINGS AND THEIR EQUIPMENT

SESSION II—OPEN-AIR SCHOOLS

SECTION II

THE HYGIENE OF SCHOOL ADMINISTRATION, CURRICULUM AND SCHEDULE

SESSION V—STATUS OF SCHOOL HYGIENE AND METHODS OF INSTRUCTION IN CITY, VILLAGE, AND COUNTRY SCHOOLS (PART I)

SESSION VI—STATUS OF SCHOOL HYGIENE AND METHODS OF INSTRUCTION IN CITY, VILLAGE, AND COUNTRY SCHOOLS (PART II)

SESSION VII—STATUS OF SCHOOL HYGIENE AND METHODS OF INSTRUCTION IN CITY, VILLAGE, AND COUNTRY SCHOOLS (PART III)

SESSION VIII—STATUS OF SCHOOL HYGIENE AND METHODS OF INSTRUCTION IN CITY, VILLAGE, AND COUNTRY SCHOOLS (PART IV)

SECTION I

The Hygiene of School Buildings, Grounds, Material, Equipment, and Up-keep

SESSION ONE

Room A. **Monday, August 25th, 2:00 P.M.**

SCHOOL BUILDINGS AND THEIR EQUIPMENT

L. N. HINES, *Chairman*

DR. HENRY R. HOPKINS, Buffalo, N. Y., *Vice-Chairman*

Program of Session One

LINNAEUS NEAL HINES, Superintendent of Schools, Crawfordsville, Indiana. "Some American School Rooms."

JOSEPHINE E. YOUNG, M.D., Chicago University. "Supernormal Environment in its Relation to the Growing Child."

A. J. SCHREUDER, M.D., Director of Medical Pedagogical Institute, Arnhem, Netherlands. "Hygienic and Sanitary Conditions of School Buildings in the Netherlands."

WALTER H. KILHAM, Architect, Boston, Mass. "The Hygienic Construction of School Houses From an Architect's Standpoint."

FRANK IRVING COOPER, Architect, President Boston Society of Heating and Ventilating Engineers. "The Planning of School Houses Against the Fire Hazard."

WILLIAM T. TOWNER, Secretary New York Society of Architects, New York City. "Modern Methods of Sewage Disposal in Rural, Country and City Schools."

HENRY D. HOLTON, A.M., M.D., President of the Austine Institute for Deaf and Blind, Vermont. "Sanitation of the Rural School House in the State of Vermont."

Papers Presented in Absentia in Session One (Read by Title)

M. K. HÅKONSON-HANSON, Head Master in the Common School, Trondhjem, Norway. "School Houses in Norway."

WILLIAM GRAY SWANK, M.D., City Health and Sanitary Officer, Crawfordsville, Ind. "Sanitation of the Consolidated Country School."

WILLIAM H. BRAINERD, Architect, Boston, Mass. "Sanitary Considerations That Should Operate in Selecting a Proper Site for a City, Rural or Village School Building."

SOME AMERICAN SCHOOL ROOMS

BY

Linnaeus Neal Hines

The opportunity of the teacher is supreme in all matters pertaining to the teaching of correct living to the coming generation. The child is forming his life habits and these habits can be made correct as well as incorrect. If every child everywhere from to-day on is taught just how to conserve his health, then we need not concern ourselves to any great extent as to how the child will live when he becomes an adult. The impressions of youth are the most vivid and the most lasting. The teacher takes the child when he is ready to form his habits of life. The great work she may do will find its fullest fruition in the coming generation. If we can surround the children in our schools with the proper physical as well as other conditions and then teach them correct habits of living, the next generation will be what we want it to be.

The problem in hand is not merely a school problem; it is a community problem as well. In the United States at least, where every public enterprise rests directly or indirectly on the will of the people, the school will not be for any considerable length of time very much better or very much worse than the people want it to be, either as to the physical condition of the building or the quality of teaching that is done in the building. The most skillful teacher or school administrator, anxious for better things, first creates a public sentiment for those better things and straightway he has them. This is also a community problem in a wider sense in that the school is serving the community directly as to making a healthier, more contented and more efficient citizenship. The opportunity of the school is tremendous.

The elements of the problem of hygiene in every school in this country may be enumerated as follows: securing a teaching body that knows what it ought to know of school hygiene and that is willing to apply and enforce all the laws of correct living in and about the school room; developing in the community adjacent to and supporting the individual school an understanding of and sympathy with the attempts of the school authorities to secure proper living conditions for the pupils while in school; developing on the part of those that control the school finances a willingness to spend whatever money is necessary to secure proper arrangements in regard to heating, lighting and other things that go towards making up proper surroundings for the pupils; the making of the school so near perfect in a sanitary way and so attractive that the pupils will want their homes to be like the school; the maintaining of competent, energetic and brave-hearted health officers and medical examiners that have the power and the disposition to over-ride ignorance, indifference and opposition and accomplish the thing that ought to be accomplished; a general community realization that the world of to-morrow will be what we make out of the children of to-day. These are the principal elements of every school hygiene problem, no matter what the clime in which the school may be located and no matter what other elements may be introduced into a given situation.

In some of the literature sent out in advance, advertising this Congress, we were given figures to the effect that of all pupils in the (United States) schools twenty-six per cent. suffer from eye strain, six to twelve per cent. suffer from enlarged tonsils, twelve to twenty-four per cent. suffer from nasal obstruction, two to five per cent. suffer from defective hearing, fifty to seventy-five per cent. suffer from decayed teeth, ten to thirty per cent. suffer from nervous disorders, five to twenty per cent. suffer from some deformity, one to fifteen per cent. suffer from skin diseases, one to sixty-seven per cent. suffer from pediculosis of the scalp. This list of defects does not cover the entire range of children's disorders or the troubles that may come out of children's being grouped together under unfavorable surroundings. This array of facts demands that something more shall be done in the way of caring for the health of the children in our schools. A constant supply of fresh air, good light, the right kind of clothing, plenty of baths and an abundance of nourishing food ought to be the portion of every child in every school in all lands. Medical inspection of and administration to the physical condition of these little citizens ought to be on the program of every school corporation. It was long ago "demonstrated that efficient medical inspection betters health conditions among school children, safeguards them from disease, and renders them healthier, happier and more vigorous." And this gospel is spreading throughout civilized countries. If it were not so, this Congress could not be held, with any considerable attendance. Every state legislature in the United States and the Federal Congress have considered, within the last few years, acts that had for their purpose the bettering of living conditions in the schools. The very fact that we hear so much of "playgrounds," "open-air schools," "school lunches," "medical inspection," and kindred terms in the general as well as the professional press, means that the people are coming to demand better school conditions for their children and better opportunities all around.

Each generation must try to mend the mistakes of the generation just passed. Each generation suffers from the mistakes of those that have gone before. The work of improving the health of the children in school in many places is retarded because of the necessity of using buildings erected in another time. Many cities in particular do not have sufficient room for their schools because of the high prices of real estate. Some time, perhaps, in some far off age, people will learn that room to educate boys and girls is more important than room to conduct a department store, a wholesale grocery or even a brewery. Practically every city school in the United States needs more room not only within its school buildings but in its playgrounds. This condition prevails all too generally, also, in rural districts where land is cheap compared to city prices. The old idea has been that almost anything will do for a school and the school has had to put up with almost anything. The public gets what it pays for. The disposition to cut down the amount expended for education since the beginning of organized instruction for the young has retarded and interfered with the proper administration of almost all schools. There is a disposition to talk about the amount of money that is being spent on the schools. There is a further tendency to criticise those that administer the schools because greater results are not obtained. If the huge school hygiene program that is upon us and that is to be given an impetus in all countries by this very Congress is to be put through, then more money must be forthcoming. There is no other way. As was said before, the public gets what it pays for. In the United States practically two billion dollars are spent annually for alcoholic beverages and less than three hundred million dollars for public education. If our schools could be considered by our nation as important as our drinks, every child would have a proper education under proper surroundings. The condition that prevails in our own country probably prevails in every civilized nation. Nothing except religion is as important as education, yet both religion and education measured by financial expenditure are not the most important things. All our school hygiene dreams as well as our other dreams will come to pass when the peoples really think them important enough to call for the spending of much larger sums of money. The wonder is that those that administer the schools have been able to accomplish so much when the limited funds and the low salaries that universally prevail are taken into consideration.

The one that undertakes to make a general survey of school conditions any where ought to have some such ideas and ideals as those that have been outlined. At the risk of being prolix, the writer has gone into a general view of school conditions. With this background, one can best invade school corporations, view actual conditions and partially at least succeed in finding the causes of the conditions that are not right. An inspection of hundreds of school rooms in this country leads one readily to believe that not all the money has been spent that ought to be spent in providing proper housing for the children in our public schools. A personal survey of actual conditions in American cities, a survey that began with the Atlantic Coast and ended with the great inter-mountain region of the West, as well as an indirect survey of many country schools, leads one to the view that in spite of all talk about progress and advanced ideas there is much yet to be done. The survey in hand includes not only personal inspection of many rooms but reports that stated at least a few facts about many other rooms. In all, at least one fact as to physical condition was obtained about almost 2,000 school rooms, 1,973 to be exact, scattered so widely that the picture here drawn may be said to reflect somewhat accurately conditions as they are in our country. The set of facts obtained is not uniform for all the rooms in question and, consequently, this report must necessarily be incomplete.

The temperatures recorded ranged from sixty degrees to seventy-six degrees Fahrenheit. The temperatures were taken down as shown by the thermometers in use in the school rooms. In all too many cases the school room thermometer was cheap and inaccurate. One room was at 60 degrees, two at 64, ten at 66, thirteen at 67, three at 73, one at 75, and ten at 76 degrees. The great majority of rooms in which temperatures were taken, one hundred and forty-four, showed temperatures ranging from 68 to 72, with most of these at 70, which seems to be accepted standard temperatures for the American school room where any attempt is made to regulate carefully the amount of heat in the room. A lower temperature would doubtless be better for all concerned.

In regulating the temperature in the school room, as much care should be taken with the location of the thermometer as with the excellence of the instrument. In this survey thermometers were found all the way from three to seven feet from the floor. In two buildings in a large eastern city 68 thermometers are placed seven feet from the floor. The temperature seven feet from the floor is not, under usual conditions, the temperature where the pupils are down in their seats. Further, the average teacher is not of such physical proportions that he can look at, on a level, a thermometer placed seven feet high. Reading such thermometers is likely to be troublesome and inaccurate. The great majority of thermometers are placed from five to six feet above the floor and on the walls. The best place for a school room thermometer is at or near the middle of the room and suspended from the ceiling so that it will be no higher than the pupils' heads when seated in their desks. A temperature reading, under such conditions, will show just what it ought to show, how warm it is where the children are. In only 29 rooms reported on as to this matter (29 out of 215), were the thermometers suspended from the ceiling so as to swing near the level of the pupils' heads.

Another objection to placing the thermometer on the wall is that it will record the temperature of the wall behind it as well as that of the air around it. It does not take much imagination to figure out about how much firing it takes to keep at seventy degrees a thermometer hung on a cold brick wall in the dead of winter. The temperature of the air about the pupils doubtless in most of such cases runs many degrees above seventy, to the great injury of the children's health.

Furthermore, the thermometer should not be placed near windows, especially if the windows are used at all for ventilation. And every school room window in even the coldest weather ought to be open at least a part of the time—at recess times at least. In many instances the school room thermometer is hung on a nail driven in the window casing. Its work can not be accurate under such circumstances. Out of 319 city school rooms, widely scattered over this country and actually visited in this survey, five had no thermometers. This shows a big majority with thermometers when we take into consideration the report of Dr. F. B. Dresslar, at the 1912 meeting of the National Education Association on "The Hygiene of Rural Schools." Dr. Dresslar reported that of 1,296 typical rural schools scattered over 19 states, two-thirds had no thermometers and that in the one-third remaining "it is manifestly clear either that many teachers know next to nothing about keeping a school room at the proper temperature, or else the conditions of the buildings are such that they can not keep their rooms at even temperature." The mistakes of improper temperature in the school room, together with poor ventilation, take away the energy and life of children, dull their minds and too often make their school work a failure.

As to lighting the city school rooms visited, out of 319 rooms, 174 received light from the left side only; 97 from the left and rear; 14 had cross lights; 7 from the right only; 8 from the right and rear; 5 from the rear only; 5 from the left and front. The few remaining had combinations of directions that were unusual and injurious. Other reports that were obtained and that concerned rural schools almost altogether, some fifteen hundred schools, showed only 30 school rooms with light from one side, 1,112 with light from two sides, 381 with light from three sides and 51 with light from the front as well as from other directions. As will be seen readily from the above figures, the practice in regard to lighting school rooms varies. The results are greatly in favor of the city school room, although there were instances where the city conditions were as bad as anything in the country. For instance, two city school rooms were found in which it was necessary to use artificial light and 34 rooms were entirely too dark. Six city rooms had no opening on the outside but opened on interior courts.

In the matter of heating, 77 city rooms were found in which the heat was obtained from steam or hot water pipes in the rooms. The ventilation was, of course, by means of the windows. Fifty-two rooms had a combination of direct radiation and the gravity system, 411 had the gravity system, and 772 depended on stoves for heat. Almost all of the stove-heated rooms were found in the country. Only here and there was a school room found in the city where a stove was in use.

Three hundred and seventy-five rooms were reported as depending or were found to depend on the windows for all ventilation. Of the more than three hundred rooms personally inspected only a third had air conditions that could be called excellent. The other ranged from fair to very bad. The poorest system of all as to heating and ventilating is to throw the responsibilities of these things on the teacher while she is at work in her room. She has other things to do and she forgets. The next best thing is to throw these responsibilities on the janitor, but the best way of all is to have high-grade automatic systems that take no attention from teachers and that get results.

Of the city schools visited practically all showed evidences of being swept not less than once per day and most of them looked well kept otherwise. The drinking water accommodations in fifty per cent. of the buildings could be called good, in twenty-five per cent. fair and in the rest questionable. The water conditions in the country schools were generally classed as poor. The colors of the school room walls were generally some shade of green or gray, or they were dingy from not having been cleaned or painted in recent times.

To go into further particulars, it hardly seems possible to believe that one big eastern city has a school building in which the light is admitted into the various school rooms from every possible direction. This particular building has one room into which the light is admitted from the left and the front, another room into which the light is admitted from three sides, another room into which the light is admitted from the back, another room in which there are cross lights, another room in which there are only two windows, one in front and the other on the left in front, another room in which it is necessary to keep artificial lights going throughout the day and other rooms in which the light conditions are almost beyond belief. Now the trouble is not that the school administration of this particular city is not progressive or not informed. The city in many ways stands among the leaders in this country. The building itself dates from the middle of the last century. There is apparent lack of funds with which to rebuild on the same spot or in a different part of the city. Real estate is too valuable, so most of the people say, for school purposes. Modern science has been able to make some modifications in the ancient architecture of this school building but, for the good of the children that must attend school within its walls, this building should be torn down and a modern one put in its place. However, in enumerating conditions in this fearfully bad school, not every thing can be laid at the door of the hesitating tax-payer. In every room the thermometer was placed seven feet from the floor. The ventilation in this unsanitary institution was obtained from the windows, the air was only fair, and conditions in a general way were deplorable.

Another building in this same city was visited. The fame of this particular school extends throughout the country. It is what may be called a modern building and is in many ways admirable in its construction and the care taken of it. However, there were found some conditions that need attention. The halls are dark. Several of the rooms have their only windows opening on a court that is closed on all four sides. A few rooms had direct radiation. The temperature ranged from 66 to 73 degrees. In one room all the pupils were seated facing the windows and in another room all of the pupils had their backs to the light. One room had no thermometer and another room had a broken thermometer. A good point was that the light came into rooms from the left, with a few exceptions. The air in the rooms was good. It was thoroughly washed and tempered before introduction into the school rooms. It did not have the deadening quality that the air has in the average school room and in most places of public meeting. Hundreds of thousands of dollars were spent in the construction of this building, and a big sum is spent annually in maintaining it. In spite of all this, however, there is need of improvement. The moral to the situation is that no matter how expensive a plant may be and how up-to-date it may be the constant attention of experts is needed to keep it as it should be.

A visit to an unusually large school in another section of this same city revealed some marked conditions, when we take into consideration the modern thought on school buildings. The building was kept clean, but there were other things to which to object: The heating was entirely by direct steam radiation. All the ventilation was by means of windows. The thermometers were placed from six to seven feet from the floor. In many instances the thermometers were near windows and, of course, could not record accurately the temperature in the school rooms when the windows were open and not even when closed, on account of the leakage of cold air at the windows. In a few instances the thermometers were placed at the ends of long rooms where they could not possibly record the real conditions prevailing as to temperature. In some rooms the light was admitted from the right. In other rooms the light was abominably bad. On the fourth floor the rooms were directly under the roof and the arrangement of windows in each of the rooms is so bad that the entire fourth floor ought to be closed up by legal action. In one of these rooms three small windows placed close together furnish the only outside light. In another, two small windows serve this purpose. In several other rooms the windows range from two to six in number but in no instance was the lighting satisfactory. The temperature in nearly all of these attic rooms ranged above seventy. There is need of some health missionaries there.

Still another building in the same city was visited and showed some interesting conditions. It was erected in the fifties. It contains 15 recitation rooms with direct steam radiation in all of them. The light is admitted from two directions in most of the rooms and in the others it comes in from only one direction. In the latter instance the rooms are too dark. Ventilation is by means of windows. Common, cheap thermometers are used in regulating the temperature. The cloak closets are in the recitation rooms and the odors from drying clothing pervade the rooms on damp days. This building should be abandoned.

A visit to a large building in another Atlantic seaport city showed favorable conditions, everything considered. This particular building takes care of the education of some 5,000 children. In the main, conditions are satisfactory, but the crowded district in which the school is located furnishes so many problems that it seems almost absolutely necessary that more room be provided not only for playgrounds and similar purposes but for getting many of the children a few stories nearer the earth. Some of the rooms in this building are lighted from the right side only. This fact is due to an arrangement that throws several of the school rooms together for chapel purposes. The plant is well kept and the teachers seem anxious to pay all necessary attention to the physical condition of their charges.

Inspections in other parts of the country, in city schools, showed conditions in the main somewhat above the average indicated above. The newer cities do not have the old buildings to contend with that the older communities have and many of the newer cities have a spirit of progress that demands the best things. Here and there was found a building that was a brilliant exception in that it seemed to be almost perfect in its condition, the care taken of it and the generally wholesome influence that it exerted over the lives of the children that attended it.

This paper has detailed some very bad conditions in order that the lesson of improper school conditions may be made more impressive. There is much that is hopeful in the public school system of this country, not only in methods and their effectiveness, but in all problems of sanitation as well.

The general points that may be put forward in conclusion are as follows:

Everywhere in our country there is the spirit of progress in matters of school sanitation.

Whenever our people get ready to spend as much money on public education as on some of the unnecessary and harmful things in which they indulge, there will come to pass readily all the things of which we dream.

There is a larger expenditure of sanitary appliances and measures now in our schools than ever before.

City schools spend more for such appliances and measures than do country schools.

The health supervision of city schools is more extensive and intensive than in country schools.

In heating, lighting and ventilation, city schools have the advantage over country schools.

The one great opportunity to lay the foundations of public health is found in the public schools.

Every school should have plenty of light, plenty of good, pure, unbaked, life-giving air, good water, bathing facilities, roomy playgrounds, school-prepared noon lunches, and all other things that go to the making of health.

SUPERNORMAL ENVIRONMENT IN ITS RELATION TO THE GROWING CHILD

BY

JOSEPHINE E. YOUNG

The data in this report were procured from the children of the experimental pedagogical department of the University of Chicago which is in the nature of a large private school, and is called the School of Education. The children come from the homes of the very rich, the well-to-do, and the faculty of the University. The report deals with 404 girls and 201 boys.

Measurements were made by expert physical education teachers trained in anthropometry. The studies in haemoglobin were carried out by Dr. Maria Blair Maver, a physician of large experience in clinical laboratory work. Uniform methods and instruments were used throughout.

The environment from which the children come varies. The faculty children live in ordinary material surroundings. A group of the others are brought up in great luxury—nursery maids and automobiles being the order of the day. The rest, largely in the majority, are the children of successful business men who, nevertheless, pursue a relatively simple life. These children are free from care, but not entirely from labor or responsibility. They walk back and forth to school unaccompanied, and, in general, express themselves with considerable freedom. Of 266 children in the Elementary School, 145 were breast fed, 26 both breast and bottle fed, making 68 per cent, 52 only were bottle fed. Most of them summer in the country, and many of them sleep out of doors, the average number of hours of sleep being 11½. 69 have had adenoids or tonsils, or both removed. The hygienic condition of the school is as perfect as equipment, science, money, and faithfulness can make it.

The accompanying tables are measurements of height, weight and lung capacity taken in the school year of 1912 and 13.

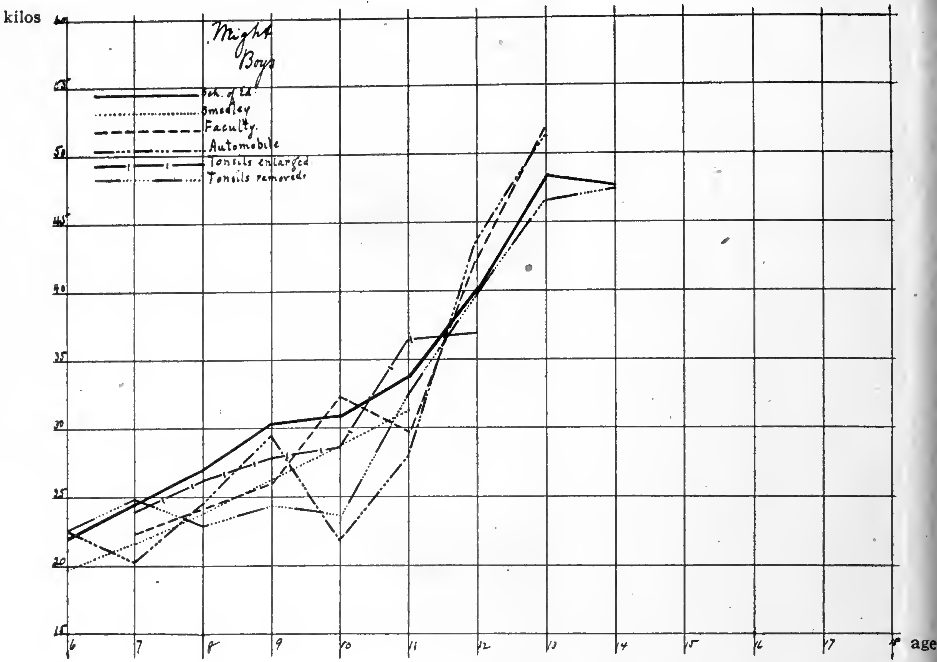


FIGURE 1

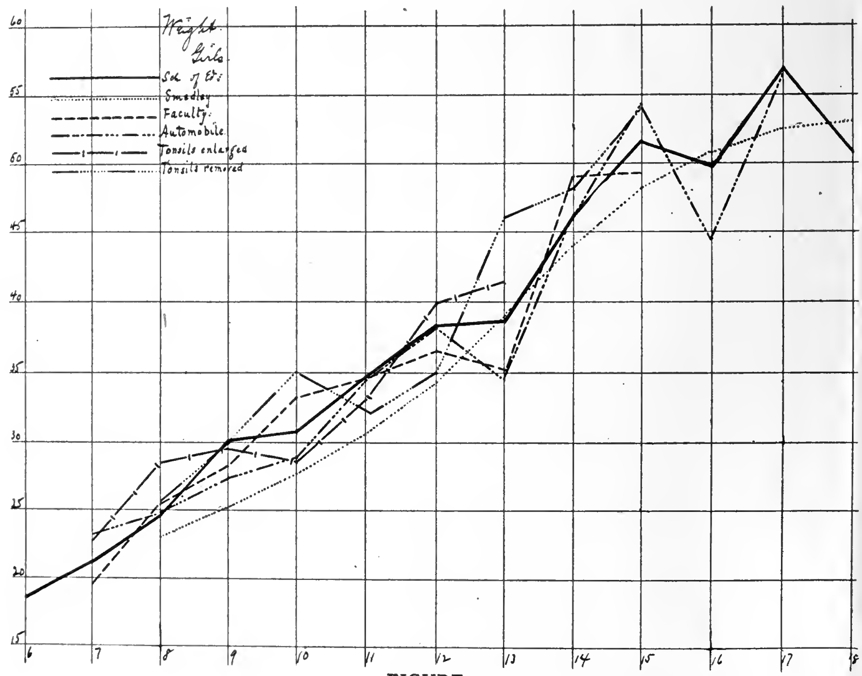


FIGURE 2

WEIGHT

BOYS

Age	No. of Cases	School of Educ't'n	Smedley	H. E. Laboring	H. E. Non-Lab.	Faculty	Automobile	Tonsils Enlarged	Tonsils Removed
6	21	22.	19.7	....	....	....	22.4	....	22.6
7	32	24.5	21.6	....	....	22.1	20.1	23.9	24.9
8	34	26.9	23.8	22.4	22.8	....	24.4	26.2	22.8
9	27	30.3	26.3	24.8	25.	26.	29.4	27.8	29.2
10	23	30.9	28.7	27.3	27.7	32.2	21.9	28.5	28.5
11	19	33.6	31.2	28.1	30.	29.7	27.9	36.4	32.4
12	17	40.	....	....	....	42.1	43.6	36.9	39.7
13	17	48.1	....	....	....	51.6	51.2	....	46.6
14	8	47.6	....	....	....	44.7	....	....	47.3
15	2	36.8	....	....	....	....	....	32.8	....
16	1	43.7	....	....	....	....	....	43.7	43.7
17	..	....	....	....	....	....	....	....	....
18	..	....	....	....	....	....	....	....	....

GIRLS

Age	No. of Cases	School of Educ't'n	Smedley	H. E. Laboring	H. E. Non-Lab.	Faculty	Automobile	Tonsils Enlarged	Tonsils Removed
6	2	18.6	....	....	....	....	....	....	....
7	10	21.1	....	....	....	19.6	23.1	22.8	12.
8	11	24.6	23.	21.9	22.3	25.3	24.7	28.5	25.7
9	13	30.1	25.2	24.	24.9	28.2	27.4	29.4	30.
10	21	30.7	27.8	26.2	26.9	33.2	28.9	28.5	35.
11	20	34.7	30.6	28.7	29.8	34.6	34.5	33.	32.3
12	16	38.3	34.3	32.8	33.9	36.5	38.1	38.9	35.
13	34	38.5	39.	37.1	38.3	35.2	34.4	41.3	46.
14	22	46.1	44.	41.4	42.	49.	46.1	....	48.
15	35	51.4	48.2	44.5	45.5	49.2	54.2	....	54.
16	23	49.7	50.7	....	....	....	44.5	....	....
17	27	56.9	52.4	....	....	....	56.3	....	....
18	7	50.9	53.	...	....	...	45.8	....	....

Number of cases in tables refers to School of Education.

	6 Yrs.	7 Yrs.	8 Yrs.	9 Yrs.	10 Yrs.	11 Yrs.	12 Yrs.	13 Yrs.	14 Yrs.	15 Yrs.	16 Yrs.
Boys—No. of Cases—Faculty Children..	...	...	...	...	4	3	4	3	2	...	...
" " Automobile " ..	...	...	...	...	10	13	4	6	...	...	...
" " —Tonsils Enlarged...	...	...	...	...	5	1	1	...	....	1	1
" " — " Removed..	...	...	...	...	2	8	6	6	3	...	1
Girls " —Faculty Children..	...	1	1	4	6	8	4	3	5	1	...
" " —Automobile " ..	...	2	2	2	5	8	6	4	6	2	2
" " —Tonsils Enlarged...	...	1	1	4	6	8	3	10	3	9	7
" " — " Removed..	...	3	5	4	7	7	2	5	7	5	...

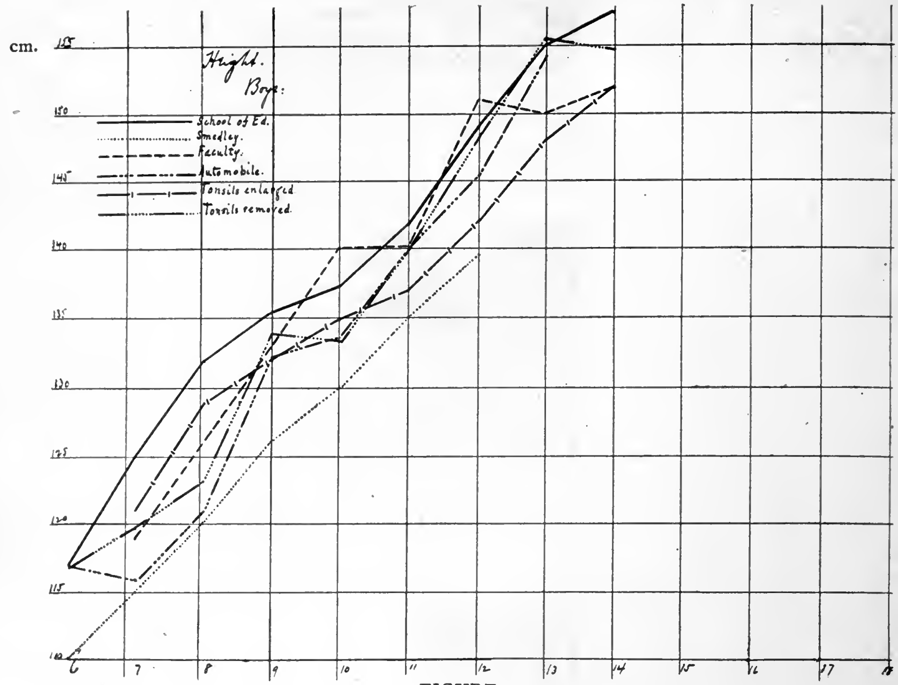


FIGURE 3

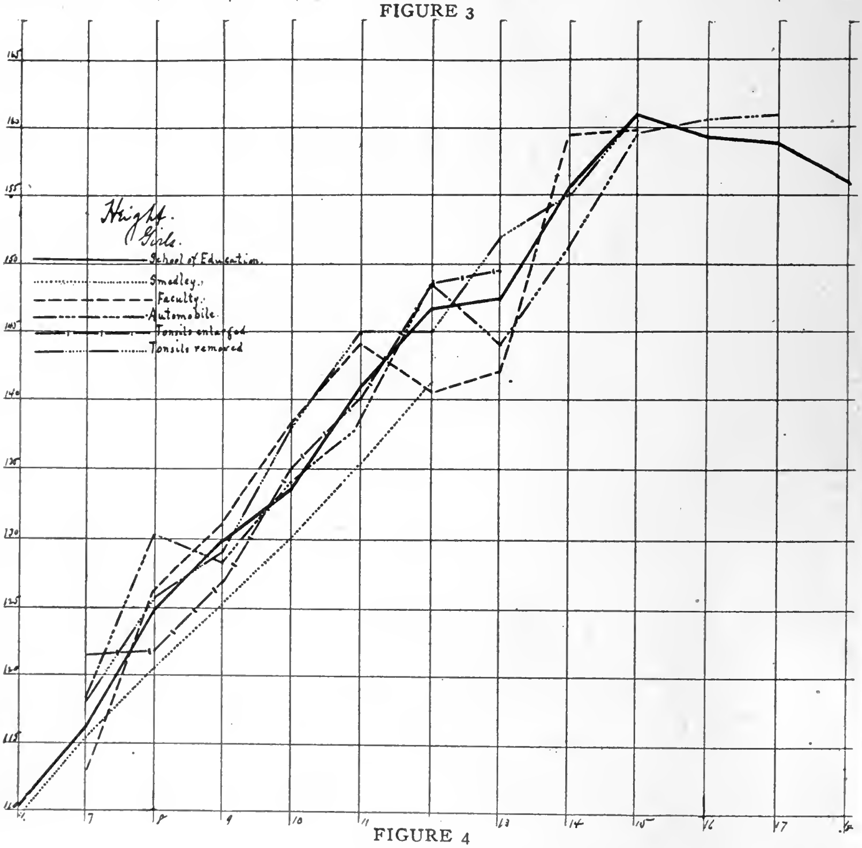


FIGURE 4

HEIGHT

BOYS

Age	No. of Cases	School of Educ't'n	Smedley	H. E. Laboring	H. E. Non-Lab.	Faculty	Automo-bile	Tonsils Enlarged	Tonsils Removed
6	21	117.	110.	....	....	....	117.	....	116.9
7	32	125.	115.	....	....	118.9	116.	121.	119.6
8	34	132.	120.	121.2	120.6	....	120.8	128.8	123.1
9	27	135.3	126.	126.4	125.	132.9	132.3	132.	133.8
10	23	137.1	130.	131.	130.	140.	133.6	134.8	133.3
11	19	141.7	135.	135.	135.	140.1	140.	136.9	140.
12	17	149.	139.5	....	....	151.	145.4	142.	148.3
13	17	155.	....	....	....	150.	154.2	148.	155.3
14	8	157.2	....	....	....	151.9	....	152.	154.7
15	2	....	....	....	....	....	....	....	....
16	1	....	....	....	....	....	....	....	....
17	.	....	....	....	....	....	....	....	....
18	.	....	....	....	....	....	....	....	....

GIRLS

Age	No. of Cases	School of Educ't'n	Smedley	H. E. Laboring	H. E. Non-Lab.	Faculty	Automo-bile	Tonsils Enlarged	Tonsils Removed
6	2	110.2	109.6	....	....	....	....	....	....
7	10	116.3	115.4	....	....	113.	118.3	121.5	118.
8	11	124.8	120.5	120.6	121.8	126.1	130.3	121.9	125.8
9	14	129.8	125.2	125.2	127.5	131.	128.1	126.9	129.
10	21	133.6	130.	130.3	131.3	138.3	134.	135.	138.
11	20	140.9	135.4	135.7	136.4	144.	138.	140.	144.8
12	17	146.6	141.3	141.5	142.7	140.5	148.5	148.2	145.
13	24	147.3	....	147.4	149.1	142.	144.	149.5	152.
14	19	155.6	....	152.1	153.2	159.5	151.4	....	155.
15	6	160.9	....	....	....	159.8	159.5	....	161.
16	.	159.2	....	....	....	....	160.5	....	....
17	.	158.9	....	....	....	....	160.8	....	....
18	.	155.9	....	....	....	....	148.8	....	....

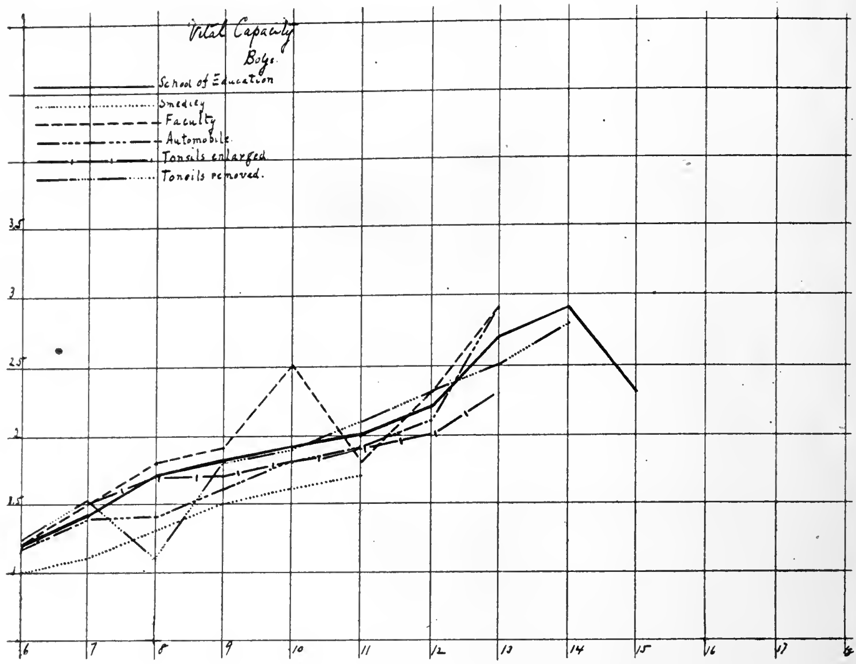


FIGURE 5

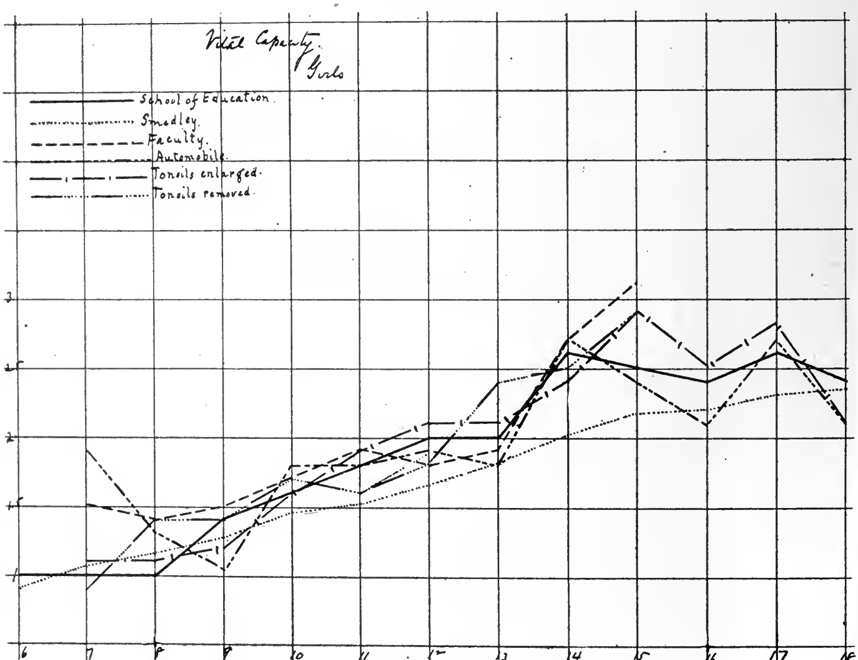


FIGURE 6

VITAL CAPACITY

BOYS

Age	No. of Cases	School of Educ't'n	Smedley	H. E. Laboring	H. E. Non-Lab.	Faculty	Automo-bile	Tonsils Enlarged	Tonsils Removed
6	21	1.2	1.	....	....	1.2	1.2	....	1.2
7	32	1.4	1.1	....	....	....	1.4	1.5	1.5
8	34	1.7	1.3	....	....	1.8	1.4	1.7	1.1
9	27	1.8	1.5	....	....	1.9	1.6	1.7	1.8
10	23	1.9	1.6	....	....	2.5	1.8	1.8	1.9
11	19	2.	1.7	....	....	1.8	1.9	1.9	2.1
12	17	2.2	....	....	....	2.3	2.1	2.	2.3
13	17	2.7	....	....	....	2.9	2.9	2.3	2.5
14	8	2.9	....	....	....	2.3	....	....	2.8
15	2	2.3	....	....	....	....	....	....	....
16	1	....	....	....	....	....	....	....	....
17	..	....	....	....	....	....	....	....	....
18	..	....	....	....	....	....	....	....	....

GIRLS

Age	No. of Cases	School of Educ't'n	Smedley	H. E. Laboring	H. E. Non-Lab.	Faculty	Automo-bile	Tonsils Enlarged	Tonsils Removed
6	2	1.	.9	....	....	....	....	....	....
7	10	1.	1.06	....	....	1.5	1.9	1.1	.9
8	11	1.	1.16	....	....	1.4	1.3	1.1	1.4
9	13	1.4	1.28	....	....	1.5	1.2	1.2	1.4
10	21	1.6	1.46	....	....	1.7	1.7	1.6	1.7
11	20	1.8	1.52	....	....	1.9	1.8	1.9	1.6
12	16	2.	1.66	....	....	1.8	1.9	2.1	1.8
13	34	2.	1.83	....	....	1.9	1.8	2.1	2.4
14	22	2.6	2.01	....	....	2.7	2.7	2.4	2.5
15	35	2.5	2.17	....	....	3.1	2.4	2.9	2.9
16	23	2.4	2.2	....	....	....	2.1	2.5	....
17	27	2.6	2.3	....	....	....	2.7	2.8	....
18	7	2.4	2.34	....	....	....	2.1	2.1	....

These will bear some study. To get a comparative estimate, they have been placed in juxtaposition to Smedley's well-established norms of Chicago Public School children, and to those of Boston laboring and non-laboring children taken by Bowditch for the Hoesch-Ernst compilation. The first striking fact is that the School of Education children average five centimeters more in height and between 2½ and 3 Kilos more in weight than Chicago Public School children. The same is true of vital capacity. An interesting fact in connection with this data is the statement of a noted pediatrician of Chicago who knows as physician many of these children. He says that in at least 100 cases both parents are smaller than the child, and seems to feel that, granting good conditions, the stock may improve.

Blood pressure and haemoglobin records, as shown by the tables, are also worthy of study.

Tables of blood pressure on both height and weight bases.

HEIGHT.

Cm.	Elem.	Boys. B. Pr.	
110–120	3.5–3.9	93	6 cases
120–128	3.9–4ft.	100	13 "
128–136	4. –4.3	106	18 "
136–144	4.3–4.6	107	16 "
144–152	4.5–4.9	111	2 "

WEIGHT. BOYS.

Kilos.	Lbs.	B. Pr.	
16–22	(35.2–48.4)	83	2 cases
22–27	(48.4–59.4)	102	17 "
27–32	(59.4–70.4)	106	23 "
32–37	(70.4–81.4)	109	7 "
37–42	(81.4–92.4)	112	3 "

GIRLS.

106–112	3.6 –3.9	85	2 cases
112–120	3.9 –4	96	4 "
120–128	4 –4.3	99	13 "
128–136	4.3 –4.6	102	33 "
136–144	4.6 –4.1	101	11 "
144–152	(4.10–5.1)	109	34 "
152–160	(5.1 –5.4)	106	76 "
160–168	(5.4 –5.7)	108	46 "
168–176	(5.3 –5.6)	103	4 "

GIRLS.

Kilos.	Lbs.	B. Pr.	
17–22	(37.4– 43.4)	94	5 cases
22–27	(48.4– 59.4)	97	19 "
27–32	(59.4– 70.4)	103.4	30 "
32–37	(70.4– 81.4)	105	26 "
37–42	(61.4– 92.4)	103	27 "
42–47	(92.4–103.4)	107	43 "
47–52	(103.4–115.4)	105	37 "
52–57	(115.4–125.4)	109	22 "
57–62	(125.4–136.4)	108	13 "
62–67	(136.4–147.4)	105	7 "

Comparative tables of Blood Pressure, according to weight:

Lbs.	Sch. of Ed.	Michael
30–40	..	95
40–50	94	100
50–60	97	107
60–70	103.4	112
70–80	105	116
80–90	108	122
90–100	107	126

Examination of this table records the fact that our children seem to be uniformly lower than Dr. Michael's carefully worked out table made from an examination of poor Jewish Institutional children. While the chief danger of blood pressure lies undoubtedly in the high ranges nevertheless low blood pressures have been regarded as significant by indicating a diminished vitality.

The haemoglobin studies were a surprise. To make them of value since but little has been done with the blood of healthy children, it was decided to get a control series of 100 from the Jewish Home for the Friendless. All of these children are poor, a number of the mothers being tubercular. They are well, though simply, fed four times a day. They are practically all below the Smedley norms, in physical measurements, some of them very much so. Comparative tables are given below. These include Cabot's statement that children between the ages of 5 and 15 have an average haemoglobin of 80.

	Haemoglobin	Haemoglobin				
Age	Jewish Home	Cabot	Sch. of Ed. Boys	No. of Cases	Girls	No. of Cases
6	79	80	72	7	76	6
7	82.7		76	13	79	11
8	86		77	10	81	11
9	82.8		79	13	81	12
10	85.4		80	10	79	24
11	82.2		81	1	83	11
12	86.2				77	20
13	87.5				79	23
14					78	13
15					86	22
16					77	13
17					80	22
	Aver. 83.9		Aver. 77		Aver. 80	

Examining these groups we find that the institutional children average five degrees higher than those of the School of Education, and that the latter fall slightly below the Cabot standard as well. Finding it difficult to explain the higher haemoglobin content of the blood of the institutional child, it was thought that possibly Semitic children as a race might show this phenomenon. A control study was therefore made with the haemoglobin findings of the Jewish children in our own school, but here it was found that 60% of Jewish girls and 83% of Jewish boys were below the general average of haemoglobin in the School of Education. Artificial living, perhaps, has an influence here also. Diet can be too rich and too sweet for the well being of the child.

Using our own averages of haemoglobin as the standard, a simple correlation between haemoglobin, height, weight, vital capacity, scholarship and industrial ability in the school, was attempted. The table symbolism will bear explanation: –Hb. refers to all those children whose haemoglobin was below the average for their age groups. +Hb. for those above. Correlating roughly Hb. with height, therefore we find that of those deficient in Hb. 29 were below in height, 33 above—a difference of 4. Of those with Hb. greater than that for their group, 26 were below and 29 above, a difference of 5. This is so small as to be practically insignificant. If we compare –Hb. and +Hb. throughout, we will find that in no case is the number of heights, weights, and lung capacities below normal, materially greater with –Hb. than those with +Hb. except in the cases of lung capacity and scholarship in girls. Good scholarship seems to occur more frequently in the anaemic than in the full blooded. In the main, there is no correlation brought out by this study. This fact may be accounted for on the ground that Hb. is a constantly changing property of the blood, but one would think that scholarship at least might be affected by anaemia. It is probable that the order is reversed and that the anaemia is produced by too close application to study.

Girls.				Boys.
–Hb.	29	below	Height	14 below
	33	above	"	18 above
+Hb.	26	below	"	12 below
	29	above	"	17 above
–Hb.	31	below	Weight	13 below
	24	above	"	13 above
+Hb.	33	below	"	14 below
	23	above	"	13 above
+Hb.	27	below	"	15 below
	29	above	"	12 above
–Hb.	29	below	L. Cap.	8 below
	28	above	"	19 above
+Hb.	24	below	"	9 below
	32	above	"	17 above
–Hb.	15	below	Schol.	5 below
	34	above	"	21 above
+Hb.	10	below	"	8 below
	37	above	"	15 above
–Hb.	5	below	Ind. Cap.	7 below
	45	above	"	18 above
+Hb.	5	below	"	4 below
	39	above	"	19 above

A study was made of 29 Elementary, 66 High School girls, and 21 Elementary boys as to the relation between persistently rapid pulse after exercise and haemoglobin. One method of determining the ability of the heart to restore itself after violent exercise is that of requiring the child to extend the arms upward so far as possible, and then quickly touch the floor with the finger tips, this act being repeated ten times in rapid succession. The pulse is then recorded at 15-second intervals for a minute. Of those children whose pulses were still above 100 at the end of the minute's rest, it was found that 75% of the Elementary boys and High School girls had Hb. below the average, while of the Elementary girls 63% had Hb. above the average. Hb. and weight apparently have no connection. 64% of a group of 28 girls with weight normal to our own standard showed Hb. below our average. In connection with rapid pulse a statement has been made to the effect that high blood pressure and persistently high pulse rates after exercise are usually correlated. So far as our figures go, this is disproved among our Elementary girls and boys, and University women, the latter being not otherwise referred to in this paper. 60% of our Elementary girls and 55% of our boys with rapid pulse had less than the average blood pressure for the school. 53% of our High School girls showed an increase. It may be remembered that in the first table blood pressure in the School of Education was shown to be uniformly lower than that given in tables hitherto published.

In examining the general tables with special reference to the prepubertal period of boys and girls, it may be seen that instead of the usual relatively rapid gain in development of girls over boys, that at no time in height or lung capacity, and in weight only at the age of 11 years—and then with a difference of no more than 1.1 kilos—can this relative gain be discovered.

It should be stated at the outset that scholarship and industrial capacity are indicated by the grades A, B, C and D.

A crude correlation of mental and physical development with the existence of adenoids and tonsils may be seen below. The number of girls having enlarged tonsils is 62; of boys 25.

Of the boys in scholarship	78%	are A & B
	22%	are C & B
Of the girls in scholarship	82%	are A & B
	18%	are C & D
Of the boys in Ind. Cap.	82%	are A & B
	18%	are C & D
Of the girls in Ind. Cap.	89%	are A & B
	11%	are C & D

Enlarged tonsils.

		Ht.	Wt.	L. Cap.	Schol.	Ind. Cap.	Hb.
Boys % no. above average		31	29	45	75	71	21
below	"	69	71	55	25	29	79
Girls % no. above	"	45	45	47	75	97	43
below	"	58	55	53	25	3	57

NOTE: To understand the above table and those immediately following like it, reading percentage number above or below, in Ht., Wt., etc., it may be of value to state that an average was made of each age for the various measurements separately. Each individual of that age was then compared with the average of his or her age group, for that measurement and marked plus or minus as he or she fell above or below the group. It must be borne in mind that boys of the special group are everywhere compared with boys of the general group, and girls similarly with the group of girls as a whole.

The sum of the averages for the different ages in Ht., Wt., Grip, and L. Cap. of the above group as compared with the sum of similar averages of the school as a whole is in

Boys

Sum of averages:	1132.3	Height	37	less for boys	.03 %
" "	186.2	Weight	9	" " "	.047 "
" "	13.7	L.Cap.	.8	" " "	.05 "

Girls

Sum of averages:	939.3	Height	5	greater for girls	.005%
" "	217.4	Weight	4	" "	.018 "
" "	23.3	L.Cap.	.5	" "	.021 "

Adenoids and Tonsils Removed:

		Ht.	Wt.	L. Cap.	Schol.	Ind. Cap.	Hb.
Boys % no. above average		37	37	69	71	85	32
below	"	63	63	31	29	15	68
Girls % no. above	"	63	52	63	72	87	50
below	"	37	48	37	28	13	50

Sum of the averages for the removed Adenoids and Tonsils Group:

School of Ed.

Boys.

Sum of averages:	1249.3	Height	25	less for boys	.02 %
" "	347.6	Weight	9	" "	.026 "
" "	168.	L.Cap.	.6	" "	.03 "

School of Ed.

Girls

Sum of averages:	1255.8	Height	15	greater for girls	.012%
" "	315.5	Weight	3	less "	.009 "
" "	159.	L.Cap.	.8	greater "	.005 "

In this group there is practically no variation.

There remain two interesting economic groups, both of which may be profitably compared with the average for the school, namely, the faculty children and those living in luxury who will be referred to as the automobile group.

Faculty Children:

	Ht.	Wt.	L. Cap.	Schol.	Ind. Cap.	Hb.
Boys % no. above	37	32	36	76	88	30
below	64	68	64	24	12	70
Girls % no. above	53	45	52	82	82	50
below	47	55	48	18	18	50

Sum of the averages for the Faculty Group:

School of Ed. Boys

Sum of averages:	1000.3	Height 16 less for boys	.016%
" "	255.0	Weight 3 " "	.01 "
" "	16.4	L.Cap. .2 greater "	.01 "

School of Ed. Girls

Sum of averages:	1255.8	Height equal for girls	
" "	315.5	Weight 4 less for girls	.012%
" "	159.	L.Cap. 1.6 greater "	.01 "

Smedley Boys	35 greater,	girls	24 greater in	Ht.
	2 "	"	18 " "	Wt.
	6 less	"	25 " "	Grip
	21 greater,	"	35 " "	L.Cap.

Automobile Children:

	Ht.	Wt.	L. Cap.	Schol.	Ind. Cap.	Hb.
Boys % No. above	36	32	69	82	65	40
below	64	68	31	18	35	60
Girls % No. above	37	39	43	70	89	44
below	63	61	57	30	11	46

Sum of the averages for the Automobile Group:

School of Ed. Boys

Sum of averages:	1092.1	Height 33 less for boys	.03%
" "	256.3	Weight 15 " "	.05 "
" "	14.9	L.Cap. 16 " "	1.06 "

School of Ed. Girls

Sum of averages:	1729.8	Height 4 less for girls	.002%
" "	473.	Weight 14 " "	.029 "
" "	23.3	L.Cap. 2 greater "	.08 "

Looking at the tables for the sums of the averages of the four special groups, it will be noted that the only appreciable variation from the average of the school, as a whole, is in the lung capacity of the boys of the automobile group, and here it is very little.

The apparently slight advantage, if any, of the child whose adenoids and tonsils have been removed, over the child with enlarged tonsils remaining intact, is very surprising. It is quite possible that a study of individual children before and after removal of tonsils, especially if continued on into the High School and College, would give us very different data, especially in those children who before operative interference were subject to frequent colds and sore throats—whose sleep at night was disturbed by snoring and emeresis—and who, in the day time, suffered unconsciously from lack of oxygen. Considering the intimate relation of the diseased lymphatic structures of the throat to rheumatism and deafness, it would, perhaps, be safer to remove them in every case.

To summarize:

1st: Children of the rich are much taller and heavier and have greater lung capacity than public school children.

2nd. Boys and girls are lower in haemoglobin and blood pressure than so-called "less favored" children.

3rd. The pre-pubertal increase in development of girls over boys is not seen on our charts.

4th. While the boys of the pre-pubertal period compared with girls show relatively and absolutely greater growth than boys of the public school, they also show when divided into groups representing physical handicaps or economic variation a slightly greater loss of vigor and development than girls of the same groups. This is to a larger extent true of haemoglobin.

5th. Of the four special groups studied, children whose tonsils have been removed show better physical measurements and conditions than those whose tonsils are enlarged and intact, though the difference is very much less than might be expected. This will bear a different kind of study.

THE HYGIENIC AND SANITARY CONDITIONS OF SCHOOL BUILDINGS IN THE NETHERLANDS

BY

A. J. SCHREUDER

Ladies and Gentlemen:

I will give you a short statement of the hygienic and sanitary conditions of school buildings in Holland, hoping to contribute to your appreciation of my little country. According to the desire of the Congress Committee that our Congresses should give more attention to the hygiene of the country schools, this paper deals in first line with such schools.

It is a well-known fact that Holland takes the first place in Europe in regard to the hygiene of school buildings. This does not mean that hygienic conditions of any school in Holland are better than those of any other school in any other country. But for aught I know, there is no other country in the world where the minimum standard of hygiene, to which every school of the country has to adhere, is as high as in Holland. This minimum applies to the town schools and the smallest country schools, to municipal schools and to private schools.

The strict rules for the construction and equipment of school buildings have been maintained and made severer in the course of time by succeeding governments of every political party. Since the State makes high demands, it also contributes to the costs of construction and maintenance, not only of the municipal but also of private school buildings.

I shall now give a review of the principal demands:

1. GROUNDS AND SITE.

The State makes no general binding instructions, but the school authorities must avoid as far as possible neighbourhoods detrimental to health and teaching, when choosing a site. When submitting the proposed plan to the Government for approval, a map of the neighbourhood with a radius of 600 feet must be furnished. The Government has however stipulated that the school buildings must stand free from other buildings, unless this cannot possibly be avoided.

Where the level of the ground has to be raised, in order to make the building water-free, the level has to be increased to 20 inches above the highest water-level of the neighbourhood. This is of the greatest importance from a sanitary standpoint in "watery" Holland.

2. The Building.

The State requires that the floor shall be made at least 8 inches higher than the highest point of the adjoining ground.

No school building may have any inside communication with any dwelling place, not even of the principal nor of the janitor.

The outer wall has to have a thickness of at least 9 inches for one-storied buildings, and 13 inches for two or more storied buildings. But this rule has been made still severer by the requirement that an outer wall, situated between south and west must be a "double wall" having an air space with a total minimum thickness of 15 inches.

There are no special requirements as regards the placing of the various rooms, as this depends too much on local conditions. The corridors must be well lighted and must be at least 7 feet 6 inches wide. The staircases must also be well lighted and at least 4 feet wide, and must be provided with railings on each side and shut off on the open sides by solid gates.

3. The Class Rooms.

No school-room may contain more than 56 pupils. In most schools the rooms do not contain more than 48 pupils.

The floor area provided for each pupil must be at least 8 square feet, the space at least 100 cubic feet. The height of the rooms is at least 14 feet. The distance between the blackboard wall and the front seat must be at least 4 feet, and if the blackboard is not attached to the wall this distance has to be increased to at least 5 feet.

The distance from the blackboard wall to the back of the back seats may not be more than 21 feet.

The passages between the seats and along the walls have to be at least 2 feet wide. The walls and ceiling have to be of a light and plain colour. Curved ceilings are not permitted. The floor must be flat and tight and not made of stone, unless paved by a material completely insulating it.

The doors may not have any direct communication with the open air, and all doors have to be made to open outward.

4. Illumination.

The ratio of window to floor area must be at least 1 to 5 if the light is not interrupted by trees or buildings, and 1 to 6 if that is the case.

The windows must be situated as far as possible to the left of the pupils; windows in the blackboard wall are not permitted. The whole room must be sufficiently lighted and if the daylight is too strong, it has to be moderated. The bottoms of the windows must not be more than 4 feet above the floor; the top must be as near as possible to the ceiling.

5. Heating and Ventilation.

No special system of heating is required. In the large towns the schools are often provided with hot-water heating systems. Most of the country schools are heated with stoves, which have direct communication with the cold air coming from outside. In this case the ventilation apparatus for the removal of foul air must be placed on the opposite side of the room. There must be an apparatus for artificial ventilation in each room. Besides, the upper sash of the windows must be arranged so as to be easily opened, and there must be at least one window which can be wholly opened.

6. Sanitary Appliances.

The number of closets and urinals must be sufficient and in proportion to the number of pupils. The closets for boys and girls must be separated.

The closets and urinals having communication with the school-room must be separated therefrom by a passage. These passages or the closets may not have a direct communication with one another and must be situated in such a manner that they can be easily controlled. Each closet and urinal and each passage must be sufficiently ventilated and lighted.

The minimum dimensions of closets and passages must be: Length, 3 feet; width, 2½ feet; height, 7½ feet. No special system is required. In the small country schools where only latrines (necessary cess-pools) or even pails can only be provided, the law requires a complete disinfecting system. Water closets are compulsory, even where there is a water supply.

The floors of the closets must be made of water-tight material; the walls plastered to at least 4½ feet above the floor, of a material which can be easily cleaned by water.

Coats, etc., are not permitted in the school-rooms; properly lighted and ventilated cloak rooms must be provided throughout.

7. School Furniture.

As regards the school furniture it is only required that the benches may not contain more than two seats each and must be provided with proper hip supports. The blackboards must be unpolished; polished boards are not allowed.

And herewith I have finished my review. I should like to point out again that those are the minimum demands which apply to every school building throughout Holland, also to the one in the smallest village.

I quite sympathize with the desire of the Congress Committee to draw special attention to hygienic conditions of rural schools. This problem has been solved in Holland in quite a satisfactory manner. If I add that the cleaning of the schools is quite sufficient as a rule (the Dutch people are known for the cleanliness of their houses and streets) then you will fully understand that the high reputation of the Dutch school buildings is well deserved.

THE HYGIENIC CONSTRUCTION OF SCHOOLHOUSES FROM AN ARCHITECT'S STANDPOINT

BY

W. H. Kilham

So much advance has been made in the general matter of the hygienic construction of schoolhouses that it seems as if the last word must have been said as far as the architects are concerned. No longer is the schoolroom air re-breathed by fifty pairs of lungs; the common drinking cup has been replaced by the bubbling stream; dust, once the bugbear of janitors, has fled before the combination of rounded corners and vacuum cleaner and the school-room is sunny, well lighted, warmed to a uniform temperature and in fact, almost sterilized by the various devices calculated to conserve the health of teachers and pupils. The schoolhouse of to-day, compared with that of thirty years ago, seems to be almost a perfect structure.

But there is another side to this. This germ-proof, dustless building is also a very costly one. City after city passes large appropriations to provide the "most modern schoolhouse that can be built." With their complicated equipment the construction of these buildings brings a formidable load on the helpless taxpayer. How many of the requirements of one of these buildings are fads and how many are in the class of things really worth while?

About the most important single item of schoolhouse expense, both in construction and maintenance, is that of heating and ventilation. Let us just examine for a moment into the matter of the supply and removal of air for the class room. The laws of Massachusetts and many other states provide that no new schoolhouse shall be occupied until after the installation of apparatus capable of delivering at least 30 cubic feet of warmed outside air per minute to each occupant. In a large building this can only be satisfactorily accomplished by providing a ponderous arrangement of boilers, fans, ducts and uptakes which sucks into the building the vivifying air from out of doors, draws it through and over steam coils which rob it not only of every particle of moisture but also whatever freshness it ever possess, then sometimes after attempting to restore the moisture by a "humidifier" or "air washer," delivers it cooked, devitalized and sterile to the children, who take it as a substitute for the winds of heaven. This sort of air is the present supply for not only school-rooms and assembly halls, but—think of it!—gymnasiums as well. The successful working of a "plenum system" as above described, depends absolutely on the outside windows being kept closed, as otherwise the air would forsake its prescribed path in each room from the inlet register via forty pairs of lungs to the outlet and immediately find an exit by the nearest opening.

In my young days I attended a public school which had been built in the year 1874 and was regarded as a model of all that a schoolhouse ought to be, but the subject of ventilation had at that time not been seriously considered by architects. A hot air register in the floor, with a wooden ventilating duct about a foot square was then considered a very up-to-date arrangement. When the air of the school-room, in winter, got to an impossible point our progressive teacher would order a girl to the piano open all the windows and put us through a standing series of exercises done to lively music, until refreshed and invigorated we sat down for another go at the books. The pupils of this room had the cobwebs cleared out of their brains by draughts of real outside air—*and there was no expense about it.* To-day a twenty-room school building, costing say $110,000.00, of ordinary plan has to cover 900 more square feet and contain perhaps 40,000 more cubic feet on account of space devoted to vertical lines of stacks. These stacks built of brick or other fireproof materials, together with the horizontal ducts cost perhaps $10,000. The cost of the plenum system over direct heating apparatus in such a building would be about $5,000.00. The extra consumption of coal might be variously estimated but probably amounts to not less than 75 or 100 tons per year.

Experiments with open-air classes have perhaps not yet demonstrated that perfection has been attained but the testimony in general shows that pupils in these rooms make a great advance both mentally and physically. It seems to me that much school work especially of the kind done in "study hours" could be profitably carried on in rooms built with windows only on one side so as to eliminate draughts and made to open the entire size of the brick opening and kept open, the extreme cold in winter possibly being tempered by direct steam coils. Recitations and blackboard work could be conducted in absolutely open rooms on the roof, made with glass sides to close when the wind is too strong. I was about to say, when it stormed, but in these times when the no-school signal sounds at the least intimation of rain, the remark seems unnecessary.

The gymnasium ventilation mentioned above is another anomaly. A town near Boston has recently built a splendid public gymnasium which I happened to pass on a fine October afternoon when the air was like wine and the cool autumn breeze a tonic to mind and body. The spacious playground in front of the building was absolutely deserted. I entered the building to see what it was like. In the great hall, warmed by the expensive "plenum system" where the sunlight, streaming through the high windows of the roof lit up the millions of dust particles in the air, thirty or forty high school boys were practicing football tactics. Possibly the tactics were dark and fearful secrets, only to be elaborated in private, and not shown to the light of day until the fateful moment, but at any rate the oxygen of that beautiful afternoon had no place in the hygiene of that particular high school.

I spoke just now of the possibility of building open-air rooms on the roofs of large school buildings and in this connection I feel like speaking a word for the roof playground. The expense of making a roof surface suitable for a playground has frequently prevented its construction. When built these playgrounds have generally been made of slate tiles set in cement over waterproofing on a roof structure of tile or reinforced concrete. Why should not a roof of second-class construction be built on the principle of a ship's deck with splined planks made tight with oakum and waterproofed underneath and used for a playground? Certainly the cost per square foot would be less than that for city land!

The school-room floor is perhaps the part of the building on which the least progress has been made. Wood, the wearing surface generally used, is liable to wear out soon if not of the very best quality, it shrinks, leaving cracks to collect dirt, splinters, and is more or less absorbent. Its principal value, aside from cost, lies in its ability to receive the screws which fasten the furniture and the furniture can be moved without too greatly disfiguring it. Battleship linoleum, which has been tried, has the disadvantage of not holding screws and being badly disfigured by the holes. The same objection applies to all the various cement preparations that I know of. A ready market awaits the advent of a smooth impervious floor surface which will stand water and is adapted for fastening down and changing furniture. Rounded corners at the junction of floors and walls have been insisted upon by many school-house sanitarians. Unless perfect mechanical execution can be attained, it seems to me that the principal value of this device, especially in these days of vacuum cleaners, lies in the moral effect which it produces upon the beholder. The cove moulding, if of wood, generally shrinks away from the floor and if of some cement-like substance a perfect joint has to be formed with the floor material. I recently visited a great new hospital near Boston where everything, particularly architectural beauty, had been sacrificed to theoretical practicality. The floors were of battleship linoleum and the coved bases of cement, all perfect. But the joint between the two! Rough, uneven, of varying widths, it secreted more dirt and held it safe from any form of cleaner than any wooden floor would have done.

In England the open fireplace with its fire has long been the undispensable adjunct of every school-room. With the help of casement windows kept liberally open these fireplaces have kept the class room air fairly good, although the rooms are frequently small and badly crowded from our point of view. But now the 'central ventilation' is creeping in and the fireplace draught is prevented, although I found last fall one intelligent schoolmaster to whom I commented on the absence of a ventilating register. "Oh, yes, we have it, sir," said he, "we only hung a picture over it," and pushing a picture aside he disclosed a small and inoffensive grating in the wall which was hardly a formidable rival to the fireplace.

I am conscious that the arguments I have advanced may seem weak, reactionary and absurd to those familiar with the problems of school operation. Under the prevailing laws indirect ventilation to the extent of 30 cubic feet per minute per person is obligatory and probably rightly so, for in working with open windows the personal element plays perhaps too prominent a part and the difficulty of supervision becomes too great. But if it is possible to give the children invigorating air and incidentally reduce the enormous cost of schoolhouse construction, I believe the matter is worthy of investigation and the gratitude of parents and taxpayers will await the successful investigator.

THE PLANNING OF SCHOOLHOUSES AGAINST THE FIRE HAZARD

BY

FRANK IRVING COOPER

Uneconomic economy—the saving of a certain amount of money by cheap construction—results in the ultimate loss of much valuable property and still worse occasionally results in awful destruction of human life.

The only remedy for this condition lies in the enactment and enforcement of strict state regulations. The people as a whole favor efficient fire protection but the trouble is that when it comes to the question of a single building the local public almost always votes for the cheapest construction. Officials in charge are always ready to make their administration look more economical by cutting out safety appliances in the foolish hope that no occasion will come for their use. Yet not only is the number of fires increasing but the danger in the case of a single fire grows greater owing to the habit of centralization; small schoolhouses are replaced by a large central building and unless this be built fire-resisting and divided into isolatable sections the peril of loss of life is enormously increased.

The public attitude toward such buildings as theaters and factories in which private owners are responsible for the lives of patrons or employees, has forced proper attention to be paid to the fire hazard in these buildings and the result is an enormous saving in property as well as the lessening of danger. Municipal buildings and especially schoolhouses should be treated from the same point of view.

Legislatures will enact the necessary regulations and executives will enforce them only when public sentiment demands and the public as a whole is heedless, except when feverishly aroused by some great catastrophe. Underwriters have perhaps the most complete information as to fires and fire dangers; their rate scales, based upon the law of averages, show the marked difference between protected and unprotected buildings, and the differences in value between different forms of fire protection, but it is of no especial interest to them to instruct the general public as to their findings while the public will never of itself pause to make deductions from insurance rate scales affecting public buildings.

Only the most thoughtful and farsighted among the school officials, realize the perils and responsibilities of their position while having charge of scores of children in buildings often little better than firetraps. The great majority of teachers are so absorbed in their specific task of instruction that they have little time to consider such dangers and still less time to spend in vain efforts to awaken the public to the situation. But it is chiefly the teachers and superintendents who are responsible for the move toward centralization owing to their desire for increased efficiency in administration regardless of the increased fire peril.

Architects have the greatest knowledge of planning and construction, they know the fire resistance of materials and have the greatest chance in planning new buildings to convince the committee in charge, of the necessity of the best protection against fire. It is to the interest of every architect that his building shall be constructed in the best possible way and that his public shall know why it is best. In case of accident due to poor arrangement it is the architect who receives well-deserved public censure.

While all school buildings should be erected of fireproof materials throughout such construction is usually prohibitive by reason of its first cost. Even the City of Boston now builds its outlying school buildings of second-class construction and conditions justify the architect who designs this class of buildings. But no architect and no school authority can be justified who omits such simple and inexpensive methods of construction as are herein recommended which insure a building that will resist fire a sufficient length of time to allow complete emptying even without previous fire drill practice.

This paper will consider buildings of second-class construction, these being 90% of all school buildings erected. The small number of first-class construction buildings are in large towns or cities and are adequately protected by building regulations.

In planning the school building the architects should aim to use the simplest form of skeleton.

The skeleton is determined by the main halls and corridors of the building. The stairways are fixed by considerations of convenience in going from floor to floor, safety in case of fire and ease of exit.

Mr. H. F. J. Porter, the authority on fire drills, has said it was impossible to limit the number of people per story to the capacity of a stairway.

Safety must be reached by having two sets of egress of ample proportions, one set located on each side of a division wall but each accessible from every part of each floor.

Fire division walls in the modern school building is a proposition which the school authority is slow to accept.

It has been my experience that school authorities are difficult to impress with the necessity of providing against fire. In one of the largest high school buildings in Massachusetts whose main corridor is over 300 feet long, two cross partitions of wired glass had been designed to divide the building into three sections, these partitions were removed over the architect's protest because the school authorities claimed the corridor monitor could not have an unobstructed view of the entire corridor if these fire partitions remained.

How far the authority of a school monitor could control that corridor in case of panic is a question for the mothers and fathers of children who attend this school.

While it is difficult to plan for fire division walls in school buildings it is usually possible to provide two independent ways of egress from the schoolroom to stairways situated far apart and so separated that no fire is at all likely to occur which will effect both stairways simultaneously. This method of providing escape has been approved by the Massachusetts State Inspectors. (See figure 1.)

The high school building at Bennington, Vermont, is planned to meet Mr. Porter's method of providing horizontal escape by having across the main corridors doors which are held open by a chain with a fusible link. The chain running from this link is also attached to an electric catch which is released by the same current that sounds the fire gongs. Sounding the fire gongs closes the door across the corridor thus dividing the building into two sections each with its independent stairways. This will allow of safe escape for a much longer period than could be had with the usual open corridors and staircases. (See figures 1 and 2—fire door at A.)

Staircases should always be in plain view and the architectural treatment of the corridor at stair points should be such as to suggest the way of exit. All stairways should discharge directly to the outside of the building and not into corridors.

The outside walls at point of discharge should be brought to the edge of the door frame, doing away with the angle which in many cases of panic has caused loss of life. (See figure 3.)

Staircases should be built in wells shut off from corridors by doors glazed with wired glass; these doors should have no locks nor latches, should swing out only and should have self-acting door closers.

Both stairs and their supports should be fire-resisting, neither slate nor marble should be used for treads unless supported under their entire width and length.

Turns in stairs should always be accomplished by landings or platforms. No winders should be allowed. There should never be less than three nor more than fifteen risers between platforms nor should a platform or landing be less than four feet wide. In large school buildings stairs should extend to the usually flat roof, from which there should be a separate escape to the ground.

The last parts of a building to succumb to fire should be the stairs.

All doors should invariably swing in the direction of the outgoing passage.

Doors to stairways should have automatic closing devices, exit doors should have an approved type of push bar device that will unlock the bolts by pressure against the bar.

Some authorities have omitted all locks on classroom doors and there is much in favor of this method wherever it is not necessary to secure rooms against misdemeanors.

All locks to schoolrooms, closets and exit doors should be those that can never be locked against the outgoing person.

Book lifts should always be enclosed by solid walls or be lined with metal from top to bottom.

While from the point of the fire engineer wood furring should never be employed, yet the difficulty of securing damp-proof solid walls, when the plastering is placed directly on the outer masonry walls, and the cost of metal furrings or tile lining necessitates wood furring as the only method left for the architect under the appropriation.

Wood furrings should be stopped off by plaster at the floor and ceiling and midway between. Even metal furrings should be fire stopped to prevent the spread of fire by draughts of superheated air or flaming gases.

There are other places where fire stopping should be used, some of which are shown by the accompanying illustrations. (See figure 4.)

The casing of walls with wood sheathing should be entirely done away with, not only because it is a help to the spread of fire, but on account of its unhygienic properties, harboring germs and making places for the lodgment of dust. Its place should be taken by hard plaster, to which is glued burlap.

The well designed modern school building has all ornamental woodwork omitted and the necessary wood trim about doors, windows and blackboards reduced to minimum.

Cast iron construction members, if unprotected, is considered unreliable by fire engineers and should not be used.

The architect should advise against pitched roofs for school buildings not only because it is difficult to design such a roof in a fire-resisting manner, but also on account of the tendency of school authorities to make use of the attic space, which is liable to be stored with rubbish and cast away furniture.

The roof covering, if possible, should be of tile or slate imbedded in a suitable roofing composition, after this comes a metal roofing over heavy asbestos paper, or composition gravel or slag using 300 pounds of slag or 400 pounds of gravel per 100 square feet of roof.

All school buildings should be equipped with chemical fire extinguishers of a type approved by the National Board of Fire Underwriters. Additional protection should be planned for by providing an efficient standpipe of two and one-half or three-inch pipe connected to the public water mains and located at some central point and having hose connections on each floor including the basement. As a matter of precaution a small pet cock should be placed on this stand pipe to allow inspection of water service. At each hose connection there should be a sufficient length of Underwriters' hose with play pipe to reach any part of that particular floor. This hose should be supported by a swinging rack in which the hose is folded layer by layer or else by a rack where the hose is looped over wooden pins which drop out when the hose is run out.

The necessity of safeguarding large property values from destruction by fire caused automatic sprinklers to be invented; they are chiefly used in factory buildings and have reduced the average loss per factory fire from over $10,000.00 to $265.00 and so far as records show no life has ever been lost in a sprinkled building when the sprinklers were in order and working. There is nothing sensational about the work of automatic sprinklers; they save lives by striking at the fire itself and checking it before it has become a dynamic force for devastation. At the same time they sound an alarm, warning every one that they are fighting fire somewhere in the building.

Statistics show that every week ten school buildings are destroyed by fire in the United States.

The Collinwood fire, with all its horrors, may be repeated any day, so little have the lessons taught by that fire been heeded. Yet automatic sprinklers installed in school buildings would practically render such a catastrophe non-existent.

A rapidly-spreading fire costs many lives. No fire can spread rapidly under sprinklers.

That the automatic sprinkler has become known and approved by school authorities is shown by the example of this City of Buffalo, where its public school buildings, 1 to 62 inclusive, its Central High School and its Lafayette High School all have the basement protected by automatic sprinklers.

In addition to the usual alarm gongs about the building, there should be an alarm to the fire department. This can be effected by having a standard alarm box placed within the building, or as in the case of the Boston schools, an auxiliary to the gong alarm may connect the school alarm with that to fire headquarters. The system allows ringing the school gongs without notification to the fire department, but the fire department cannot be called without sounding the school gongs.

Boiler rooms should be placed outside of the buildings. When this is not possible boiler and heater rooms should be isolated by means of brick walls having thoroughly fire-resisting doors with automatic closing devices. Should the floor over the boiler be of ordinary wood joist construction on account of small appropriation, the joists should be filled in solid with mortar or mineral wool and the ceiling be of thick plastering on metal lath wired to metal furrings.

All ceilings of cooking and manual training rooms should be treated in the same manner as the ceilings over boiler rooms.

Prof. A. D. F. Hamlin has said that the "schoolhouses of any community are gauges of its enlightenment," also "it requires only the diffusion among the people of correct information on the subject to secure from them all that is necessary for the erection of suitable and creditable school edifices."

I believe this is true, yet it is difficult to put conditions plainly before the people and secure their action.

In one New England town a high school building of three stories was being built, with wood laths for plastering, the committee in charge of erection would not permit the change to metal lath on account of expense. A public appeal to the townspeople however, made it clear to the committee that the safety of the children against the saving of $1,000.00 was not to be considered. Wire lath was then voted.

Any informed and awakened public will demand that an architect shall design school buildings which shall meet the demands of the educators and protect the lives of the school children. When law holds him criminally responsible for faulty planning and construction reform will be immediate.

How the position of the architect is now controlled by public opinion was clearly stated by Mr. George Bruce in a manual published in 1903. He says: "Schoolhouse designs are made to be accepted rather than to educate public taste. The architect must try to please the taste or fancy of prospective patrons, when he is thrown into close competition, he cannot afford to deal in ideals, he must meet conditions."

And Mr. E. M. Wheelright, in his book on school architecture, published two years before the above, stated: "In one large Ohio city, where the authorities pride themselves upon the low cost of schools, there is a building four stories in height, with stud interior partitions, furred walls, and no fire stops. No metal or brick ducts are provided for ventilation; the foul air is supposed to find its way through the hollow spaces in floor and walls to the space between roofs and the ceilings of the upper rooms and from thence through ventilators to the outer air. A more imperfect system of ventilation and a more ingenious fire trap could not well be devised."

Mr. Wheelright's book was largely distributed and without doubt

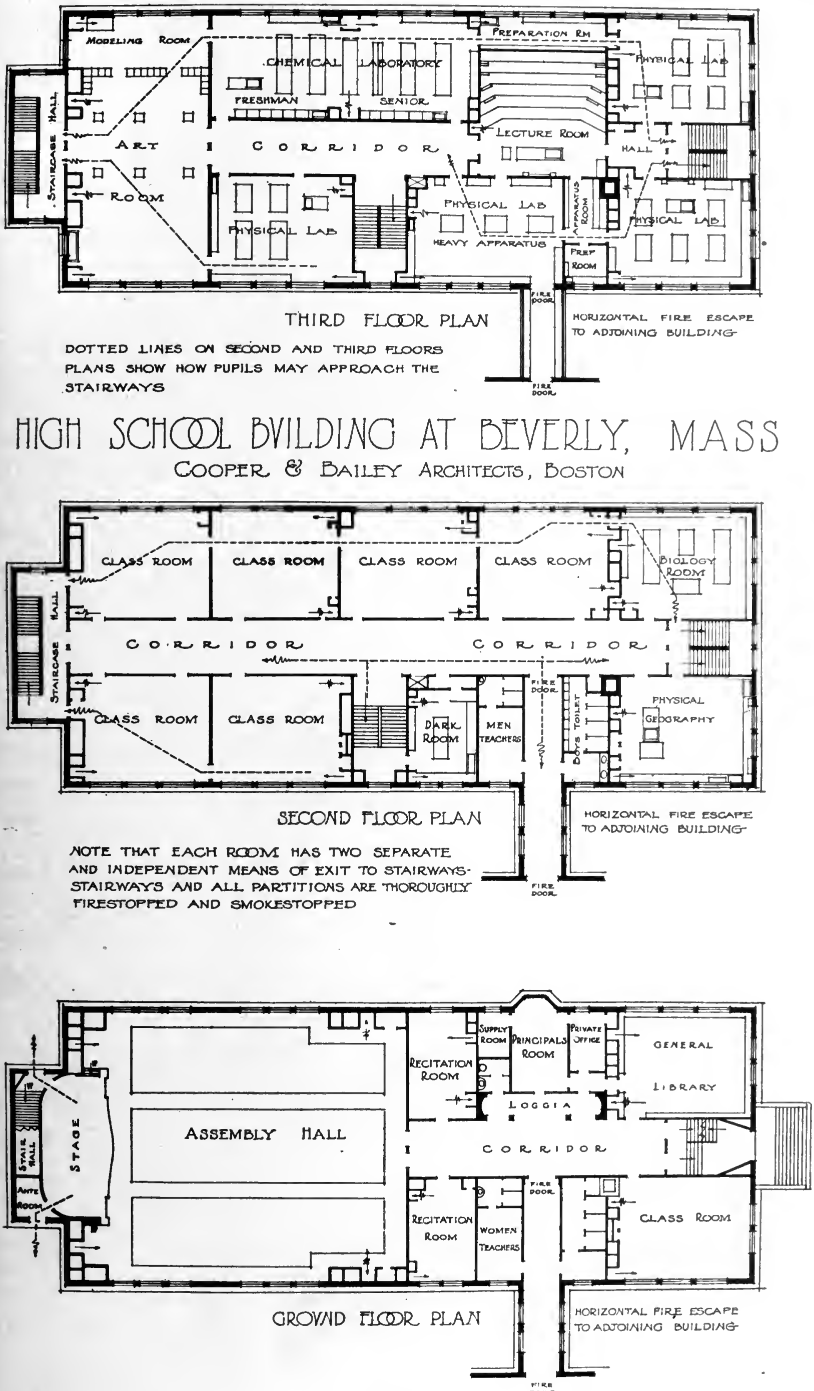

MODELING ROOM
CHEMICAL LABORATORY
FRESHMAN
SENIOR
PREPARATION RM
PHYSICAL LAB
LECTURE ROOM
STAIRCASE HALL
ART ROOM
CORRIDOR
HALL
PHYSICAL LAB
APPARATUS ROOM
PHYSICAL LAB
HEAVY APPARATUS
PHYSICAL LAB
PREP ROOM
FIRE DOOR
THIRD FLOOR PLAN
HORIZONTAL FIRE ESCAPE TO ADJOINING BUILDING
DOTTED LINES ON SECOND AND THIRD FLOORS PLANS SHOW HOW PUPILS MAY APPROACH THE STAIRWAYS
FIRE DOOR
HIGH SCHOOL BUILDING AT BEVERLY, MASS
COOPER & BAILEY ARCHITECTS, BOSTON
CLASS ROOM
CLASS ROOM
CLASS ROOM
CLASS ROOM
BIOLOGY ROOM
STAIRCASE HALL
CORRIDOR
CORRIDOR
CLASS ROOM
CLASS ROOM
DARK ROOM
MEN TEACHERS
FIRE DOOR
BOYS TOILET
PHYSICAL GEOGRAPHY
SECOND FLOOR PLAN
HORIZONTAL FIRE ESCAPE TO ADJOINING BUILDING
NOTE THAT EACH ROOM HAS TWO SEPARATE AND INDEPENDENT MEANS OF EXIT TO STAIRWAYS-STAIRWAYS AND ALL PARTITIONS ARE THOROUGHLY FIRESTOPPED AND SMOKESTOPPED
FIRE DOOR
SUPPLY ROOM
PRINCIPALS ROOM
PRIVATE OFFICE
GENERAL LIBRARY
RECITATION ROOM
LOGGIA
STAGE
STAIR HALL
ANTE ROOM
ASSEMBLY HALL
CORRIDOR
FIRE DOOR
RECITATION ROOM
WOMEN TEACHERS
CLASS ROOM
GROUND FLOOR PLAN
HORIZONTAL FIRE ESCAPE TO ADJOINING BUILDING
FIRE DOOR

FIGURE 1

was in the hands of many Ohio authorities, but nothing was done to oblige safer school buildings until one May morning came a fire in the Collinwood schoolhouse. You all know the result, 167 of the children in that schoolhouse were burned to death. Yet it is stated in Insurance Engineering that "within three months after the Collinwood fire plans for an exact duplicate of that building were submitted to the Ohio authorities."

Mr. Elliott, Consulting Architect of the Ohio State Building Code Commission says, "Numerous actual cases have proved that the moral effect of the Collinwood fire amounted to nothing."

These facts are before the people. Let them place laws upon their statute books that shall demand right construction and safety and give heavy penalties for those violating the law.

This movement is already started. A chart of the laws of each state upon this subject shows a general public awakening and in many states an encouraging sense of responsibility.

In legislation upon this subject the State of Ohio is in the lead. Will other states have to repeat Ohio's experience in the Collinwood fire before they will follow her good example?

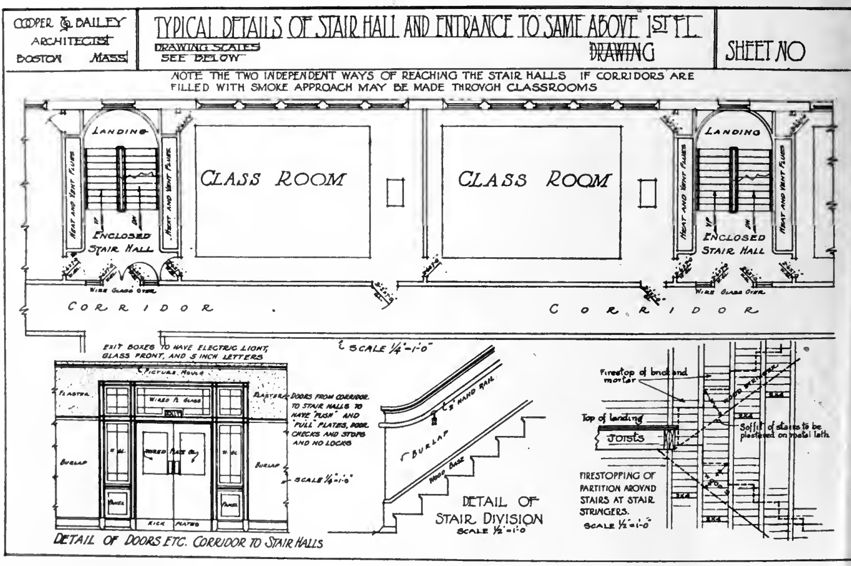


FIGURE 2

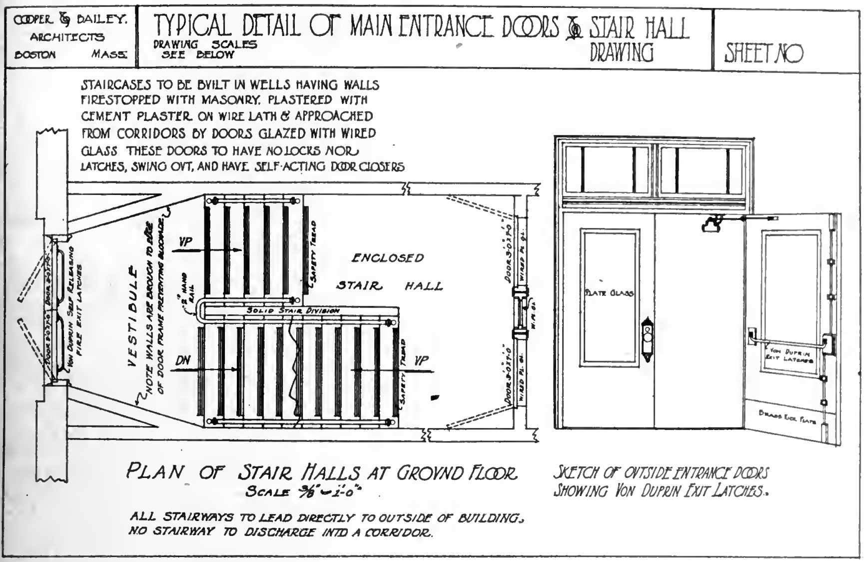


FIGURE 3

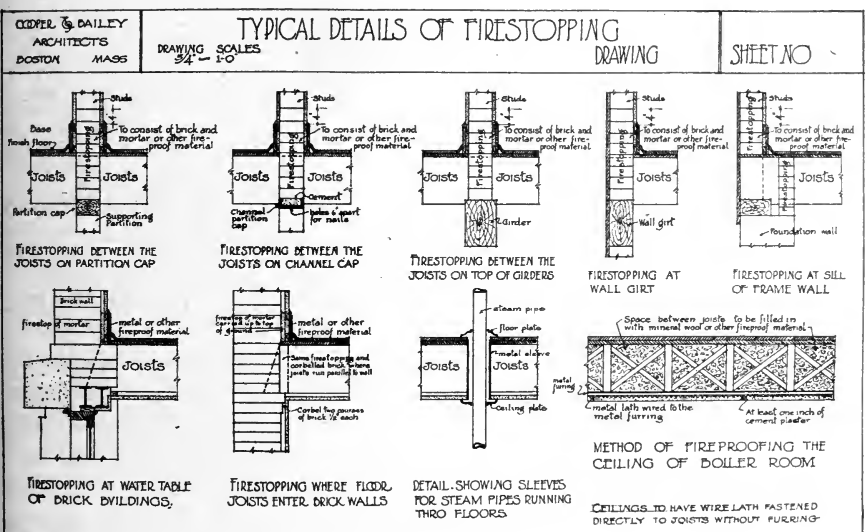


FIGURE 4

MODERN METHODS OF SEWAGE DISPOSAL IN RURAL, COUNTRY AND CITY SCHOOLS

BY

WILLIAM T. TOWNER

One phase of school hygiene that has not received the attention to which it is entitled is that of Sewage Disposal of Rural and Country Schools and yet, I believe, this is a most important subject, if not the most important in the matter of school-house architecture. We may discuss the proper methods of lighting; the orientation of the building; the fire hazard; the dust problem; cleaning and humidifying the air; ventilation; re-circulation and all the different angles to school hygiene, but no matter how perfectly a school building may be constructed as regards the above phases, without proper and sure methods of disposing of the sewage wastes from the building, to just that extent is that building inefficient and all other hygienic principles, no matter how perfectly worked out, are consequently nullified.

It is only within recent years that complaints have been made in the large cities about the foulness of the waters in rivers and streams, into which empty the sewage and household wastes and street washings; and yet there is, to the ordinary observer, only a small portion of the waters and streams which can be really called a nuisance, but with increasing population and use, the nuisance will become greater. The proper disposal of sewage from large cities—and small— as well as from rural and country schools is an engineering subject to which unusual value must be attached, for, with successful methods, the fly nuisance, the typhoid germs, the tubercular germs and all other disease transmitting agencies, will be abated, and not until then will we experience perfect hygienic conditions. The adoption of laws regulating the construction of school buildings is of only recent occurrence and that only in a few states, but in none of those laws, so far as I have been able to find, is there any provision for sewage disposal. Thirty cubic feet of fresh air per pupil is required; but how is it possible to supply that fresh air if the surrounding grounds are saturated with the wastes from the toilets?

No matter where the toilets may be or how perfect the fixtures may be or how well ventilated; no matter what means you may have taken to have your school building thoroughly modern and up-to-date, your most important duty to the pupils of that building will be sadly neglected, unless greater thought is given to the subject of sewage disposal.

The children of to-day are facing more strenuous times than was the case thirty years ago and perfect school hygiene must be guaranteed them that they may be enabled to overcome disease, pests and misfortunes better and more simply than their parents did.

How often we see school buildings in the country and small villages, where there are no sewage facilities which appear to be excellent examples of school-house architecture, depending altogether on a cesspool arrangement, one receiving tank and one overflow for taking care of the sewage? I know of a number of cases of buildings, where there are 700 and 800 pupils in a building, and the cesspool perhaps not over twenty feet away, and you can always locate that cesspool by the swarms of flies hovering over the spot. In such an arrangement as this, there is positively no protection against contamination. The strata of the soil, no matter what it may be, will certainly conduct all the wastes to the nearest well. Therefore, cesspools are to be condemned in my estimation.

A short time ago, the University of Illinois issued a bulletin showing that after testing 868 wells, 520 were unfit for use under 85 feet deep and 13% 100 feet deep were unfit; all caused by cesspools.

Pure air, good drinking water, good, healthy, earthy soil are absolutely necessary to sustain life and neither of these three essentials can be secured if we permit the soil to become permeated with sewage wastes.

There are only two effective methods of Disposing of Sewage at the present time; and which of these is preferable is a point I do not now feel qualified to decide. Those two methods are: (1) The Hygienic Bacterial System, (2) The Incinerating Process.

A system that will dispose of sewage almost as soon as deposited and before it leaves the school building, is the system that will solve the problem. It can be disposed of bacterial action by the installation of a series of tanks—clear water only being discharged from the last one—in which there is nearly 90% purification. It can be used for watering lawns, sprinkling streets or can be discharged into any ditch.

Such a system as this has been adopted not only by a number of schools but also by communities and cities. Waste waters, however, from wash-basins, etc., should not be run through the Sewage Disposal System, as the soaps, etc., being disinfectant retard the action of the Bacteria. I believe that it will only be a short time before the United States Board of Health will require all sewage to be disposed of before leaving the house. Sewage contains within itself its own means of destruction—Bacteria.

In a properly constructed system, the Bacteria will multiply very rapidly, and the heat generated by the depositing of the Sewage, breeds the Bacteria germ which liquifies the Sewage.

Under the Hygienic Bacterial System, I shall subdivide as follows:

(1) Sub-surface Irrigation System.

(2) Septic Tank with Contact Beds.

(3) " " " " " and Sand Filters.

(4) " " " Percolating Filters.

(5) System of air-tight cells connected to each other and operated as I shall describe.

The first four (4) subdivisions I shall ignore for the time owing to the limit of time and space; and shall describe the last, which in my opinion is the best of this kind.

This system is composed of a series of air-tight cells of suitable capacity, constructed of material to make them water tight, the cells being connected with one to another near the bottom, except the first and last cells, which are not connected to each other. The first cell is the inlet cell with the inlet at the top, and the inlet pipe pointing downward toward the bottom of the cell inside. The last cell is the outlet cell, with the outlet at the top, near a level with the inlet, and the outlet pipe extending from toward the bottom of the cell, inside, up through the top and outward, just at the top. All cells are covered and sealed with air-tight covers, making the System water tight. The System is filled with water before using, and is always full of water, which removes the air. As the inlet and outlet are at the top, no water is discharged until it is forced out.

The principle of the System is this: The Sewage enters the System from the drain, through the inlet pipe and into the first cell, necessarily forcing out as much water through the outlet pipe as the amount of Sewage deposited. This water discharged is, of course, clear. The Sewage deposited will rise to the top of the first cell, and as more is deposited, it will also rise to the top, as the cells are full of water. In a short time enough sewage will accumulate to generate heat which breeds bacteria; this bacteria liquifies the sewage and purifies the water, consuming all the poisonous matter. As more sewage is being deposited, it forces the clear water at the bottom of the cells through the connections at the bottom, and at last through the last cell and the outlet.

As the sewage all rises to the top and the clear water goes to the bottom and the connections are at the bottom, nothing but clear water can pass through the connections into the next cell. Of course, when too much sewage is deposited for the first cell to liquify, some of the impurities pass through the connection into the next cell, and there rise to the top in a like manner, and so on in each cell, until it is thoroughly liquified and purified, leaving nothing but pure water to be discharged. This process of liquification and purification goes on in each cell where all sewage is deposited, and on a smaller scale in each succeeding cell than the one preceding. The bacteria are multiplying fast; in cell No. 1 where all the sewage is deposited, and on this cell the greatest amount of liquification goes on. To make sure that the System discharges no impurities, always use enough cells so that when the water reaches the last cell the solids are all decomposed or liquified and the water thoroughly clarified; then it has an extra cell to go through before being discharged. In smaller Systems the decomposition or liquification is practically all effected in the first cell, with a very small amount or no impurities at all passing into the second cell; then there is no chance for impurities passing into the last cell. In larger systems always use at least one extra cell so there will be no chance of any impurities being discharged.

It is a well-known fact, stated by scientists and bacteriologists, that 99% of the ordinary sewage at the time of being deposited is water, with less than 1% of impurities, or poisonous matter. Of course, when allowed to stand in the open, and it is exposed to the ground or atmosphere the 1% grows and pollutes the ground and air with impurities and disease germs. But it can be readily seen that when deposited into a System such as this, the 1% of impurities is easily liquified and decomposed.

Sewage deposited in this System that has a capacity of one hundred gallons daily will not leave the last cell until about one hundred gallons are run into the System to replace the one hundred gallons already in. Therefore, we get the most important action of Bacteria known by bacteriologists, which is *rest*, undisturbed solids, which accumulated Bacteria. In this system we get much *rest*; not much disturbance of the solids, no agitation of the Sewage already in the cells.

Air in sewage makes sludge; there is no air in the System described and, therefore, no sludge or formation of scum. The System is entirely filled with water, leaving no space for air. It generates heat and breeds Bacteria *without air or light*, and is the only System that does this. Without the presence of air, gases do not form, sewage never sours, and germs multiply faster. All septic tanks breed the germ with air. It is claimed by some that the small amount of germs discharged by the septic tank are not dangerous. Care is taken so that this System does not discharge any, but if any should be exposed to the air from any cause they would immediately die, as germs bred without air cannot live in the air and the taking on of oxygen would immediately kill them. For this reason we can discharge the clear water from our System into any open ditch, and the death of the Bacteria is sure. As the Bacteria multiply, the young devour the old, so there is no chance of accumulating too many.

This System can be installed in any capacity desired, the size being based according to the average number of persons to use the school, the larger the size the more cells should be used. The System may be installed under the ground outside the building, and the discharge water, which is clear, run into a drain, or into any open ditch or waterway, or may be allowed to seep away in the soil if it is poroused. The System is then covered with earth, and the ground can be used again for the same purpose it had been, as it never needs cleaning out or attention of any kind and never be replaced or dug up. It may also be placed in the basement on the floor, and the discharge run out into the cellar drain. Either way, it is out of sight. No odor comes from the System.

Sanitary journals, scientists, bacteriologists and all health officials are agitating the disposal of sewage (excreta) by sanitary methods, and discontinuing the polluting of streams, waters and the ground and atmosphere, and discharging nothing but clear, odorless water into the soil or waterways. This System makes this possible. It is a long step forward in the widespread movement throughout the world toward sanitary conditions. It is past the experimental stage.

The System that I have described is one that has been put in use in a number of school buildings and communities by A. M. C. W. Russell, a sewage disposal engineer of Chicago, with the most satisfactory results.

The City Chemist of Burlington, Iowa, reported, some time ago, an analysis of the water discharged from a system, installed as above described, as follows: Nitrogen, as free Ammonia, .030 parts in one million, and Nitrogen as Albuminoid Ammonia, .289 parts in one million; only a slight excess of organic matter as compared with the standard for drinking water.

Incinerating Process. The other method I mentioned, the Incinerating Process, seems to be gaining favor among engineers and scientists, but having adopted this method of Sewage Disposal in some school buildings with none too good results, I hesitate to dwell at length on this method, although assured that much more complete apparatus is now being made providing for greater combustion and the positive removal of all sewage wastes without odor of any kind. It must be remembered that the cost of maintenance in an incinerating process is continual and expensive because of the necessity of constant fire and attention of the janitor.

This System should not, of course, be installed in any but fireproof buildings and every part of the apparatus should be of fireproof material.

There are two forms of Incinerators: (1) the lever acting and (2) automatic acting. In small school buildings the lever acting Incinerator should be used for it is not necessary to have the fire burning all the time. At the bottom of the bowl in the lever acting Incinerator is a rotating paddle wheel or scraper. This is operated by a hand lever with an up-and-down motion, much as a chain is pulled in connection with an ordinary flush closet. The excreta is scattered upon a drying hearth directly over the fire grates. Through and around this drying hearth, the air is constantly drawn by the draught through the stack and unless the deposits are too great, it will be constantly and thoroughly dried, ready for combustion.

For larger school buildings the automatic acting Incinerator is recommended. The operating parts of this are very simple. The cover is always closed when not in use, and when raised, a receptacle drops into place to receive the deposit, when cover is permitted to fall the deposit is dumped into the fire, thus keeping the receptacle always sterilized and ready for use.

In connection with these Incinerators is an evaporating tank for liquids, with properly covered urinating facilities. Properly installed and cared for there seems to be no reason why there should be odors, but to safeguard against any possibility, the use of formaldehyde gas mechanically applied to prevent odor from the burning of excreta is recommended.

Flies are excluded from all parts of the System. Any kind of fuel may be used. A chimney stack of course, must be used in connection with this method and it should be lined inside with an impervious material and a ventilator should be put on top to cause draught; as stated hereinbefore, there is a growing tendency to consider the Incinerating Process as the most hygienic system of Sewage Disposal.

The two methods described in this paper are applicable to any school, no matter whether rural, country or city.

SANITATION OF THE RURAL SCHOOLHOUSE IN THE STATE OF VERMONT

BY

HENRY D. HOLTON

Four hundred years ago when our forbears came to this continent their souls were filled alone with religious fervor, they recognized that in order to secure civil and religious liberty it must be on a basis of an educated and enlightened mind. To that end they erected what came to be known as "The Little Red Schoolhouse by the Roadside." Of these in Vermont there were 1,363, now reduced to about 800. The one-room schoolhouses have been the mark for much unjust criticism, with urgent recommendations that they be abolished. The critics are not well informed, the one-room rural schoolhouse will continue by reason of local conditions. The demand must be, and is that all such school rooms must conform to, and be equipped with all sanitary arrangements. In the last few years a large number of them have been so equipped. The number of these remodeled houses is increasing each year, and in a short time all will be provided with the requirements as prescribed by the State health authorities.

In this small State in which the largest city has only about 20,000 or 25,000 inhabitants, there has been expended, in the last 15 or 20 years, on new schoolhouses, and in putting already existing schoolhouses in sanitary condition over two million dollars, making a tax of 176 per cent. upon each dollar of the grand list. It is true that the one room, as well as the larger buildings were constructed when sanitation was unknown; these one-room houses were quite uniform in being about 20 feet wide, 25 feet long and 10 feet high. No attempt was made to ventilate, but to be sure to keep out the cold air so that none would suffer with the cold. The window surface was equally deficient. The number of pupils, often being from 30 to 50, reduces the floor space so that elbows touched. The development and teaching of sanitary science has produced a great change in school architecture. While these one-room buildings remain for the accommodation of pupils they must be made to conform to regulations relative to air space, light and other sanitary requirements. The regulations of a rural school should embrace a sufficient area of land to give a reasonable playground, from one-half to one acre, according to the number of pupils to be accommodated, ground to be dry. A supply of pure running water should be secured if possible. If this cannot be secured a tank should be provided located in the upper part of the room, so that sufficient head can be acquired to have a bubbling fountain. This tank to be filled every day.

Lighting. The windows must be numerous, large enough, and so arranged as to give ample light to every part (and corner) of the room. The window space should be one-fourth of the floor space, and must not be less than one-fifth. There must be no more space between the top of the window and the ceiling than is required to finish the building, and the window-sill must be four feet from the floor. The light must be so arranged as to fall upon the pupil from the left, or left and back, *never from the front.* There must be curtains of a grey or buff color for all the windows—two to each window—hung in the center of the window so that either the upper or lower half, or both, can be shaded.

Ventilating and Warming the House. If it were possible to point out the most objectionable feature of the one-room schoolhouse it would be that there were not means provided for any ventilation whatever. Many of these buildings are now provided with the "jacketed stove" for warming and ventilating; when a furnace for any reason cannot be installed, with the attending ventilating pipes this method is simple, inexpensive and satisfactory.

The heating apparatus must be of sufficient capacity to warm the room to 70 degrees Fahrenheit in any weather. This air should be made moist by passing over water. Not less than 30 cubic feet per minute of pure air for each pupil should be supplied, and it should be so introduced that there shall not be uncomfortable draughts. The difference in temperature between any two points on the breathing plane shall not exceed 3 degrees. The ventilating flues shall be of sufficient size to readily introduce and remove the requisite amount of air from the room. In rural houses of one room where a furnace is impracticable, the above conditions can most economically and satisfactorily be met, as suggested, by the use of the "jacketed stove," Figure 1.

The ordinary wood-burner stove may be surrounded by a casing, or jacket, of galvanized iron, with proper air space of six to nine inches between jacket and stove. Fresh air should be conveyed from the outside of building through tin tube to space under stove. The vent, or foul air pipe (also of tin), should be set on legs with an opening at the bottom, 12 inches from the floor, to run straight up through the roof as high as the chimney. This pipe should be placed on the same side of the room as the stove. The stove-pipe should enter this at not more than six feet from the floor, passing up as far as possible before it leaves the vent pipe for the chimney. There should be a door in the jacket at the rear end of the stove which can be opened for pupils to warm their feet. A room 28 x 30 x 12 would have 10,080 cubic feet of air. Thirty

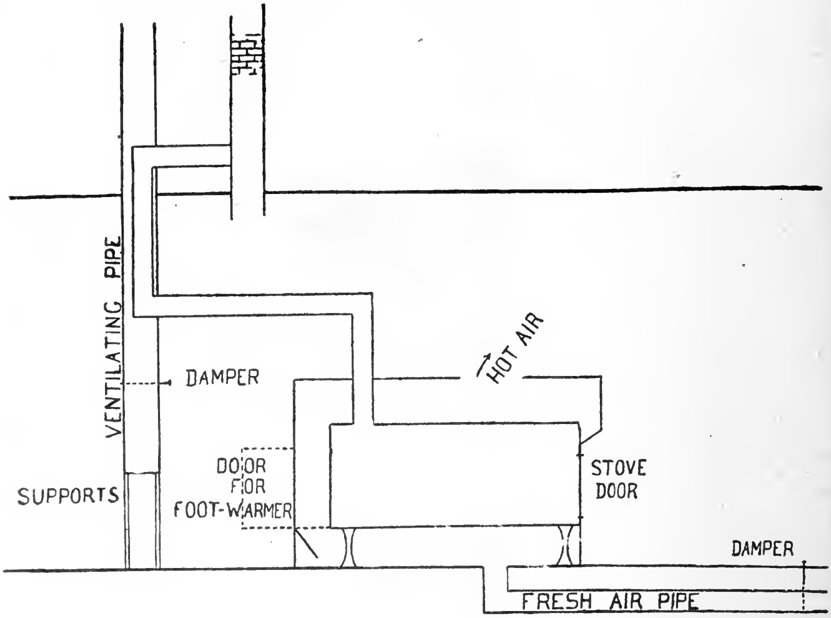


FIGURE 1

pupils in this room would require at least 900 cubic feet of fresh air per minute. To supply this amount of fresh air would require a tube 24 to 30 inches in diameter. In order to properly warm this volume of air in the coldest weather it would be best that there should be two of the jacketed stoves, each receiving fresh air through an 18 or 26-inch tube. The foul air vent should be of corresponding size. All of these pipes should be provided with dampers to regulate the inlet and outlet of air. School Directors should not only see to it that their teachers are instructed how to use these dampers properly, but they should be sure that their instructions are carefully followed. In locations where it is impossible to construct and maintain water closets, there should be two out-houses provided, at least twenty feet from the school building, with a high board fence between them, so that they could be afforded comparative privacy. Each closet should be provided with a box of dry earth, and a second one of hyperchloride of lime. It should be the duty of the teacher, or some one designated for the purpose, to see that the deposits were covered with these two articles each day. The closets to be cleaned every two to four weeks. It is true that the one room, as well as the larger school buildings were constructed when comparatively little attention had been given, not only to school sanitation, but to general hygienic conditions. Having, however, brought a large number of school buildings up to the modern sanitary requirements, the work should not be halted but continued until all are thus transformed.

And this work should be continued and perfected and pupils thoroughly imbued with the importance of each individual adopting, as a part of their educational equipment, the sanitary principles demonstrated in the school building. For this reason it is especially important that medical inspection of all schools should be adopted to the end that it would require the observance of all sanitary regulations regarding the school building, as well as insuring proper observation and care of pupils. For a long time it has been apparent that there were many pupils in our schools who, for various reasons, were unable to meet the requirements adopted by educators. After considerable investigation, it seemed that there were both physical and mental reasons for this. Often the mental ability to master the tasks assigned them depends in a measure upon their physical defects, hence this inspection is not alone for the purpose of discovering and preventing communicable diseases, but also to ascertain the physical and the mental reason for the pupil's inability to accomplish successfully the school work. School Inspectors should use especial care in examining the general conditions to which the observant teacher calls attention, with reference to the causes that have produced them. These are: emaciation, pallor, puffiness of the face, shortness of breath, swelling in the neck, general lassitude, flushing of the face, eruption of any sort, a cold in the head with running eyes, irritating discharges from the nose, evidences of sore throat, vomiting, frequent requests to go out, which teachers are inclined to consider as a desire to shirk, but are however often indications of physical trouble of some sort. The mouth may be the source of disease germs, especially if the teeth are diseased. By all means examine carefully the teeth.

Nervous trouble should be investigated, particularly if symptoms develop which are not usual for the pupil—restlessness, inability to stand or sit quietly, irritability, fainting, momentary loss of consciousness, as well as other nervous manifestations are often the precursors of serious nervous diseases and of total depravity. The mentally defective are usually unable to profit by the ordinary methods of instruction, they can not fix their attention upon any exercise. As soon as the teacher's direction is withdrawn their attention ceases. If they apparently take an interest in anything it is soon forgotten. These cases should have careful and repeated examinations. Much is said to-day about the overwork in schools. The reply is that the course of study is for the average or normal child. May we ask what constitutes the normal child? We believe that the spurring on of pupils favors, or even induces various nervous diseases. We should never lose sight of the fact that the period in the child's life from six to sixteen is the period of development; the period of preparation for puberty, which entails a complete upheaval of mental and physical powers—a revolution, a reconstruction, a readjustment. Pedagogy and medicine must join forces to prepare our children, both physically and mentally, for the duties of citizenship. The Medical Inspector should give particular attention to the sanitary condition of the schoolhouses, ventilation, lighting and heating; the source of the water supply; the closets, especially in rural schools, and should keep in mind the abolishment of the common drinking cup. We are aware that objection has been made to medical inspection of schools. Practically the objectors have no ground on which to base their opposition. So long as the State compels its children to attend school for a given period the burden rests on the same power to see to it that they are physically in a condition to receive and assimilate its teachings. Further it is incumbent on the State to see that no harm comes to them, keeping in mind that the efficiency of the child does not depend alone upon the mental training, but upon its physical health and vigor.

However the time for consideration and argument relative to medical inspection of schools has passed. Its adoption by so many States and its satisfactory operation has established its necessary usefulness. We know of no school having once installed medical inspection that has subsequently abandoned it. However it remains for the States that have neglected to adopt it to secure its beneficent results. The pupils in schools not subject to medical inspection have a right to demand of their States reparation for the deficiency from which they may suffer. They have a right to have the schoolroom properly warmed, lighted and ventilated, to have their mental capacity tested and to be placed in suitable classes. They have an equal right to have their physical soundness and capacity determined and thus be able to correct any imperfections that exist.

DISCUSSION OF

Dr. Holton's Paper

BY

B. Franklin Royer, M.D.

I am not inclined to agree entirely with Professor Scott nor altogether with the engineers who advocate keeping windows closed so that the Plenum system may operate exclusively. After an experience for years with every sort of ventilating scheme in hospitals, from the old-fashioned push and pull Plenum, operated by fans forcing the air through radiators and into hospital wards and with fan exhaust systems, up to the later method of exhaustion by means of aspirating coils in vent boxes gathering together a series of galvanized iron sleeves with inlets placed at various positions near the floor of the building, the heat outlets being eight feet above the floor, up to the modern split Plenum, I confess to being something of a rebel. In fact, I have no hesitancy whatever in opening windows any time its suits my pleasure. The open window, it is true, does break in a little on the system but the break scarcely affects, and in most systems does not in any way affect, the incoming heated air, and affects but little the exhaust system that is supposed to be taking up the impure air. No system should be constructed that will not permit of window use occasionally and especially during mild weather.

SCHOOL HOUSES IN NORWAY

BY

M. K. HÅKONSON-HANSEN

As long as there was no instruction, in the present meaning of the word, the idea of gathering children and young people in schools did not naturally occur to the people. But when once this institution was created by the social necessities at that time it continued yet longer and went through a lengthy development before the demand for proper school houses was spoken about. This demand came naturally with the development, and just as the school institution came to us from the South from Greece and Rome, so also has the governing type of school buildings come from the South, viz. from Germany. In every case this refers to the towns. As regards the country school buildings, it is to be noted that a more national Norwegian style of building has been adopted also in erection of the school houses.

It was in the 18th century, that here, in Norway, people first began seriously to talk about schools as a social institution. The advanced schools (University or Latin schools) had existed, for a long time, but they belonged to the Church, which in those days, was a State within the State, and therefore the people stood rather far from it. These University schools had really, more or less, their own church premises. Just as the school was on the point of becoming a social institution, at the same time there arose a house-question which could not avoid bringing the people a little nearer, for once at least, quite to find its solution with them.

To begin with, we find a royal ordinance of the 13th of January, 1736, "regarding the confirmation of the growing youth and their confirmation in the mercy of the Baptism," and according to two decisions of this ordinance the teacher, *i. e.* here the priest, "shall let them (the children) come to live in his house." A step further a royal ordinance of the 23d of January, 1739, reads, which among other things, decides, that there shall be erected "permanent schools," yet so that where the population is very scattered, "the teacher" shall go there from one parish or farm to another, to gather the children and give them instruction.

We pass over, in this our short description, a whole course of years in which the development considerably exploded the foundations of all the older legal decisions. Then came the law of the 12th of July, 1848, about board-school departments in towns, which decides (as in par. 8) that each class, with its distinct teacher, "shall have a special teaching room, furnished with the necessary school requirements with sufficient space." It continues, in the same paragraph, as follows: "By the decision, how far every school shall have its own special school house, or more schools could be held in one and the same building—it ought to be considered that never more children are taught in the same house than can be done consistently with morality and good order." There is not yet required anything more decided than "sufficient space." Regarding the board school department in the country, 12 years later, viz, the 16th of May, 1860, a law came into existence which in par. 3 decides "that if at least 30 children can each day visit the same school this is to be held in special premises, erected or let, and furnished in every respect for this purpose." In the same legal decision it is further added, as follows, "that if certain circumstances make the keeping of a school inadvisable in their own building, the school can be held as an ambulatory school, yet that creditable premises be given thereto." According to the demands of the present time for school houses, only a few, in the meantime, and yet fewer of the rented premises, which were given to the ambulatory schools, could be recognized as creditable or even suitable. But since that time the development has advanced quickly enough and Norway has followed, in some measure.

In reality, greater progress has been made than what the law expresses. The law at present in force regarding public schools in the country is of 26th of June, 1889. Par. 13 of this law says: "As a rule, there shall be erected or rented special premises for every public school." However, the school in small circles (*i. e.* concerning infant schools) and in public school circles, where the number of pupils gathered do not exceed 20, is to be held as ambulatory by the people of the district as far as convenient room can there be obtained. And thereafter follows this important decision: "Before any scheme for the erection of a new school building is agreed upon, the health and superintendent commissions shall have had occasion to express themselves regarding it. At the same time the health commission shall have had an opportunity of expressing its opinion about the other rooms, which are intended to be used as a school. No room, or house, must be used as a school, which has been forbidden by the health commission in this respect."

This last repeated legal decision must be considered as a great advance. It is also therefore taken up in the corresponding law for towns, which, besides, has a decision (par. 14), as follows: "The rooms which are used as public schools shall be sufficiently large and suitable for the purpose. Each school shall be supplied with sufficient furniture and playing ground, as also with such means of instruction as are necessary for common use under the instruction."

The law of the 27th of July, 1896, goes still a step further concerning the higher board school, which (par. 65) in all, says as follows: "The superintendent has to see to it that the premises of the schools are always in accordance with the requirements of hygiene and of instruction. Every scheme for new building, or rebuilding of the school premises, must be laid before the health commission, before it is acknowledged by the superintendent. Every school shall be supplied with playing ground, furniture and means of instruction according to the further decision of the superintendent."

The above is all that Norway's legislation has to say on the question as to how a school house shall be arranged. As we will have seen from these legal decisions, steady progress has been made from the incomplete to a state of things almost perfect. The last mentioned legal decision even recognizes "the requirements of hygiene," and thus may one say that it begins to dawn.

In the meantime, it is clear that from the vagueness with which these decisions are expressed, there must arise in the people's minds many a question such as: What is meant by a usable room? When are the rooms sufficiently large? What is meant by sufficient furniture? What are the requirements of hygiene? etc. The governing department concerned has therefore, in time, frequently had reason to express itself and has done so by means of circulars to the school authorities in the communities. These circulars shall here, briefly, be mentioned:

1. The circular of the 23d of March, 1886, regarding *the outfit of the school premises*. Here are given instructions about the situation of the school building as well as the condition of the ground and its preparation. The corridors ought to be at least 2.4 meters wide and the class rooms should have a height of at least 3.5 meters, together with a floor space of at least 1.4 square meters, for each pupil. The air-cube for each pupil shall not be less than 5 cubic meters. The window-space must be at least one-sixth of the floor space, etc.

2. The circular of the 15th of February, 1898, about *ventilation of the school premises*.

3. The circular of the 18th of June, 1898, regarding *the drawing room fittings and equipment*. Both these last mentioned circulars are illustrated.

4. The circular of the 14th of May, 1900, about *building and fitting of handicraft rooms*. There is required in this circular an air cube of 10 cubic meters and a room height of at least 3 meters, together with a floor space of at least 1.8 square meters for each pupil. There are further given detailed rules for the erection of joiner's benches.

5. The circular of 1887 about *the procuring and manufacturing of school desks.* There are here given the measures of quite common, one and two seated school desks of the Olmutzer or Chemnitzer type.

6. The circular of the 18th of April, 1906, regarding *fitting of the gymnastic premises.*

In all these circulars the minimum requirements are set forward which a modern school hygiene can accept, but which can be recognized only in a strong financial respect. In all larger town communities the requirements put forward are as a rule exceeded, so that the pupils are offered better conditions during their stay in the school premises.

As above mentioned, it is the German building type which is the governing type in the towns here in Norway: the great brick-stone building with 20 to 30 instruction rooms and with corridors along the centre. The Norwegian school building which, usually, has 3 floors, differs, however, essentially from the model, so that, as a rule, nothing is expended on exterior fittings. The facade is a gray, unbroken space where the repetitions become tedious and the ceiling has hardly ever any resting point for the eye. The aesthetic requirements are not even directly connected with the hygienic. However it must be recognized that the realization of the idea of beauty through the eye creates a good impression which is hardly without a hygienic significance.

The dimension of the class rooms turns, not seldom, about 6.5 x 9.0 x 3.75 meters. If it is considered that the maximum fixed by the law for pupils is 35, the size of the rooms must therefore be considered as very good. The lighting of the pupils' places is generally good, especially the natural light, as the size of the window space stands in good proportion to the size of the room. As artificial lighting the Aureske glowing or electric light is installed. In the solution of the question of ventilation, on the contrary, we are here in Norway somewhat undecided, because at one time it is the difference of the temperature which shall be the driving power; at another time it is the fan-system, and a third time it is the overheated air, which shall procure the necessary circulation of air.

In the country, the ambulatory schools are on the point of disappearing. Every school circle has now, as a rule, its own house, if it only consists of one class room and a residence for the teacher. The Norwegian government department for church and instruction matters has given out common drawings for country school houses which have been of great use.

What happened in the towns during the law of 1848: It is also, a long time, out of force that one bought on account of the community greater common residential houses which were arranged for the use of the schools. Where school houses are needed, new ones are now always erected and perhaps we stand at present in front of a time with quick new building in the most of our towns, because people begin increasingly to understand that the evening instruction in the public schools must be removed as it is of less value. The evening instruction in the higher school has been reversed a long time ago.

Finally, a few words about school conditions in the country, in Finmarken, the most northern part of Norway. The conditions here become special as a greater part of the population consists of the wandering nomadic Lapps. In order to get these children sufficiently taught, means have been taken to erect boarding-schools at the public cost. It is natural that these houses be built and fitted, as far as possible, according to the hygienic requirements.

SANITATION OF THE CONSOLIDATED COUNTRY SCHOOL

BY

William Gray Swank

In considering the subject of the sanitation of the consolidated country school, the writer will try to confine his discussion, as nearly as may be, to those phases of the subject of school sanitation that appeal with special force to those responsible for the physical welfare of the pupils of the country school.

Most questions of school sanitation concern the town and city school authorities in the self-same way that they do those in charge of the country school; but because of difference in environment some questions of sanitation must be met and solved in an entirely different way by those responsible for conditions in the country schools. There are also some phases of the question of the sanitation of a large school that give the city school authorities no trouble at all, but which are well calculated to worry and concern the rural school Trustee. For instance, the selection of a site, favorable in situation as to drainage, and soil, and as to a probability of securing a bountiful supply of pure water, as well as the location of the school in its relation to the length of the routes over which the pupils must be conveyed from their homes to the school at public expense; the method of transporting the pupils from their homes, scattered over a territory of from twenty to forty square miles; the disposal of the filth and dejecta from the pupils without any public sewer or public water systems; and the care of the horse stables that are an invariable accompaniment of the large country school. In addition to these questions that of a bountiful sanitary water supply must be solved in a manner entirely different from that in the city.

As all other questions of sanitation are alike for city and country schools, they will be passed with only a word; for the writer would not be able to say anything new in regard to them, or if he should say something new, he would not presume to speak with authority. The questions of light, heat, air-space, ventilation, the flushing of school rooms with fresh air at each intermission by throwing wide-open the doors and windows, cleanliness of floors and furniture and methods of securing and insuring such cleanliness, adjustable seats and desks, cloak rooms with facilities for drying wraps, sanitary drinking fountains, play-rooms and playgrounds—all these and many other questions have been treated thoroughly and at length by many and divers experts. So I shall not touch upon them.

But in regard to those questions that effect the country school alone, the last word has not yet been spoken. The sanitary engineer and the physician may be agreed upon all of them, but the country school Trustee and the tax-payer who foots the bills and who votes upon the expenditures are not yet informed upon them, or, if informed, not yet convinced of their vital significance. The vital importance of a high, dry, rolling situation for the schoolhouse, with an underlying formation of such nature as to insure good natural drainage, and so located with relation to adjacent grounds as to furnish an outlet for under-drainage that will insure a dry basement, and for a sanitary sewer system—I repeat, *the vital importance of these items in helping to decide on the site of the consolidated school* is not understood by the patrons, nor even by the school Trustees themselves when the selection of such a site interferes with the equalizing of the length of the various school-hack routes. Allied to this question and inseparable from it is the question of a dry basement. Further, physicians, sanitarians and school men and school patrons are not agreed upon how many miles, and during how many hours, the average six, eight, ten or twelve-year-old child can be carried over rough heavy roads twice a day in a cold, poorly-ventilated—or a hot, poorly-ventilated—rough-riding school wagon, with from fifteen to twenty-five other such children, without injury. Neither are the sanitarians and the school officers agreed upon what kind of out-door privies shall be installed where out-door privies must be used; nor whether it is necessary to have out-door privies warmed in cold weather, nor whether it is necessary to have them connected to the school building by dry covered walks to protect the children from exposure in passing from the warm school-rooms to the privy. They are no more nearly agreed on the question of the danger of the privy-vault as usually constructed and maintained. The merits of the "dry-earth" privy are still a bone of contention between the sanitarians and the school men, especially between the sanitarian and the school janitor. The inconvenience, the filthiness and the menace to the health of the pupils, from the "dry-closet" system—the crematory system—is not yet generally recognized. And the value of the sanitary water-closet and sewer system for disposal of the filth of the school is not yet at all appreciated by many persons who have to do with these questions in the country school. The question of disposal of the stable filth so that it will not be a breeding place for flies has hardly been thought of in connection with the school. These unsettled questions, to the almost entire exclusion of all other questions of school sanitation will serve as the basis for this article. It is not necessary to state here, what every reader already knows, that all these questions would be easily settled, and without dispute, but for the false ideas of economy that still becloud the vision of many school officials and school patrons.

The Site of the Consolidated Country School. If a school district four or five miles by five or six miles in extent is of reasonably similar contour, with a suitable site at or near the center of this territory, and if a bountiful supply of pure water can be secured at this site, one of the most vital questions connected with the health of the school is settled, and besides being settled right, is settled to the satisfaction of everyone concerned. The school-hack routes then can easily be arranged so that no large number of pupils will be carried to school over very long and rough routes while others are being carried over comparatively short routes. But when an ideal site (not forgetting any of the vital points before enumerated) cannot be found at or near the center of the district (the "center of the district" referring always to that location which will allow the school routes to be of practically equal length) then by all means convenience in reaching the school should be sacrificed to a very considerable extent, if thereby the ideal site can be secured. For, while every reasonable effort should be made, not only to shorten all hack routes, but to equalize them, the location of as nearly a perfect building spot for a school as is possible *is such a sacred thing that no ordinary questions of convenience or expense* should be allowed in any way to interfere with the selection of such site if it can be found. Instead of sacrificing or compromising on the site question in order to equalize the length of the routes, the right thing to do is to make the roads more perfect on the longer routes so that lighter rigs, which could make better time—even auto-busses—could be put into service, thus, while carrying the children a slightly longer, or even a decidedly longer, distance than the other children are compelled to ride, they would not be on the road as long a time; and it is the time spent on the road and not the length of the ride—if the riding is not too rough—that is objectionable. More will be said, however, on the transportation of pupils, under another heading.

The Water Supply. Now we have the site selected. Ideally this site should be a sandy, gravelly knoll, in reasonable proximity to a woodland and adjacent to, or within a reasonable distance from a rivulet or stream or other natural drainage. Next we drive at least a six-inch well down, down, down till we reach a bountiful supply of good, wholesome water, and pleasant to the taste. We must not forget that water for a school should be such that all the children, if possible, will like it; for surely nothing is of more importance to the health of the child than plenty of pure water, unless it be plenty of pure air. The absolute necessity of a first-class water supply cannot be too strongly emphasized. Of first importance, of course, for drinking and for what, in the home, would be called domestic purposes, then for sanitary purposes in connection with the school water-closet and sewer system, and finally for fire protection.

The Dry Basement—Its Importance. While water is a splendid thing, and absolutely necessary at school, there is one place about a school building as well as any other building where we do not want water, and that is in the floor and walls of the basement. In these times when vocational teaching is so common in our schools, not only are the playrooms and the gymnasium in the basement, but the rooms where the various vocations are taught—the dining-rooms in connection with the cooking school, the kitchen and also the children's lunching rooms are all located in the basement as well. Therefore a considerable part of the time of nearly every pupil in the school is spent in the basement; and as the lower layers of the air in a basement are difficult to heat, because the hot air furnace commonly in use is never located lower than the basement floor, it is of the very greatest importance that no precautions should be omitted that will help to insure a perfectly dry basement. Books on school architecture will indicate technically how this may be done; but here a few words will suffice to indicate the measures that should be used to secure a safe basement.

First, of course, is a favorable site with a naturally drained sandy or gravelly subsoil. Next is thorough under drainage—deep drains of tile all around near the foot of the walls and shallow tile drains all about the grounds. All down spouts from the buildings should be connected with these drains unless the water is carried to cisterns where it is stored for domestic use, or for fire protection. The surface of the ground should be graded to slope away from the building. The floor of the basement should be of reinforced concrete eight inches thick, extending at least two feet beyond the full width of the walls, and the walls, which should be of reinforced cement, should be built in one piece with the basement floor, so that there will be no joint between the floor and the walls to let in water. Everyone knows how impossible it has been heretofore to keep moisture out of a cellar and to keep dry the walls of a building below the grade line; but now it is an easy matter, if the walls and floors are built right, and in one piece and if a good water-proofing mixture is used in the cement. If it be considered too costly to make the whole of the concrete material waterproof, it will be perfectly adequate to mix the water-proofing material with the cement that is used in the lower and in the upper one-inch of the floor and the outer and the inner one-inch of the walls. Of course the work rooms in the basement should have a wood floor laid above the cement; but this by no means should be an excuse for a failure to use the necessary precautions to secure a dry cement floor.

Transporting Pupils To and From Schools. Space will not permit me to discuss at length the question of how long a route (in miles, or in hours) can be maintained with safety nor of the best kind of vehicles to use. A long article could be written to advantage on either of these questions. In as few words as possible it can be said *with emphasis* that the health of the child *will be greatly jeopardized* if day after day he is on the road an hour in going to school and an hour in returning. I can imagine conditions so ideal, however, that the child might safely be on the road this long. But these ideal conditions would have to include an easy riding rig with well cushioned seats and high backs, reinforced with coil springs like a good carriage seat, and the seats divided into spaces with arms to prevent the crowding of the little children by the larger ones. The conveyance should have to be well ventilated and well heated and not overcrowded. There is no doubt that the automobile will be the conveyance used as soon as we are sensible enough to build good permanent roads. Whatever the style of the conveyance, it must be under the care of a good safe driver who has such powers of authority and discipline over his company of children that the hour on the road will be an hour of *bodily rest* and *mental recreation*, instead of an hour of *bodily torture*, and to the timid little boy or girl, *an hour of terror*, as it often is to such a child crowded into a rough-riding hack full of big, rude boys and so cold that the said big, rude boys are almost driven to be boisterous, not to say riotous, in order to keep warm. Thick dry rugs should cover the floor of the hack in the cold season, and a safe and efficient method of heating the hack should be installed in every conveyance. For the common wagon-like school-hacks that are in common use, the W. H. Miller Hot Air Furnace, manufactured at Crawfordsville, Indiana, seems to fill the bill better than anything else I have ever seen. It is a little charcoal-burning furnace, absolutely fire-proof and gas-proof, that fastens under the middle of the body of the hack. It has a radiator in the floor of the hack that lets the fresh warm air enter as needed. Anyone can adjust it to almost any hack with a few screws or bolts. In auto hacks or light rigs which make the trips in a half hour or less, it may be that robes and foot-warmers will suffice.

Water Closets and Sewerage Systems. Now we have the pupils gathered at the school. What preparations have we made—what care taken—to preserve them from their own filth—from disease-producing conditions that are bound to arise where large numbers of children are brought together? We are taught that some of our most destructive acute diseases could be stamped out, almost, if we were only sensible enough and practical enough to go to the trouble and expense of getting rid of our excrement and protecting ourselves from other domestic filth, in a safe and sanitary way. Of course all sanitarians are agreed that there is only one ideal way—really only one way that ought to be considered—for a good country school plant and that is the sanitary water-closet system with a sanitary sewer carried a suitable distance away into a stream or into a septic tank system.

What can I say here that will help some school official who reads this to get a firmer grasp upon the truth *that there is nothing else relating to the health of the pupil that is of such vital and far-reaching importance as is the subject of this section?* It justifies the most extravagant language and the most positive statements. The question of economy should not be permitted to enter into the question at all—much less a stinting, parsimonious spirit, in deciding what shall be done in regard to a closet system. There are but two systems to consider at all—there is no middle ground, no other system—(or lack of system) that ought to be thought of but these two, namely, (1) a thoroughly equipped pressure-tank sanitary water-closet system with a sanitary sewer into which all the filth of the whole institution, including the washings from the school stable, empties and is carried away from the school site; (2) the "dry-earth" privy for the reception of the human excrement and an equipment of incinerators for the domestic filth and garbage from the school kitchen and lunch rooms, and suitable dry fly-tight bins or pits for the stable filth.

Of course the first is the only one to be thought of if a sufficient water supply and a suitable drainage site can at all be secured. The final cost of the labor of caring for any other system if this labor is taken into the question is greater than the cost of a thoroughly equipped dry-earth system of privies and of the other above mentioned disposal appurtenances.

It is unnecessary to advance arguments in favor of the first method over the second. Everyone sees at a glance the advantages of the one over *all* others. The only question is that of cost.

But it may be profitable to show the advantages of the dry-earth system of privies over all other systems, excepting, all the time, the sanitary water-closet system. In the first place it is the only *safe* system and costing so little in skill or time or money to install. Under certain circumstances these items cut quite a figure and are of real importance. In the second place, and of more importance if possible, is the fact that the simple old fashioned privy system is the system that will be used by the vast majority of the individual children when they have grown up and become heads of families, especially if they continue to live in rural districts. Then what could be *more important, more sensible, and withal more practical*—these times of teaching the practical things of every day life—*than to make choice of necessity and institute a system of simple dry-earth closets at the consolidated educational center of the country community, and teach the growing-up citizen, as well as the grown-up ones, how to use and how to care for the only one kind of family privy that should ever be countenanced in these days of advanced thought on sanitation.* I am almost persuaded to advocate the construction of a sample dry-earth privy at every country school to be used and cared for by the boys of the higher grades, even when a sanitary system of water-closets is in use; that the coming heads of families may learn in a practical manner this all-important lesson of home sanitation. But where the weight of necessity may also be added to the scale, the question is settled—nothing can outweigh the importance and value of it. The practical lessons of caring for other domestic filth from kitchen and stable, can be and should be taught by example so that the lessons will be carried to the rural homes to impregnate the minds of the parents, and set in motion methods of home sanitation that will work for good in these country communities that are often, if not always, so far behind the times in the knowledge and practice of the laws which conserve the health of the individual and of the public.

SANITARY CONDITIONS THAT SHOULD OPERATE IN SELECTING A PROPER SITE FOR A CITY RURAL OR VILLAGE SCHOOL BUILDING

BY

Wm. H. Brainerd

The Ideal School Site.

The essential sanitary problems of a school are:

1st. To provide a place for instruction, where it may be given with the minimum of fatigue and strain for pupils and teachers.

2nd. To provide hygienic conditions for the necessary accessories, such as corridors, toilets, playrooms and playgrounds.

The question assigned to me for presentation is how these problems are affected by the site. I have chosen to treat this question under the following heads, arranged as nearly as possible in the order of their importance:

I. Exposure to light.

II. Surroundings.

III. Space.

IV. Access.

V. Proper conditions of soil.

While this arrangement of subjects is based on relative importance for an ideal site, it is by no means certain that they will have the same relation of importance in the selection of an actual site. Good space and access may well outweigh a slight advantage in surroundings.

I. *Exposure to Light.* The primary purpose of a school building is to provide a place where teaching may be done. Our concern in the matter is that the effort necessary to impart and receive instruction shall none of it be wasted in overcoming adverse conditions which can be avoided by reasonable forethought. Leaving out the consideration of schools for the blind, which are so few in number as to be negligible, all instruction is dependent on the use of the eyes. To make satisfactory use of these organs we must have light, and that sufficient, both in quantity and quality. This is true in all grades, from the work with charts in primary classes to the blackboard exercises in geometry, or the reading of German and Greek texts in the high school. This condition is equally essential for the clear demonstration and execution of exact work in mechanical instruction or domestic science. All these operations require light, in large amount and without glare, in order to avoid nervous strain and fatigue.

This is the primary demand of a room for instruction. There are also secondary uses for light. There is nothing that will so sweeten and vivify the air of a class room or work room as sunshine, even though it be for a small portion of the day, and this secondary use of light with sunshine is as desirable for the corridors, playrooms, toilets and such necessary accessories in a school building as for the class rooms; but it is true that the latter have the first claim to such light, because they are used for a larger portion of the school period than are the accessories. Expressed in terms of site, this means that the ideal location should have light on all sides.

As I have said before, the light must be in abundance, but we must consider the use of the individual room before we assign to it a specific exposure. Sunlight sometime during the day is desirable for all the instruction rooms, but if it continues too long in them it may occasion such a glare as to be as bad as none at all. The nervous strain which it causes upon the eyes may more than offset its cleansing effect in the room. A flood of westerly sunshine which is helpful in a corridor or stairway may be distressing in a class room.

Our investigation and experience lead us to select exposures for class rooms in the following order of preference: 1st, easterly; 2nd, southerly; 3d, westerly. If the building contains few class rooms, the exact shape of the lot is not essential, since we can generally obtain suitable exposures with a little study. For large buildings, a site admitting of the major axis running north and south, or better still, northeast and southwest, is desirable, assigning to the class rooms the easterly and southerly exposures, while assembly hall, stairways and other accessories, are given westerly and northerly exposures.

In selecting a site in a crowded city, sometimes every consideration but light for the class rooms has to be waived. One notices in the buildings for the Borough of Manhattan in New York City, so excellently planned by Mr. Snyder, that while he does most thoroughly light his class rooms, apparently little attention can be paid to the location of the rooms in relation to points of compass, because of the restricted choice in sites available in the city. To get light for all accessories, he is obliged to make shift as best he can. However, these difficulties due to restricted sites do not seem to prevail in this country anywhere outside of New York City.

We have not alluded to exposure necessary for circulation of air, since the conditions which we consider necessary to provide proper light are sufficient to ensure a proper quantity of air. The quality will be determined by the surroundings.

II. *Surroundings.* The requirement that these should enhance, not detract, that they should be neither noisy nor noisesome, is axiomatic. That a boiler shop or the smoking chimney of a power house are undesirable neighbors, no one will question. The value of many a site in town or country which was excellent when selected has been impaired in these later days by the noise arising from electric cars or the constant stream of automobiles on some great thoroughfare. Railroad and freight yards, too, are not desirable neighbors. And even in the peaceful country, the noises from a farmyard may not add to studious quiet. The brook and water garden which have been the pride of some old private estate do not necessarily add to its value as a site for a high school.

All these, however, are negative considerations. There are other matters to be considered on the positive side. Hills or trees, which shelter the site from prevailing cold winds, are desirable. I recall with a shiver that old building located on one of the highest points of a windswept western prairie, and, besides this, raised on a mound, with its entrance of many steps exposed to the full fury of the northwest blasts, to which I used to struggle on cold winter mornings to receive instruction; and how, many times, the girls of the class were almost blown from their feet because of the force of the wind.* In revisiting the school during the past year I was pleased to notice that by the growth of trees, the wise placing of other buildings, and the shifting of the entrance to the southerly side, access to the building has been made reasonable, even in extreme weather.

Beauty of outlook whereon the eye may rest is also one of the positive qualities, and should be sought for its hygienic value in quieting and stimulating the mind.

The surroundings in their effect on the architectural effect of the building should be carefully considered, so much may be added to the beauty of a building by an appropriate setting, and this beauty is a real asset, being constantly before the pupils to add to their joy and pride in *their* work and *their building* and to foster the civic pride of the whole community. The appreciation that is being shown for beauty, and the efforts made to attain it, in all that concerns a building, is one of the hopeful signs of the times.

*The strain, both physical and nervous, caused by such conditions, can better be imagined than described.

III. *Space.* This must first provide for the actual ground area of the building and its necessities of light. To refer again to the Borough of Manhattan in New York City, these absolute necessities seem to be all that can be obtained for the grade schools; and to obtain even these they are obliged to construct buildings four to six stories in height. Under such conditions one must be content with the bare necessities and endure the added strain caused by the extra stairs and cramped playgrounds.

In the average case, grade-school class rooms will be provided in two stories. In such case the area occupied by the building should not exceed twice the net area of the largest number of class rooms in either story.

In the greater part of this country, costs for construction and for heating prevent the use of one-story buildings. California, however, seems to find them feasible; these should provide ideal conditions for ease of access and for quiet during hours of instruction.

For school accessories, the first requirement is for playgrounds. School authorities in England, Germany and America agree that from 30 to 50 square feet per pupil should be provided for this purpose.

If these playgrounds can be protected by the building, or placed on the southerly slope of a sheltering hill, it will materially add to their usefulness in northern latitudes during winter.

Other needs that arise in connection with the individual school should be kept in mind. Athletic fields, school gardens, and even larger spaces for practical instruction in horticulture and agriculture are sometimes desirable, especially for rural schools.

All these have hygienic value insofar as they add to the ease and pleasure of instruction.

In cities and towns, municipal parks and fields may provide all the accessory space needed, particularly if the school site can be placed adjacent to them.

IV. *Access.* That the ideal site should, for ease of access, be central to the district served will be granted by all; but it is harder to get agreement on what is the meaning of central in this connection.

We have seen a rural school house on our central western prairies carefully located at the crossing of two roads which provided equal access, measuring the feet and inches, from the extreme limits of the school district; but the roads were minor ones, frequently unbroken in winter, and the site itself, while ample in size, had a northerly slope, down to a marsh. In such a case the *central location* by feet and inches is not central for attendance, and has been gotten at the expense of hygienic conditions.

Many times the question of central location is one of transportation rather than of geography. We have had this fixed in our mind by experience in New England country towns where the convenience of trolley service frequently makes a site central in spite of geographical considerations.

Care should be taken that the site is not located directly contiguous to trolley lines or main automobile thoroughfares, where the children in their play may thoughtlessly rush into danger.

V. *Conditions of Soil.* These must be such as will provide a dry basement and playgrounds. While moisture is needed in the air supplied for ventilation, this moisture should come from a source whose purity is known and which can be controlled. It must not be ground air from an uncertain source.

Earth full of decaying vegetable or animal matter, with the resulting gases and germs, or oozing with water cannot be used in this state. However, since these conditions can be corrected by underdraining, refilling and grading with proper materials, and waterproofing the basement, the problem becomes financial rather than sanitary.

In cities where the choice in sites is restricted and costs vary greatly, it may many times be wise to spend money in improving the soil condition of a site otherwise acceptable. In towns and rural districts the range of choice is generally sufficient to avoid any large expense for special preparation of the site. In such districts, the more vital questions are those of water supply and disposal of excreta. As these are to be discussed in detail in other papers, I will only mention them.

I present to you two lantern slides showing what application we have made of the principles which I have enunciated in the development (1st) of a rural, and (2nd) of a town site for grade schools.

The first is in the Pond End School, Waltham, Mass. An old site in a farming district.

This is partly a level space and partly a rocky hillside sloping to the southwest, and is between two main roads near their junction. The building contains three class rooms, all on the first floor, and may later have a second story. The slope of the land and the desire of the authorities for a frontage on Winter Street have forced us to face two of the class rooms to the southwest; the other is lighted from the southeast. The surroundings and setting of level road in front, great elm at the left, and the background of wooded hillside, are almost ideal. The level space at the left and the site of the old building (shown in outline) make a good playground, sheltered by the hill and shaded by the tree. The basement is protected from the ground water from the hillside back of it by a foot drain.

We were fortunate enough to have a water supply from the town system. The excreta are cared for by a septic tank system, located on the other side of the road in front. This replaces the privy shown at the rear of the old building.

The second slide is of the Adams School, Lexington, Mass. This site is practically level. The street and access are on the west.

The street happens to be that by which the British retreated on that memorable 19th of April, 1775.

The building contains eight class rooms and an assembly hall, arranged in two stories. Later, four rooms are to be added at the rear.

The soil is the loam of an old orchard overlying gravel, and that in turn overlying blue clay and boulders. At the rear there is a municipal playground of several acres, lying at a lower level.

We have arranged the building for the class rooms to have easterly, southerly, and westerly exposure, the assembly hall being on the north. The children's playgrounds and entrances are on the south and west, sheltered by the building. Everything is kept well back from the street, to avoid the noise and danger from electric cars and automobiles. The boiler room, the only portion of the building going below the dry gravel, is protected by a foot drain with outlet at the rear. There is a supply of water from the town system. The sewage is temporarily disposed of by a leaching cesspool, but will eventually go to a sewer which is planned for the street.

I wish to sum up briefly the points made:

I. *Exposure to Light.*

The first purpose of the school is instruction.

The first need of instruction rooms is light, for the use of the eyes and apparatus.

Light must be in abundance and without glare.

Sunlight should reach all instruction rooms, and others so far as possible. Long-continued, hot sunlight is not desirable in class-rooms.

The desirability of exposure for class-rooms is in the following order:

Easterly. Southerly. Westerly.

For large buildings a site permitting the major axis to run northeast and southwest is most desirable.

Class rooms having the easterly and southerly exposure.

Assembly hall and accessories westerly and northerly exposures.

If the site provides sufficient exposure to light, the circulation of air will be sufficient in amount.

II. *Surroundings.*

These should enhance, not detract. They should be neither noisy nor noisesome.

Light and quiet should not be impaired.

Beauty has positive hygienic value, by soothing and stimulating the mind.

III. *Space.*

The space must be sufficient to allow of low buildings—generally two stories, never more than three stories except in crowded city districts.

Open playground space from 30 to 50 square feet per pupil.

Other needs, such as School Gardens, Athletic Fields, etc., should be considered. A southerly sloping hillside is many times desirable.

Substitutes for accessory space may occur in adjacent municipal grounds or even in quiet side streets.

IV. *Access.*

Site should be central to district served. This may be a question of transportation rather than of geography.

Site should not be exposed to the noise and danger of contiguous railroad or street car lines, or main automobile thoroughfares.

V. *Conditions of Soil.*

Must provide for a dry building. This generally is more a matter of expense than of actual soil. A well-drained site with, if possible, a sand or gravel subsoil is desirable.

In rural and town schools the range of choice is generally sufficient to provide a suitable location. In older towns and in cities more important considerations may make wise the expenditure necessary to overcome poor soil conditions.

SESSION TWO

Room A. **Tuesday, August 26th, 9:00 A.M.**

OPEN-AIR SCHOOLS

JOHN W. BRANNAN, M.D., *Chairman*

CALVERT K. MELLEN, Buffalo, N. Y., *Vice-Chairman*

Program of Session Two

I. OGDEN WOODRUFF, M.D., Physician to the Open-Air Schools, New York City. "Fresh Air Schools in New York City."

FRANKLIN W. BARROWS, A.M., M.D., Medical Inspector of Schools, Buffalo, N. Y. "Open Window Schools in Buffalo."

JOHN V. VAN PELT, New York City. "The Architecture of Open-Air Schools."

GEORGE JENKINSON HOLMES, M.D., Supervisor of Medical Inspection, Newark, N. J. "The Results of Open-Air Treatment in Public Schools in Newark, N. J."

B. U. RICHARDS, M.D., Medical Director of Public Schools, Pawtucket, R. I. "The School Room Window."

HAROLD BROWN KEYES, M.D., Physician to Horace Mann School; Instructor, Department of Physical Education, Teachers' College, New York City. "Effects of Outdoor and Indoor School Life on the Physical and Mental Condition of Children."

WALTER W. ROACH, M.D., Supervisor of School Medical Inspectors, Fourth and Fifth Districts, Philadelphia. "Vitalizing School Children."

Dr. LUIS MIRO QUESADA, Professor of Pedagogy, University of Lima, Peru. "Porvenir de la Escuela al aire libre."

Dr. ANTONIO VIDAL, Buenos Aires, Argentina,
and
Dr. CARLOS ROBERTSON, Buenos Aires, Argentina. "The Open Air School in Scientific Pedagogy." Joint paper.

FRESH AIR SCHOOLS IN NEW YORK CITY A COMPARATIVE STUDY

BY

I. OGDEN WOODRUFF

The title "Fresh Air Schools in New York City" suggests a rather wide range of subject. We all know something about fresh air classes and so much has been written on them in general that I am going to ask you to bear with me while I cover a rather narrow field.

The work reported upon in this paper has been undertaken by me in the capacity of physician to the outdoor classes of the Board of Education of New York City, and it has been made possible only through the interest and generosity of the Committee on the Prevention of Tuberculosis of the Charity Organization Society, which furnished me the assistants and financial support necessary to make such a study practicable.

During the last two years I have suggested that while glowing general accounts have been published concerning the improved condition of the children treated in fresh air classes, practically no attention has been paid to the fact that the problem—as our fresh air classes are conducted—is a complex one.

In some cases—particularly in the classes for the tuberculous children—the children have had a great increase in their diet, and their amount of exercise has been markedly restricted. This combination of factors has produced a gain in weight much beyond the normal and this has been the factor in the reports upon which most emphasis has been laid.

All of the benefits derived has been attributed by the general public to the fresh air, and unthinking persons who have put poorly nourished children in the cold fresh air, without giving them additional nourishment, have been discouraged because the gains in weight have not been as satisfactory as many previously reported. Thus the fresh air work has been hurt because proper consideration has not been given to other important factors besides the changed environment (notably to the school feeding).

Now I believe that no careful study has ever been made to estimate the relative influence of the changed air and temperature conditions and the additional nourishment received, or to phrase it more popularly, the relative value of fresh air and feeding in this type of class; and it is with this question, together with the influence of the home conditions, especially of poverty, in producing subnormal children, that I am going to deal.

The ideal is generally prevalent that the chief reason for malnutrition and anemia in school children is under-feeding at home, with poverty as the ultimate cause.

On this basis there are those who contend that placing poorly nourished and anemic children, without feeding in the cold fresh air would cause them to burn up a portion of their already inadequate nourishment to maintain their body temperature, and that consequently not only would we fail to benefit them, but we would actually work to their physical detriment.

A well known authority on the hygiene of school children recently told me that in a New England town this past winter he managed to postpone the opening of a fresh air class in which there were to be a number of poor children until the authorities had provided for extra nourishment, and he did this because he believed that without feeding the children would actually be injured.

Now this is a contention requiring serious consideration, for the view is an entirely logical and rational one if the premises on which it is founded are correct; namely, that under-feeding due to poverty is the chief cause of malnutrition.

So far as I have been able to find, no careful investigation has ever been made to ascertain if there is any definite relationship between poverty and malnutrition in school children; and at present then we shall have to realize that the assumption that poverty is the chief cause of such malnutrition has not yet been supported by proof. Consequently there is a possibility that malnutrition may be due to other causes not yet determined; or if due to under-feeding, that the insufficient nourishment may be caused by lack of appetite, especially for fatty foods, or to lowered powers of assimilation, instead of poverty. With such premises it is conceivable that with the increased bodily tone and appetite, which are notable among children after a stay in the fresh air class, they might eat and assimilate sufficient food to maintain their nutrition, even though feeding were not given in the school.

If such were the case, perhaps fresh-air classes could be run much more economically than at present when feeding is deemed necessary; or at any rate, classes could be organized with benefit to the children even if funds for additional nourishment were not available.

It can be seen from the foregoing that the fresh air classes are not a separate, isolated feature of the school system. Their problems are intimately interwoven and go hand in hand with the problems of two important features of school hygiene—school feeding and malnutrition—which are demanding so much attention to-day.

On this account I have thought the subject of sufficient importance to warrant a special study.

In order to ascertain the relative effects of fresh air and feeding, I simply divided the fresh air classes into two groups. To one I gave additional nourishment at school. The food value of this (milk and crackers) amounted to 350 calories daily. The other children received no nourishment.

The results from the two groups were then compared. For the purposes of statistical study it was essential to compare such results as could be reduced to figures. Consequently an especial study was made of the weight, nutrition and hemoglobin. The influence of the home conditions, especially the economic, was studied by getting as accurate data as possible regarding the family income and general living conditions and by comparing the degree of malnutrition and anemia on admission and the physical progress during the year of those children from homes of poverty, with those in comfortable circumstances.

It was realized that for the work to be of any value, extreme accuracy in the examination and compilation of records was essential as well as a searching analysis of school and home conditions, to ascertain if any factors were present which by their predominance in either group might tend to influence the results.

I have taken a good many precautions to insure the accuracy of our basic figures. All figures have been checked and rechecked and care has been taken so far as possible to eliminate variations due to personal element; for example:

The hemoglobin determinations were all made by one physician—Dr. Nilsen, and the data of the home conditions were all compiled by one individual, a trained social worker, one of the Board of Health nurses. Finally all the figures were checked and compiled by an expert statistician.

The children were primarily selected for the class because of their anemia or their malnutrition. Only when the parents' refusal to co-operate rendered the filling of the class otherwise impossible did we introduce more normal children.

The compilation of the data relative to the physical condition of the children on admission is given in Chart "A," which shows that we have to deal with groups of children closely approximating each other in nutrition and degree of anemia. The children on feeding were 9 months older and correspondingly taller and heavier. They were kept in the class, if possible, throughout the entire year, and this was accomplished in most cases in 11 of the classes. As the other three classes failed notably to meet these conditions, no attempt was made to study the results obtained.

CHART "A"

Average Height, Weight, % Malnutrition and % Hemoglobin on Admission and Respective Gains and Losses.

Feeding Class figures in Black. Non Feeding Class figures in Green. Total Class figures in Red. Control figures in Blue

Classes	Number of Cases	Average On Admission: Height (inches)	Weight (lbs)	Percentage: Malnutrition	Hemoglobin	Average Gains or Losses: Height (inches)	Weight (lbs)	Percentage: Nutrition	Hemoglobin
Feeding	103	49.8	56.5	6.6	73.4	1.4	4.4	.5	4.0
Non Feeding	129	48.4	52.6	6.9	74.9	1.4	3.6	.2	3.7
Total	232	49.0	54.3	6.8	74.2	1.4	3.9	3	3.8
Control	24	47.8	53.2	1.3	821	1.2	4.7	.4	3.8

In all, we have studied the results in 232 cases, of which 103 were on feeding and the remainder received no nourishment. In point of attendance and duration of time under observation, conditions are almost identical in the two groups.

Those on feeding averaged 156 school days' stay in the class, with 89% of attendance; and the others, 155 days' stay, with 90% of attendance.

Incidentally, all the children went home to luncheon, in order that the variable of restricted exercise due to remaining in school during the noon hour should not operate in either group.

CHART "B"

Conditions on Admission and Average Gains by Annual Incomes

Feeding in Black. Non Feeding in Green. Totals in Red.

Annual Income	Percentage of Cases			Average on Admission: % Malnutrition			% Hemoglobin			Average Gains or Losses: Weight (lbs)			% Nutrition			% Hemoglobin		
	Feeding	Non Feeding	Total	Feeding	Non Feeding	Total	Feeding	Non Feeding	Total	Feeding	Non Feeding	Total	Feeding	Non Feeding	Total	Feeding	Non Feeding	Total
Under $600.	39.	34.	36	6.8	5.2	6.0	73.9	72.5	73.2	4.4	3.9	4.1	.6	.8	.7	5.8	5.8	5.8
$600.-$900.	44.	43.	44.	7.2	8.3	7.8	73.1	76.0	74.7	4.6	3.7	4.1	.4	.7	.6	2.9	3.2	3.1
Over $900.	17.	23.	20.	7.3	6.5	6.8	74.5	77.7	76.5	4.3	2.9	3.4	1.4	-.5	.2	2.9	1.3	2.0

In Chart "B" I have endeavored to compare economic conditions in the homes in the two groups. A division of the income arbitrarily into three grades has been made, merely because of the difference of opinion as to what constitutes a living wage. Some maintain that $600, others that $900 a year should be considered the minimum income.

You will see that in the matter of income the two groups lend themselves well to comparison, as the percentage of children in each grade of income is about the same in the two groups. The slight differences between the two groups are not of much importance, however, as the other figures in the chart show that, contrary to expectation, there seems to be little difference in the degree of anemia and malnutrition or in the rate of progress in the class whether the income be under $600 or over $900.

These findings are very similar to those I obtained last year in a corresponding analysis.

An analysis of the children's sleeping rooms with reference to light, air and overcrowding likewise, both this year and last, furnished negative results regarding the physical condition of the children.

While these findings are entirely at variance with what current opinion has led us to expect, their chief value to us now is, that they enable me to show, before examining the results of this year's work that we are dealing with two groups of children so closely resembling each other physically, and under such similar conditions in school and at home that for purposes of comparison, the only variable of importance is the additional feeding, the influence of which we are desirous of investigating.

In connection with this work, a small group of 24 children, all of one indoor class, who offered themselves for the purpose of comparison have been kept track of to compare their changes in weight and hemoglobin at the end of the year with the results of those children in an outdoor class. Their condition on admission is given in Chart "A." There we see that they were approximately of normal weight and averaged about 82% of hemoglobin.

Results. Taking up first the gain in weight, I have constructed a weekly Weight Chart "C," which shows much more clearly than mere figures the gain in weight in the two groups and in the control class during the year.

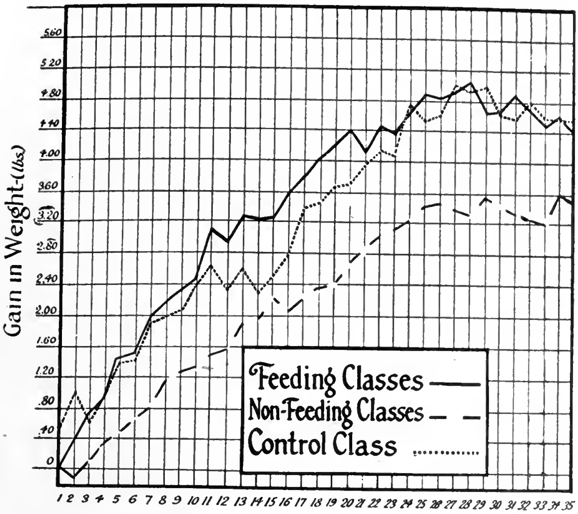
The class on feeding is indicated by a heavy continuous line.

The non-feeding by an interrupted line.

The control class by a lighter continuous line.

CHART "C"

Accumulative Average Weekly Gains in Weight (lbs.)



Weekly Intervals from Sept. 25, 1912 to June 5, 1913.

You can see immediately that the gain in weight for the group on feeding approximates much more closely to that of the normal children in the control class, while those not on feeding lag perceptibly behind.

The sharper rise at the beginning of winter in the class on feeding is probably due to an earlier donning of heavy clothing.

A partial explanation of the difference in gain of weight between the feeding and non-feeding classes is due to the difference in height. The normal increase in weight for a group of children averaging about 50 inches and gaining 1 and 4-10 inches is about ½ lb. greater than for children an inch and a half shorter.

Referring to Chart "A" again, however, we see that despite the smaller gain of the non-feeding classes, their increase is sufficient to keep up the nutrition they had on admission and even to add a bare fraction to the credit side of their account.

Most of these non-feeding children were from poor homes and a reference to Chart "B" shows that those children in the group from homes with smaller incomes gained equally well and that there was no loss of nutrition at the end of the year.

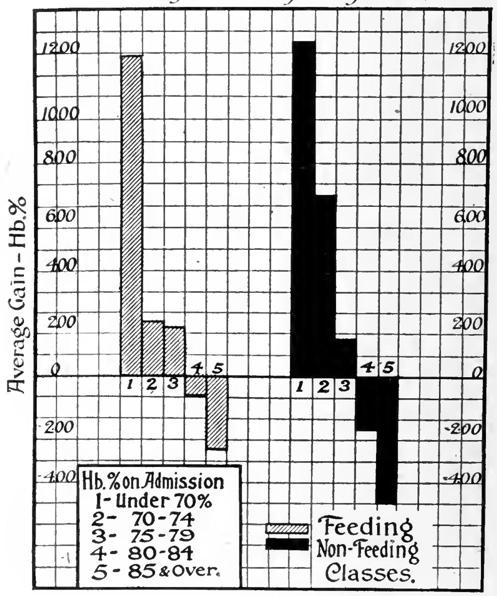
These results are very interesting. In the non-feeding group we have children coming mostly from poor homes, under-nourished, placed out-of-doors with no additional nourishment, and yet who gained enough to maintain their nutrition despite their handicaps.

These children were from schools chiefly in the so-called poorer districts of the city and in widely separated areas. So far as we could get them they were the most anemic and poorly nourished in each school, so they may be considered as representing fairly the under nourished school children in the city.

That these children maintained, even those from the poorest families and in the non-feeding classes, the weight they had on admission, shows that they had sufficient food at home to supply their average daily needs. That these children gained on an average of three pounds apiece shows that there was food at home for them in excess of what they needed for daily consumption, even though their daily requirement in winter was presumably increased by their exposure in the cold fresh air. Under these conditions if their malnutrition had been due to poverty there should have been, not a gain, not even merely a maintenance of weight,

CHART "D"

Average Gain in Hemoglobin %
According to Hemoglobin % on admission
(Feeding and Non-feeding Classes)



but an actual loss during the year, a condition which did not occur in a single case under our observation. It seems fair from this to assume that poverty is not the ultimate cause of malnutrition in the great majority of cases among school children.

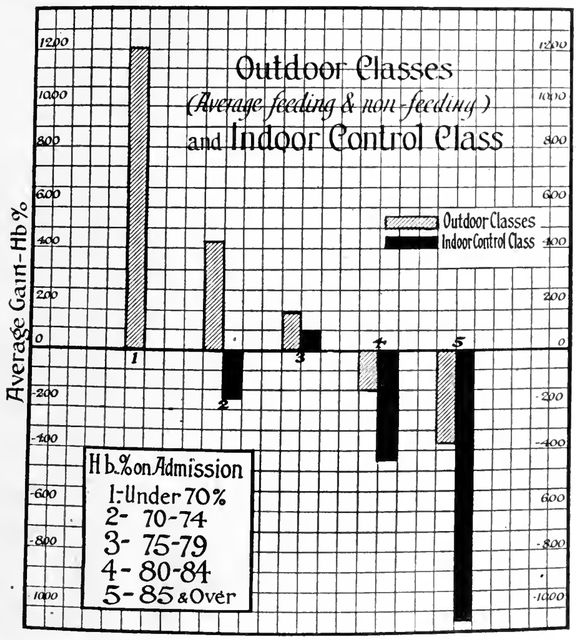
In the matter of hemoglobin the difference in the gain in the two groups is almost nil, being a matter of only 3-10 of 1%, each class gaining an average of about 4%.

An analysis of the hemoglobin gains shown in Chart "D" illustrates very well how closely the gain approximates in the two groups. The open rectangles represents the feeding and the shaded the non-feeding; the rectangles are arranged from left to right according to the per cent. of hemoglobin on admission and indicate from under 70% to over 85%; the height of the rectangles above or below the base line represent the amount of hemoglobin gained or lost.

It shows in each case a striking gain of the very anemic, somewhat greater in the non-feeding class, and an unexpected loss in those over 80%, which is greatest in those children whose hemoglobin is highest on admission.

CHART "E"

Average Gain in Hemoglobin %
According to Hemoglobin % on admission



This loss indeed at first glance suggests that there is not very much difference in results between the more nearly normal children in the fresh air class and those in the control class, who average 82% hemoglobin and lost on an average about 4%.

However, Chart "E," a chart similar to Chart "D" analyzing comparative hemoglobin results of the fresh air class with those of the control class, shows that the losses of the children with over 80% of hemoglobin is really much greater in the indoor class; and that between 70% and 75% there is also a loss as opposed to the gain in the fresh air classes. Here the rectangles with the heavier shading represent the indoor class.

To explain these complexities one must enter the always dangerous realm of speculation, but I cannot help venturing a suggestion which seems to me fairly simple and reasonable.

Clinical pathologists seem to agree that the hemoglobin precentage in childhood varies considerably at different periods of life, and that in general in children the normal percentage is considerably lower than in adults, probably below 85% as measured by the adult standard.

It is quite likely then that the hemoglobin determinations over 80% may well be normal for these children we have had under observation. Their failure to gain, or even their slight loss, suggests that the general environment of a child during the winter, with increased housing, and artificial and frequently too great heating of both homes and school tends to produce anemia. This tendency even an additional five hours in an open window class cannot entirely overcome.

But, to observe the control of the class, it prevents the development of as much anemia as occurs under usual methods of living. With the distinctly anemic child it stimulates markedly the blood-forming organs and raises the hemoglobin to an appreciable extent.

Now what of practical value can we draw from these results?

First, as just suggested, from a comparison of the hemoglobin results in the control class and the fresh air classes, it is likely that during the winter our usual living conditions have a tendency to produce anemia and lowered physical tone. It is to be hoped that more recent studies in heating and ventilation will show us how to live that we may in a large measure overcome this; but at the present time between the ventilation we now enjoy and the arrival of millenium, the health of our children can be much improved in school by a marked extension of the open-window classes.

Second, proof is yet lacking of a casual relationship between poverty and malnutrition as found among school children. Probably poverty is not the cause in the great majority of cases. During the last two years of the children selected for the fresh air classes, a study of the home conditions has failed to show that either poor economic or hygienic conditions were a potent factor in determining either the degree of malnutrition and anemia or the progress of the child in the fresh air class. Fortunately, the Association for Improving the Condition of the Poor, of New York City, is planning an exhaustive investigation of the subject of malnutrition during the coming winter. Meanwhile we shall have to consider malnutrition as due either to individual susceptibility or to other factors not yet determined.

Third, with a lack of proof of the relationship between poverty and anemia, and the results in our non-feeding classes, we feel that poorly nourished and anemic children even from poor homes, can be placed in the fresh air in school and without school feeding and kept there during the cold of winter, not only without physical injury, as shown by their maintenance of nutrition during the year, but with actual benefit to them, as indicated by the marked increase of hemoglobin in the very anemic and the general gain in mental and physical tone, with which all of us in our outdoor class work are familiar.

The practical application of this is, that I believe a fresh air class can be started in a community with the expectation of benefiting the children even if funds are not available for feeding. By this I do not in any sense wish to be considered as advocating running these classes preferably without feeding, for it seems that one thing our results show conclusively is that:

Fourth, we cannot hope to improve appreciably the nutrition of these children by merely placing them in the fresh air.

Now we shall always include in a group of children picked out for the fresh air classes those who are poorly nourished, those convalescing from illness, those exposed to tuberculosis or with a family history of the disease. The nutrition of these children we wish to raise to as high a point as possible; if we can, to a point beyond the normal. If we are going to attain a proper measure of success in this respect it is certainly necessary to include additional feeding as an integral part of the work.

Now in this paper you may have noticed I have not used my results to emphasize the particular value of the fresh air class and the necessity for it, but merely as an exposition of some of the problems connected with this branch of school work. To my mind, the outdoor classes need no defense. Their usefulness and value have long since been established even if chiefly by means of the intangible gain in "mental and physical tone," which is noticeable in the children.

When I see a girl whom her teachers tell me is listless, does poor work, and frequently faints in the class room, when I see such a girl after a month or two develop energy and ability to work and go through the winter without a single attack of syncope, I know the class is doing her good, without reference to weight and hemoglobin determinations.

When a class as a whole tell me they have had no colds all winter long—something outside of the previous experience of any of them, I know that somehow or other their general resistance is raised; and when a teacher tells me, as one did, that her children on coming to her were so listless at the end of the day that she had to give them any work requiring concentration in the morning, and that after three or four months their condition was so changed that they became progressively more alert as the day advanced and took the hardest work just before 3 o'clock, then I know and we all know that the physical condition of these children has markedly improved.

Whether further studies in ventilation will show how we can prevent our school children from running down and becoming listless and anemic, and that we can also build them up indoors, remains to be seen, but for the present the fresh air or open-window class is the best practical means at hand for accomplishing this result. Feeding or no feeding let us all urge its widespread adoption.

DISCUSSION OF I. OGDEN WOODRUFF'S PAPER BY FRANK H. MANN

The work done by the Committee on the Prevention of Tuberculosis of the Charity Organization Society, of the City of New York, through Dr. Woodruff, in connection with certain problems of the fresh air class has, we believe, settled in part, at least, the question of the necessity of feeding these children. As Dr. Woodruff well says, there is practically unanimity of opinion in regard to the value of the fresh air classes. The good that they do is apparent to the most casual observer. No one who has seen the children on admission and watched their progress during the year and seen them at the close, could doubt for a moment the good resulting from treatment in the fresh air. The concensus of opinion is doubtless overwhelming in favor of the wide extension of these classes for anemic children.

One of the most serious drawbacks to the extension of these classes has been the matter of funds. It is well known that the feeding of the children has been the largest element of expense. The cost of equipping kitchens, paying for service, as well as the purchase of the food has deterred many communities from undertaking this most desirable work. I have had occasion, as Secretary of the Tuberculosis Committee, and as being intimately connected with this experiment described by Dr. Woodruff, to come in contact with a great many persons from all parts of the country interested in the establishment of fresh air classes. I have found always that the element of expense for feeding the children in these classes has been a serious handicap.

We have demonstrated, we believe, that without extra feeding in the schools, children from the poorer families can be taught in the open air to great advantage. It is admitted by Dr. Woodruff that additional food given in the schools does mean an increase in weight and a slight increase in nutrition; but it has been fully proven that in other respects, in the increase of percentage of hemoglobin, in the increase of bodily tone and vigor, in the increase of mental ability, children taught in the open air without extra feeding improved more rapidly than the same class of children in the closed class rooms.

While it may be claimed that this does not finally settle the desirability of school feeding, it must at least be admitted that it does answer the query as to the necessity of school feeding as an indispensable part of the program in the development and extension of fresh air classes. Perhaps, indeed, a few individuals could not advantageously be taught in the open air without additional diet, but certainly the vast numbers of anemic children who would profit by the open air treatment without extra diet, should not be made to wait until this very moot question of school feeding is finally settled.

One other thing I think is important to observe. It is certainly true of our work in New York City. The fresh air classes have proved to be not only beneficial in themselves, but a means to perhaps a much larger end. I refer to the influence of these classes on the whole question of better ventilation of the public school buildings. In March of 1912, the Board of Education of the City of New York appointed a committee of its own members "to investigate and report regarding the subject of ventilation in public school buildings." I believe that the agitation for fresh air classes by the Committee on the Prevention of Tuberculosis, together with the general agitation for better ventilation, was the direct cause for the appointment of this committee. The committee made a very full study of the whole subject and presented a series of recommendations looking towards the better ventilation of all class rooms in all school buildings. Among these recommendations was the following relative to the fresh air classes themselves—"Your committee recommends that every possible encouragement and facility be given by the Board of Education to open air classes, especially when parents desire such classes for normal children." The report in its entirety, including all of its recommendations, was adopted by the Board.

There is but one conclusion to reach and that is that fresh air classes for anemic children should be extended as widely and as rapidly as possible.

OPEN WINDOW SCHOOLS IN BUFFALO

BY

Franklin W. Barrows

For years past our city has been blessed by the presence of a few courageous teachers who would dare to brave the wrath of principals and even of janitors in order that they and their pupils might breathe the air just as it comes to us, fresh from the purifying billows of our great lakes, Erie and Ontario. In spite of rules, remonstrances and threats these teachers have loved fresh air more than any theories of ventilation and have persistently kept their school windows open wide, the year round. Perhaps these open rooms, with their bright, rosy-cheeked girls and boys have been the strongest argument in our city for a real open air school. At any rate, when the Department of Education started our first fresh air class they placed the children in charge of a teacher who had already demonstrated her ability to get fresh air into a room in spite of any and all "systems" of heating and ventilation. I mention this important fact because it shows that our open air school was merely the continuation, under somewhat more favorable conditions, of a campaign that had been waged for years by a few of our most progressive teachers. I call them progressive because wherever you find an intellectual worker using his or her full share of oxygen, you find one who excels in mental vigor and efficiency.

In most of our American cities the open air school has made its advent under the management and support of private philanthropy. In some cities a portion of the initial expense for room and equipment has been paid by organized benevolence and the balance has come from the public treasury.

In Buffalo, while the Department of Education was subjected for some months to a brisk campaign of exhortation from societies and committees interested in child hygiene, these agencies limited their activities strictly to a policy of agitation and goading. No one thought of raising any money or providing leaders for the important work of founding and maintaining our first Open Air School. Whatever success we have attained in this good work is due, therefore, to the efforts of our Department of Education and the Health Department.

Our first Open Air School occupies an ordinary school room with windows on the east side only. The sashes are hung on pivots so that they may be swung into a horizontal position and admit the maximum amount of air. The desk-seats are movable and can be pushed into one corner of the room to give the children space for exercising or resting in their reclining chairs. By shifting the furniture in this way the room accommodates comfortably twenty pupils. This is merely an open window school room.

Across the hallway is the Domestic Science Room where the Open Air Class meets at noon for a well served hot dinner. Adjoining this room is the lavatory with its clean, white wash bowls, toothbrushes, and individual towels and cups for each pupil. Warm blankets, leggins, and moccasins are provided so that no one suffers from cold.

You will naturally ask if a fresh-air environment can be secured in a school room of this sort which merely opens to the full all the windows on one side. Our experience answers this question emphatically in the affirmative. Except on the most sultry days, when children could be easily assembled out-of-doors for their school program, the ventilation of this room has been quite adequate. In the coldest winter weather the temperature has hovered between 20° and 38° Fahrenheit while the activities of the school have gone on without interruption. In short, we may say that the history of the class and the results attained in this room present a satisfactory parallel to the best type of Open Air Schools.

It is not my intention to give a large array of details concerning this severely simple experiment of our city. It should suffice us to know that the program of the school follows the usual lines in accordance with the tradition "Double rations of air, double rations of food, half rations of work." The children receive some form of light nourishment at the beginning and end of the session and a good square meal at noontime. From calculations made by the domestic science teacher we know that every child receives in this way about 1,000 calories per day in the form of easily digested food, besides the two meals that he eats at home. Due emphasis is placed on exercise, especially on singing. Manual training and lessons in domestic science give variety to the program for the week but take the pupil out of the open air room for an occasional period. With all the freedom and spontaneity that characterizes the life of this particular room, discipline is not forgotten for a moment, and the weaklings who are too prone to be peevish and selfish on entering, soon acquire habits of courtesy and mutual helpfulness which give to the class a delightful air of good fellowship and loyalty to the institution. This improvement in the morale of the children may be due partly to the excess of oxygen, but is chiefly the result of expert management on the part of the teachers, who prize character quite as much as physique.

As this class is housed in the same building with several hundred normal children, great precautions are taken to exclude all sorts and conditions of contagious disease. No cases of active tuberculosis are accepted and if a child develops any symptoms of this or any other contagious trouble he is at once carefully examined, and if necessary excluded until the suspicion is cleared up.

The enrollment of the class seldom exceeds twenty. The grand total of pupils, from the first day to the present, is slightly over one hundred, ranging in age from six to seventeen years and comprising all sorts and degrees of physical defects, such as anemia, weak lungs, weak hearts, nutritional disorders, chronic appendicitis, asthma, nervous disorders—including one epileptic—mouth breathing, spinal curvature, and various deformities resulting from disease or accident.

Each child receives a careful physical examination on entering the class. This is the beginning of an active and persistent campaign for the medical and surgical relief of all his removable defects. Great credit is due to the teachers for their enthusiastic work in following up the recommendations of the medical inspector. Through their labors about two-thirds of the children have received relief from dispensaries, hospitals and private practitioners. Teeth, tonsils, adenoids, defects of vision and hearing, skin diseases and nutritional disorders have submitted to treatment because the teachers have insisted and persisted until they have brought the child and the doctor together. Orthopedic appliances have been secured for the cripples, and the little girl with appendicitis was relieved of her chronic misery by an operation at the hospital.

It is no wonder that, with such zealous care, and with the wholesome influences of the open air room the pupils have gained an average of ¼ pound per week during their attendance at the school. One girl gained twenty pounds in forty weeks; another added to her emaciated body seven and one-half pounds in six weeks. Comparatively few of the pupils have remained in the class for more than one year. As soon as they are sufficiently improved to return to their former classes they are "promoted" although there is a feeling among them that it is a misfortune to graduate from the Open Air Class.

While the children of this room are all debilitated in some way or other, and on that account are obliged to make special efforts to get to the Open Air Class, and while some of them travel long distances on street cars, the attendance record for these twenty pupils is better than that of the ordinary grades. They cannot afford to be absent from their school and they manage to get there in all sorts of weather.

If the children realize instinctively their need of this open air school why cannot their elders take the hint and supply this need by enlarging the school to accommodate hundreds instead of scores, and by helping the most delicate pupils to and from the school? We are glad to say that our city has begun to meet the growing demand by opening a second fresh air room in another quarter of the city. This room has windows on *two* sides—also sunshine—and accommodates thirty children. As it has opened very recently we have no statistics at hand concerning its work.

This is but a brief summary of our short experience with open window school rooms. Our plant is by no means ideal. We would prefer specially constructed buildings, apart from our large public schools, with such accessory aids as baths, parks and school gardens. We do not possess these alluring features in *our* open air schools. But we do not have to abandon the schools for want of these luxuries. We have secured excellent results worth striving for, right inside of an ordinary public school building. We have hundreds of rooms in the city that can be opened to the air on one or two or three sides; in some of them we have sunshine too. And we have thousands of children whose minds and bodies would rejoice in the exhilaration of such an environment. We needn't reserve our good supply of fresh air for the weak and debilitated child. It is good enough for the so-called "normal" child, too. For this reason we hope to see these simple open window school rooms opening up by the hundreds all over our city, and changing the destinies of many nice little boys and girls who are regarded by their teachers as not being particularly smart. We want a whole lot of plodding teachers to appreciate the significance of such little items as CO_2 and 80° Fahrenheit.

On the whole, we rather like the Open Window Room. The idea can be applied to any room, dungeon, den or other place of confinement in which school is kept. In some respects our Open Air Class is better off than the more modern schools that dwell in tents and shacks. We have less interruption during storms of wind and rain; the roof never blows off, as in some of the canvas houses; the glass doesn't smash under atmospheric pressure as in some schools of the conservatory type; our school is never hopelessly frozen up; it never had to be thawed out, and the pupils never get wet feet in their efforts to secure fresh air.

Considered merely as a station in our progress toward the ideal, the open air school room is full of suggestion and delight.

THE ARCHITECTURE OF OPEN AIR SCHOOLS

BY

JOHN V. VAN PELT

The number of words and time at my disposal are so limited and the subject of open air school architecture so large, that I shall have to confine myself to dogmatical statements or to expressions of personal belief, without adducing the arguments that uphold the statements. Unlike the architecture of the ordinary school where experiment has prescribed the type, open air schools have not yet been built and tried out. Ferry boats have been adapted to the use, open air school rooms have been built or altered from old school rooms as minor parts of buildings, roofs covered and uncovered have been turned to the purpose, but the complete school, planned in all its details toward the one end and of an advanced type, is yet to come.

In describing the ideal conditions to which I think such a school should conform, I have in mind a type slightly less radical than what is sometimes known by the title, namely, a school that is entirely out of doors with little more than a roof, and is typified by those at Shrewsbury House and Bradford in England. On the other hand, something that is considerably more open that what has been styled the low temperature school, such as the Graham School, or than such schools as School No. 21 in New York, where the rooms have been adapted from the regular type by merely changing the pattern of the windows and keeping them open. In other words, I propose a building so constructed that the air in all parts of rooms where the children remain, will be continually replaced by outdoor air that has only sojourned a few seconds within the limits of the building, yet not a building that is entirely without heat.

First, I wish to consider general aspects of the plan formation. The ground for such a school should be sandy or gravelly without too much clay, so as to preclude a humid condition in the entering air. It should be protected from the wind, pine, spruce, etc., forming an excellent screen; but these trees should not be too close to the building and should not cast a shade upon it. City schools should be so situated that sun will not be cut off from them by adjacent skyscrapers. This is also important because the high buildings of our later construction cause concentrated air currents that would render work in an open air school almost impracticable, by blowing papers and material about and forcing dust and dirt up and through the school. Exposed conditions, such as

Riverside Drive in New York City, would be objectionable, rendering it difficult to protect the school rooms from violent storms.

The orientation of the school should be such that sun will enter all class rooms during a part of any day in the year. This is especially important in such rooms as study rooms, where the children sojourn for a protracted period. As the rooms are all open, it is not so important that the greatest length of the building be across the direction of the prevailing wind and it is important that it be not across the direction from which storms are likely to come; but no room dedicated to the children should be in a pocket so that free circulation is impeded.

Toilets are to be placed so that odors cannot reach the open class rooms. An unsanitary condition of this kind will become particularly objectionable in warm weather.

It is essential that the plan be so arranged that all class rooms, study rooms, the auditorium and wherever the children remain shall have ventilation on two or more sides and to really fulfill conditions properly, the room should be open on at least two sides that are opposite each other. Corner rooms with windows on the sides perpendicular to each other may be satisfactory when there is a sufficient amount of wind; but when there is little movement in the atmosphere, a dead corner with eddies is likely to retain the air in certain portions of said rooms. On the other hand, if rooms are entirely open on two opposite sides without protection, a storm or misty rain will carry completely across the room. For this reason, an open gallery is advantageous. Such a one is shown in the ideal open air school originally prepared to illustrate the important contribution to this subject made by Dr. S. A. Knopf in his paper at the International Congress on Hygiene and Demography in Washington, D. C., September, 1912, and will be found in the plans and model that I have on exhibit at our present Congress.

General plans may be divided into three classes: The "U" or "H" plan, where the wings are about open courts, the "T" or "Star" plan, where the wings radiate from a center, and the enclosed court plan. The last named is not so good, and all plans should so enclose the courts that the latter are open on at least one side which is not the north. This is to insure the entrance of the sun into all parts of the court during some part of the day.

I see no objection to building three stories high above basement or higher, if means of ascent can be provided. Open galleries and open staircases are good, provided they are protected from snow and sleet. A great advantage is that children passing between the cold rooms do not undergo a sudden change of temperature. Snow and ice are particularly dangerous in the staircases.

An objection to placing class rooms on the ground floor, is dust and odors from the street and the general impurity of the air.

Overhanging cornices are good, because they afford protection from rain for the open windows; but on the top floor they cast a shadow. A glass cornice, like a marquise, might be extended at the top of the building, or such protection might be constructed over each of the large windows. It would certainly be unusual in its appearance and difficult to make it appear architecturally attractive.

The auditorium should be so situated that it can be thrown entirely open. It may be convenient to have it arranged so that it can be closed for special exercises, when visitors are present.

Under a second head, I am grouping some recommendations for the details of the building.

Class rooms should have predominant unilateral light, that is, the light on the left of the pupils should be stronger than that from other directions.

Blackboard space must be preserved, especially behind the teacher.

Sills may be three feet high on the side whence the light comes, namely, the maximum for the ordinary sill. Higher than that, they cast a shadow. It has been found in the experiments made by Mr. C. B. J. Snyder, architect of the Board of Education of New York City, that low sills are disadvantageous, because they create draughts around the pupils' feet, taking away warmth, do not materially improve the general condition of the air and are of no advantage to the respiratory organs.

If blackboard space is maintained opposite the lighting windows, large windows should open up the room above these blackboards; but it is not good to place children immediately under a high sill, as the cold air dropping down on them may be objectionable.

Class room windows must be so arranged that any side from which comes a heavy driving storm or a drifting mist can be closed. In such schools as the Providence School, one of the first open air schools of the country, hinged windows were tried. Mr. Snyder has experimented with these and they have not been found as advantageous as pivoted sash dividing the windows into three parts, the upper half of the lower sash opening in so that it projects above the head of a full grown person. Still more recently the scheme of operating the two upper sash together and the lowest sash independently has been adopted. Such sash somewhat inclined to the outside, form a protection from slanting rain, throwing the water out of the building. Double hung windows are possible running up into pockets in the head of the windows and below the sill of the window above so as to leave the entire opening free. They are somewhat difficult to operate and do not afford any protection.

In the U or H plan, if the court is not wide, the noise from class rooms opposite each other is objectionable. I will take up preventives later in discussing acoustics.

Class rooms may have the floor warmed. This would slightly temper the air and keep the children's feet from becoming cold, tending to dry them if they had not come to school with rubbers. This will also be referred to later. Wood floors are good to walk on, as they are not too hard, and very durable; but rain, snow and dampness soak into them and are objectionable. Linoleum is good, especially if it can be cemented down. It wears out rather easily and is therefore expensive. What is known as composition floors are somewhat expensive, but come within a possible range of prices. They can be made in different ways, and a type should be selected that is not too hard under foot. If the floor is heated, it must necessarily be of a material that will not be affected by the heat. For this reason the warmed floor shown in the design I have made is attained by metal plates separated by composition.

Coat rooms should be well ventilated, but kept reasonably warmed, that is about 65° Fahrenheit. This will appear quite warm to the pupils coming from the class rooms and halls, and a higher temperature would be uncomfortable before the smaller children could succeed in adjusting their clothes. It may be suggested that coat rooms could be omitted, in that the children wear about the same clothing in the class room that they do out of doors. If they have to come to school through snow and storm, their outer wraps should be taken off and dry wraps put on, and I believe it would be better to provide a proper place to keep such wraps, allowing the damp ones to dry.

Furthermore, exceptional cases occur where fragile or anemic children suffer from time to time from the cold. This has been noted in the Graham School reports, and the warmed cloak room offers an excellent place where their vitality may catch up. Although limited space may seem to force wardrobes in the class rooms, I consider it a bad solution. In such case a warmed room for recuperation should be provided on each floor.

Toilets must necessarily be warmed, as the children have to remove some of their clothes, and in very cold weather plumbing pipes would freeze. A temperature of 60° to 65° is ample. Anything higher than this would be bad. Toilet rooms should be screened to prevent insects from entering through the open windows. As in all schools, an automatic means of flushing toilets should be provided, as the children cannot be relied upon to do this properly.

In laboratories, manual training rooms, etc., provision often has to be made to maintain such a temperature that liquids under study will not freeze, and where fine and delicate work is done, the temperature cannot be allowed to go quite as low as where some protection for the hands may be worn in cold weather. Furthermore, below a certain temperature it is not easy, and for some persons, not possible to perform very delicate work. Steam radiators should be introduced in such rooms and if a number of small radiators are scattered about, the heat can easily be graduated by turning on one or more and allowing the others to remain empty. Provision must be made for draining these radiators rapidly.

Rooms for visitors should be provided where the temperature is not allowed to fall too low, and heat will probably be required in the principal's and teachers' rooms.

In spite of the fact that such a school is open and a considerable amount of heat lost, the fact that the average temperature of the building is kept so much lower than is ordinarily the case, will probably show a slight saving in coal over the usual type of school house. Sufficient experiment along this line has not yet been made to definitely determine the proportion.

Hot water systems cannot be used, owing to the danger that pipes and radiators may freeze. Hot air is useless, as it cannot be controlled in such a building. Steam or water vapor are therefore the only possible means of heating, and water vapor is hardly effective enough under the conditions that usually obtain.

Heating the floors of the rooms has already been mentioned. The floors should not be overheated, chilblains would probably result to the children, in the cold rooms the steam that would form would probably be objectionable, a high degree of heat would cause odors. About 40° centigrade is a maximum temperature for a floor surface.

The acoustics in such a building play an exceedingly important role. In an auditorium they must receive special study, as the open windows supply the equivalent of total absorption, and furthermore, allow exterior sounds to penetrate. This would make speaking in the rooms more dead, and in the noisy quarters of a city, exterior sounds would become predominant. In the class room, the question becomes quite important. Up to the present time, sufficient attention has not been paid to the acoustics of the ordinary school. At the new Brierly School in New York City an effort has been made to introduce a reasonable proportion of deafening material. Absorbent felt has been placed on the ceiling and this has been covered by a muslin blind-nailed, on which paper has been pasted, the latter being decorated in waterproof color to give a smooth surface. In the open air room, where class rooms are opposite each other, across a somewhat narrow court, the sound would be thrown over to the opposite room and would cause reverberation in the court. This would be increased by a non-absorbent wall and opposite the windows of the first room, notably if large blackboard spaces covered the reflecting wall. In certain cases it is possible that the reverberation in the room would be sufficiently reduced if absorbent material were placed on the ceiling of the rooms, and sound entering the class room might be sufficiently absorbed if the reverberation were kept down. On the other hand, conditions might exist as previously noted, where a concentration of sound from a reciting class, might be thrown out of the window and into the opposite class room in sufficient proportions that the direct sound would be objectionable. It will appear from this that a special study of the acoustics for each class room should be made. In order to obviate the difficulties mentioned, in the drawings here exhibited I have shown a glass screen that might be built in front of the windows, deflecting the travel of the sound to a certain extent, without preventing light from penetrating the room. If the screen were inclined away from the head of the windows and Luxfer prisms introduced the sound would be dissipated and the light increased, but such increase might not be desirable.

It is surprising that the medical profession which has occupied itself so considerably with the light and color of the walls in class rooms, should have been so oblivious to the nervous strain created by the discordant sounds in recitation in class rooms, or, on the other hand, brought about by imposing too rigid silence and restraint on small children.

In the matter of light, the general color of the class rooms should be that of the ordinary room, except that it must be kept in mind that to light a wall reflecting a glare from the snow on a winter's day, would be trying. As a much larger quantity of light will probably penetrate the rooms than ordinarily enters the class room having glass areas of only 20% to 25% of the floor area, the walls of the room might advantageously be somewhat darker.

It is due my audience to explain that although the complete open air school contemplated in the foregoing paper is still unrealized, I have felt that I could speak authoritatively because of extended experience, on the one hand, in building schools of various types, and on the other, in some twenty years of theoretical study and practical experiment in the construction of sanatoria for the treatment of tuberculosis. These are the two types of building that must be parent to the new ideal, and in closing I can not do better than urge that as you investigate details beyond the scope of this curtailed résumé they be studied simultaneously in exponents of both of these types.

DISCUSSION OF THE PAPERS OF

DRS. WOODRUFF AND BARROWS, AND MR. VAN PELT

BY

DUNCAN B. McEACHERN

Mr. Chairman, Ladies and Gentlemen:

The point was raised by Dr. Barrows that the cost of feeding limited the application of the Open Air School. I want to thank Mr. Van Pelt for his presentation of the architectural needs of such schools. I believe it answers Dr. Barrows' contention.

In his scheme he made provision for heat through the floors, radiators, etc.

It stands to reason that food requirements are greater in cold than in moderate temperature conditions. There is evidently some confusion between the cold air and fresh air advocates. What we are after is fresh air. Humidity is the crux of the situation. We have also been led astray by the so-called tuberculosis experts, who desire to apply their narrow specialty, and confine the use of such rooms to tubercular children. If a tubercular child is worth saving, surely the healthy, normal child deserves consideration, before he has contracted the disease.

Scientific technique, if governed by narrow specialism of this kind, will interfere with, rather than promote, the growth of open air rooms in the public school.

I can best illustrate my point by referring to a statement of Madame Montessori, in which technique and specialization have resulted in failure, or in at least obscuring the real issue. The orthopedic experts have been exercising their ingenuity and skill in developing an adaptable desk for children with spinal curvature, after the regulation desk has been the chief factor in producing the pathology. And she hints at the weird possibility of some future orthopedic expert advocating surgery, or other measures, as a supplement to desk improvements. And the spectacle of our children being regularly suspended by the chin is a possibility, if sufficient pressure is brought to bear upon school boards. When the whole proposition is best answered by throwing out all the desks.

Similarly, if we are governed by the ideal architectural requirements which Mr. Van Pelt has outlined, we may make all our rooms open-air rooms.

RESULTS OF OPEN AIR TREATMENT IN PUBLIC SCHOOLS OF NEWARK, N. J.

BY

GEORGE J. HOLMES

Open air treatment in Newark has been conducted on two different plans: The Pavilion Type and the Open Window Type; likewise for two different types of children: The tubercular and the anæmic, frail, under-weight non-tubercular.

Both types of classes were born of necessity, as pupils so afflicted were numerous and to make no provision for such seemed a failure on my part to perform my whole duty.

History of Open Air Movement in Newark.

The establishment of the first open air class took place in September, 1911. This was the Pavilion Type and was used to accommodate anæmic, frail, under-weight pupils. Later this class was removed to another building, being housed in an open window class room.

The Pavilion Type Class, less than a year later being devoted to the care and instruction of pupils afflicted with pulmonary tuberculosis, who because they were a source of danger to others, were excluded by the Department of Medical Inspection from attendance at a regular class. This movement has grown slowly until now there are in our city one Pavilion Type Class for tubercular pupils and three Open Window Classes for anæmic, frail, under-weight pupils.

The Pavilion Type Open Air Class.

Equipment. This consists of a frame pavilion standing about two to two and one-half feet above the ground, covered entirely by a roof, open on three sides but having protection for the feet and limbs afforded by the front and sides being built up about three feet from the floor. This allows a free circulation of air but protection from the wind and storm.

The floor area of this pavilion is 750 square feet. A canvas shield is provided which can be put up and fastened in place on any side, to keep out the wind and storm when coming from a certain direction or to shut out too strong a cross light, but the latter is hardly ever required as the desks are movable so that the light is always being received in the proper direction.

These desks and seats are individual and of all sizes, as this is an ungraded class. Each desk and seat is provided with cleats, making them firm but movable. A portable blackboard and the usual books and other equipment are furnished.

The personal equipment consists of caps, gloves, overcoats, sweaters, reclining chairs, sitting-out bags, soap-stone foot warmers, tooth brushes, sputum cups, paper handkerchiefs, and paper towels. Each article is marked with the child's name. Car fare to and from school is also furnished.

In a stone building against which this pavilion is placed there are installed cupboards and drawers for storing away equipment of the

FIGURE I
Pavilion Type Open Air School

pupils, also a stove for heating the soap-stone foot warmers, which is operated with charcoal. There is also sufficient space for storing the desks, seats, blackboards and teacher's desk at night, which are easily carried in and so protected.

Alongside the pavilion and store-house is a large frame building which might be called the dormitory, in which there are two large rooms, separated by a sliding partition. Each room has a floor space of 1,400 square feet. The light and window surface is large, coming from all sides but one. The ceiling is 15 feet high, thus affording two large, airy rooms, well lighted.

The room with the southwest exposure is utilized as a rest room for pupils and it is here that the reclining chairs are placed and where all pupils are required to take their after dinner rest and sleep for an hour.

The remaining room is used for a dining-room and kitchen, one corner of which is railed off for a kitchen, in which space is installed a coal stove, hot water boiler with gas heater connection for summer use, two gas stoves with ovens, sink with hot and cold water connections, two kitchen tables. The railing, separating the kitchen from the dining-room, is fitted with a flat top which acts as a service table.

There are installed in the dining-room proper four long wooden, highly polished tables with chairs sufficient in number to accommodate the forty-five pupils enrolled. For the sake of better discipline and order the boys and girls eat at separate tables.

A pantry and cold closet adjoin the kitchen, in which are stored

FIGURE 2
Open Air Pavilion for Tubercular Pupils

the ice box, dishes and food stuffs. All windows and doors are screened to keep out the flies.

The basement of this building provides for both girls and boys; sanitary drinking fountains, toilets, wash basins and a steam heater, which latter is never used except to keep the basement dry.

The above-mentioned buildings are located on a knoll overlooking Weequahic Park, which is not only pleasing to the eye but affords plenty of clean, fresh air.

The Operating Staff consists of a head teacher and assistant, a janitor and his wife who acts as a cook. Besides the above whole time employees, there is provided the daily services of a medical inspector and frequent visits of a school nurse.

Qualifications for Entrance. Up to date no pupil has been permitted to enroll in this class unless it is evident, after a medical examination, that he or she suffers with pulmonary tuberculosis.

The cases are discovered by the medical inspectors in the various schools. Immediately the diagnosis is made by a medical inspector the case is assigned to a school nurse to visit the home, whose duty it is to obtain and record, on a printed form, a complete record of the family history, previous history of the pupil from birth, present history of pupil and social history of family, also obtaining written consent for the examination of the pupil by the Supervisor of Medical Inspection. The pupil then visits the Supervisor at his office, accompanied usually by one or more relatives. The Supervisor at this time conducts a complete examination, covering the general condition of the pupil, recording weight, per cent. of hæmoglobin, height, the condition of the eyes, nose, throat, heart, lungs, etc. Should the diagnosis of pulmonary tuberculosis be confirmed by the Supervisor the Von Pirquet Tuberculin Test is at once conducted and its results afterwards recorded at subsequent visits. Recommendation is then made by the Supervisor to the Superintendent for the transfer of such pupil to the Tubercular Class.

By this method it is evident that few mistakes in diagnosis will be made. In our city the tubercular class or school only accommodates forty-five pupils, with the results that there has been a waiting list of thirty or more pupils who have been examined and found tubercular; because of this limited accommodation only the positively tubercular pupils and much needy cases have been enrolled, making it doubly sure that all pupils are pronounced tubercular subjects.

Curriculum.

Daily Plan of Operation of School. The school session is from 8:45 to 3 p. m. On arrival at school each morning each pupil is given a breakfast consisting of the articles set forth on the menu. On finishing the breakfast the mouth temperature of all pupils is taken and recorded. On completing this all pupils file into the basement to wash their teeth, face, and hands. Then each pupil whose temperature has not been abnormal, puts on its outer garments, the character of which depends on the season of the year. Class instruction then begins in the open pavilion and continues up to the noon hour. In all about three hours of serious instruction is given.

No pupil having a temperature of 99.5 or over is permitted to attend school session, but is compelled to recline in his or her chair in the open on the piazza, wrapped in the blanket and sitting-out-bag should the weather require it. On first establishing the school there were quite a number of such cases daily, but now it is only the new pupil, enrolled from time to time, that has to be so treated.

At noon the class instruction ceases and a short recess follows, then dinner, consisting, as will be seen by consulting the menu, of a hot, well-cooked, substantial meal of fair variety. After dinner teeth are again washed and pupils attend to their toilet, then enter the rest room. No conversation is permitted and as a rule nearly all the pupils sleep during this hour. This is not the case with the new pupils on first entering the class, but after the first week they seem to fall right into the spirit of the place and sleep, eat, work and play as they find the others are doing.

FIGURE 3

Rest Period at Tubercular School—Dining Room at the Side

After the rest hour there remains about one hour more of the school session which is employed in manual training or other occupational study.

This school is an all year school having only two breaks in the sessions; one week at Christmas and another week before the fall term in September. This is not done for pedigogical reason but for health's sake. It is found that invariably after the pupils return from their mid-winter and fall vacations that they have lost in weight, which is due undoubtedly to the pupils running wild, not getting sufficient rest and food.

For this reason, therefore, with tubercular pupils it is considered wiser and cheaper to retain them in school the year round, where they can be properly supervised and not lose the advantage already gained.

Diet. It will be seen by consulting the daily menu that the Supervisor, through the Board of Education, offers the pupils a varied, wholesome diet, keeping in mind the need chiefly of good rich milk, eggs, and a rich carbohydrate diet with sufficient proteid diet.

The Newark Board of Education is one of the few Boards offering to its pupils such generous school meals, paid for entirely out of the school funds. The results justify the expenditure.

MENU

BREAKFAST	DINNER	SUPPER
Rice and milk	Mutton broth with barley	Cocoa
Cornmeal mush and milk	Split pea soup	Raw egg
Oatmeal and milk	Vegetable soup	Bread and butter
Cream of Wheat and milk	Boiled mutton	
Hominy and milk	Hamburg steak	
	Creamed codfish	
	Lamb stew	
	Baked beans	
	Baked potatoes	
	Mashed potatoes	
	Stewed Lima beans	
	Spaghetti with tomatoes and cheese	
	Bread and butter	
	Fruit tapioca	
	Apple sauce	
	Prunes	
	Bread pudding with raisins	
	Rice pudding	
	Caramel custard	
	Stewed peaches	
	Peanuts and dates	
	Bananas	
	Chocolate ice cream	

Health Supervision. This school receives the daily visit of a medical inspector whose duty it is to inspect each pupil for the presence of contagious or infectious disease; to consult with the teachers and nurse regarding any pupil in particular; to conduct a complete physical examination of each new pupil on arrival, recording his findings and making his recommendations in writing to the parents; to refer such pupils requiring treatment to the school nurse with the request to make a home visit and coöperate in the cure of each defect or disease; to weigh each pupil weekly, recording the weight on forms supplied, investigating and recommending for treatment and special care all pupils not gaining, or losing in weight, or running an abnormal temperature; to recommend to the Supervisor regarding the cure and arrest of the disease and the transfer of the pupils cured back to the regular school.

No pupil has been transferred back to its regular school or permitted to go off roll definitely without the weight, height, and hæmoglobin index being recorded and definite recommendation, stating that the medical inspector finds the pupil well and the disease arrested, and not then unless his findings are corroborated by the Supervisor after a careful physical examination.

The school nurse follows up the recommendation of the medical inspector in respect to each pupil, visiting all the homes, consulting with the parent or guardian with regards to the physical condition of the pupil and his needs; making observation of the home conditions with respect to the housing, especially the sleeping apartments; inquiring into the nourishment of the pupil at home; his hours of rest; and instilling in the parent an interest in what is being done for the pupil and a coöperation that, with very few exceptions, has been appreciated with the result that teeth have been repaired; tonsils and adenoids have been removed; glasses obtained and a variety of other surgical and medical treatments instituted with the resulting benefit to the pupils.

Sanitary and Health Instruction. Each new pupil and periodically all pupils are taught through practical talks given by the physician and nurse with the aid of a portable exhibit, the origin, means of infections, prevention and cure of tuberculosis. They are also taught the use of the sputum cup, the necessity of guarding against infection of others by the destruction of sputum, the use of the handkerchief while coughing, the necessity of having their own tooth brush, towel, face cloth and dishes—in fact all that is known and practical for them to learn and put into daily use.

Enrollment. The total enrollment of the tubercular class since its origin to July 1st, 1913, is 80.

The total enrollment for the year 1913 was 62. The average enrollment for the year beginning July 1st, 1912, and ending July 1st, 1913, was 43½. The average attendance for that same period was 37½.

The average enrollment for the year beginning September, 1911, and ending June 30th, 1912, was 35. Average attendance for the same period was 30.

Considering the fact that this school is located at the extreme southern boundry of our city, that it is only reached by one car line which makes travel difficult many times in stormy weather, also that the school draws its patrons from all sections of the city, many of whom have to travel two or three miles to school, also the fact that all of these pupils are sick and subnormal in health, it will be granted that this showing in average attendance is very good.

Name School Feeding

Address Floor F. B. Grade Date

Date of Birth SEX MALE / FEMALE COLOR WHITE / BLACK NATIONALITY NATIVITY OF PARENTS SCHOLARSHIP

	ON ADMISSION	SUBSEQUENT EXAMINATIONS								ON DISCHARGE		
		DATE	GAIN OR LOSS	DATE	GAIN OR LOSS	DATE	GAIN OR LOSS	DATE	GAIN OR LOSS	DATE	GAIN OR LOSS	TOTAL GAIN OR LOSS
HEIGHT												
WEIGHT												
% BELOW WEIGHT FOR HEIGHT												
CHEST MEASUREMENTS												

HAEMOGLOBIN ON ADMISSION % ON DISCHARGE %

VON PIRQUET'S RE-ACTION POSITIVE / NEGATIVE

PHYSICAL DEFECTS

ON ADMISSION				ON DISCHARGE
NUTR.	B. G.	DEF HEAR	Y. N.	
ENL. CERV. GL.	Y N. A. P.	DEF NASAL BREATH	Y. N.	
CHOREA	Y. N.	TEETH	B. G.	
CARDIAC DIS.	Y. N.	DEFORM. PALATE	Y. N.	
PULM DIS.	Y. N.	IMPED. SPEECH	Y. N.	
SKIN DIS.	Y. N.	HYPER. TONS.	Y. N.	
DEF. { SPINE / CHEST / EXTREM.	Y. N. / Y. N / Y. N.	P. NASAL GROWTH	Y. N.	
		MENTALITY	B. G.	
DEF. VIS R. E. V. / L. E. V. /		TREAT NECESSARY	Y. N.	NOTE IN THE SPACE ABOVE ANY IMPROVEMENT THAT HAS TAKEN PLACE IN THE PHYSICAL CONDITION OF THE CHILD SINCE ADMISSION.

WEEKLY WEIGHT RECORD

DATE	WEIGHT	GAIN OR LOSS	DATE	WEIGHT	GAIN OR LOSS	DATE	WEIGHT	GAIN OR LOSS	DATE	WEIGHT	GAIN OR LOSS

SOCIAL CONDITIONS

THE HOME	THE FAMILY	ECONOMIC CONDITION	THE CHILD
NO. ROOMS CLEANLINESS GOOD FAIR BAD CHARACTER GOOD FAIR BAD VENTILATION GOOD FAIR BAD CHILD'S SLEEPING ROOM LIGHT FAIR DIM VENTILATION GOOD FAIR BAD NO IN ROOMS NO. IN BED	TOTAL NUMBER ADULTS CHILDREN BOARDERS PARENTS ALCOHOLIC YES NO ILLNESS IN— WHO? WHAT? ATTEND CLINIC?	RENT INCOME CHARITY RECEIVED WHO WORKS?	FOOD WHAT? FRIED? BEVERAGE TEA COFFEE WINE BEER WHISKEY SLEEP HOW MUCH WORK YES NO WHAT? PLAY-OUT HOW MUCH? BATH HOW OFTEN?

ACTION TAKEN

BOARD OF EDUCATION,
NEWARK, N. J. Form 805

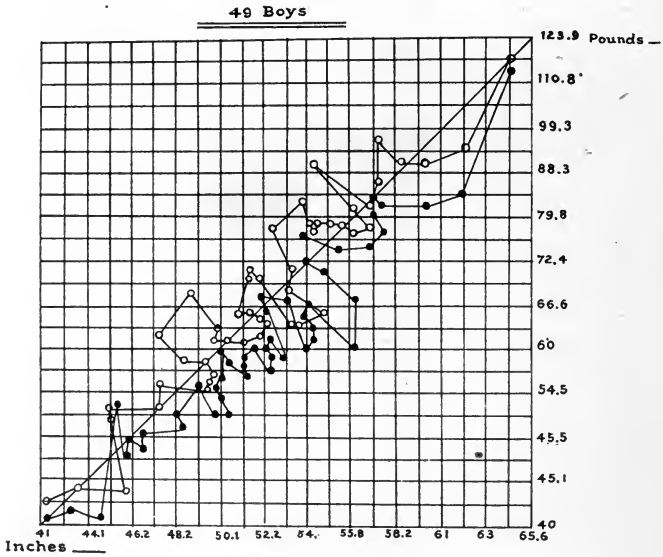

49 Boys
123.9 Pounds
110.8
99.3
88.3
79.8
72.4
66.6
60
54.5
45.5
45.1
40
41
44.1
46.2
48.2
50.1
52.2
55.8
58.2
61
63
65.6
Inches

Fig. 4

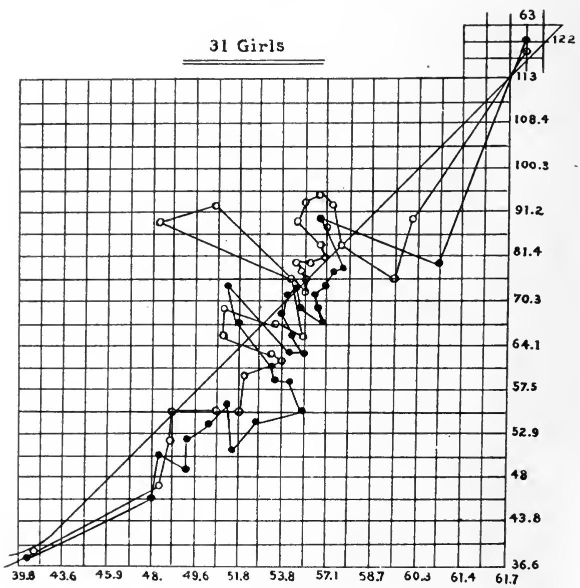

31 Girls
63
122
113
108.4
100.3
91.2
81.4
70.3
64.1
57.5
52.9
48
43.8
36.6
43.6
45.9
48.
49.6
51.8
53.8
57.1
58.7
61.4
61.7

Fig. 5

DIAGRAM ILLUSTRATING GAIN IN HAEMOGLOBIN.

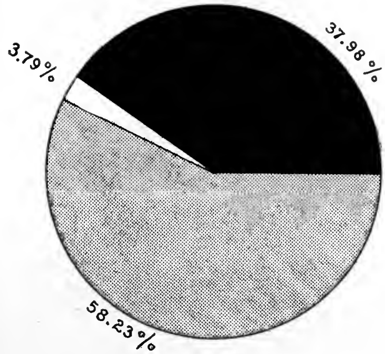


FIGURE 6

25 to 50% in haemoglobin
3.79% of total enrollment
50 to 75% in haemoglobin
37.98% of total enrollment
75 to 100% in haemoglobin
58.23% of total enrollment

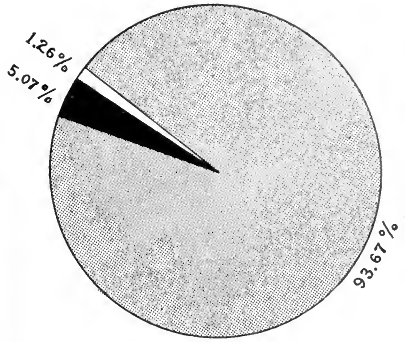


FIGURE 7

25 to 50% in haemoglobin
1.26% of total enrollment
50 to 75% in haemoglobin
5.07% of total enrollment
75 to 100% in haemoglobin
93.67% of total enrollment

Analysis and study of information and facts obtained through investigation of family histories, previous histories and observations of pupils in the school has uncovered some very interesting data.

Of the eighty pupils so far enrolled the average term enrollment has been eleven months plus. The average age of the boy, on entrance, was ten and one-half years; the average age of the girls on entrance was twelve years; the average total age of both girls and boys was ten and three-fifths years. The average per cent. of hæmoglobin on entrance was 78.9%. The average height on entrance was 54.5 inches; the average weight on entrance was 62.4 pounds. The average number of pounds below normal in weight as compared with the height, on entrance, using the Bowditch Scale of Weights, was 9 pounds.

Forty-one and one-eighth per cent. of the total enrollment on investigation gave a family history of tuberculosis. Forty-seven and one-half per cent. of the total enrollment have been in direct contact with a case of pulmonary tuberculosis in their homes.

Ninety-one and one-fifth per cent. of the total enrollment showed, on examination, positive physical signs of pulmonary tuberculosis.

Ninety-three and seven-tenths per cent. of the total enrollment gave positive reaction to Von Pirquet Tuberculin Test. On conducting a physical examination of both boys and girls enrolled it was found that there was an average of 2.6 physical defects other than those found in the lungs.

Results. During the period beginning September, 1911 to July 1st, 1913, the following results have been obtained:

Sixty-one per cent. of those enrolled have had the disease in the lungs arrested.

Sixty per cent. of those enrolled have been cured.

Thirty-nine and one-half per cent. of the total enrollment have improved.

One-half of one per cent. of the total enrollment have not improved. This latter is a very small percentage, as in this number are included four pupils who died, two pupils who were at the school a very short time (one to attend a school in another city, the other because she was too small to make the trip daily on the cars to and from school) and left the school.

The average gain in weight has been eight and one-quarter pounds. The average gain in hæmoglobin was 7.5 per cent.

The per cent. of those having physical defects and receiving treatment for the same was 57.5 per cent. This treatment took place while the pupils were enrolled in the school, and is directly the results of the efforts exerted by the department of medical inspection, through its physician and nurse. Their efforts in behalf of the defective pupils awoke a spirit of interest and coöperation in the parents, with a result that teeth were repaired, tonsils and adenoids were removed, glasses obtained as well as many other surgical and medical measures. None of this treatment was given in school, but was obtained at free clinics connected with the hospitals or from private physicians or dentists.

Thirty-three and seven-tenths per cent. of the total enrollment have been transferred back to their regular classes in other public schools. Of this number none so far have had to return for further treatment.

Occasionally a parent offers slight objection to the enrollment of a pupil in the tubercular school for fear he or she may be retarded scholastically. No doubt there are some educators who feel doubtful about the mental progress made in such an open air school. Our records kept with care during the period this school has been in operation, show that 81.2 per cent. of the total enrollment received and were entitled to promotion, while 18.8 per cent. failed of promotion. This is a very small per cent. when it is known that it includes those that died, those that left school after a very short period of attendance and one pupil that is undoubtedly feeble-minded.

The mortality of the school since its opening has been one-half of one per cent., the total number of deaths being four, one of whom it is reported by the city health records as being directly due to diphtheria, the other three to pulmonary tuberculosis.

Cost of Maintenance. The annual cost per pupil for salaries, supplies, repairs, etc., based on the average enrollment and for ordinary expenses for the year 1912 was $120.92. Of this amount $66.04 was for salaries; $44.26 for text books and educational supplies; $0.13 for miscellaneous items and $3.36 for repairs, and $7.13 for miscellaneous supplies.

The annual cost per pupil for the year 1913, covering the same items as previous year was $109.94. Of this amount $60.93 was for salaries, $41.15 for text books and educational supplies; $6.13 for miscellaneous supplies; $0.31 for miscellaneous items and $1.42 for repairs.

FIGURE 8
Rest Period at the Morton Street Open Air Class

Conclusions. It must be apparent on considering the above mentioned facts that pulmonary tuberculosis in its incipient stage is comparatively common in pupils of elementary school age.

That pulmonary tuberculosis will be frequently discovered on conducting a careful, painstaking physical examination.

That on discovering physical signs in the chest, accompanied with failing health, a positive Von Pirquet reaction, the exclusion from a regular class is justified and the transfer to an open air class imperative.

That pulmonary tuberculosis in children, discovered in its incipient stage, is curable without exception by placing the patient in a healthful environment, properly clothed and fed.

That medicine plays a very small part in the cure of incipient tuberculosis.

That in pupils of primary and elementary school age, suffering with pulmonary tuberculosis, over 93% gave positive reaction to the Von Pirquet Skin Test.

That contact with a case of pulmonary tuberculosis in the home readily causes infection of the child; that children in contact with a case of pulmonary tuberculosis in the home will react positively to a Von Pirquet Skin Test even though there are no physical signs of disease or clinical symptoms.

That provision should be made in open air classes for the care of other forms of tuberculosis, such as glandular, bone and joint tuberculosis.

FIGURE 9

Pupils at the Morton Street Open Air Class Receiving Nourishment

That no harm would result through infection by placing in the same school all forms of tuberculosis regardless of the particular part of the body affected.

That incipient tuberculosis can be cured in children without neglecting their education, without breaking up the home or the expenditure of large sums of money.

That instead of inheriting a predisposition towards tuberculosis from the parent, which is commonly held responsible for the appearance of the disease in the offspring, the child has received through contact with the diseased subject an absolute infection which lies dormant and under adverse conditions of physical health or environment takes on renewed activities, developing some later clinical signs of disease.

Open Window Type Open Air Classes.

These classes, three in number, differ from that provided for the care of tubercular pupils in that they are located in regular school buildings. In describing these classes I shall make no reference to one as it has been in operation only a few months and so has not produced many results.

These classes are simply the regular class rooms located high up on the third floor of each building above the dust line, having a south-easterly exposure with large window space. One row of seats have been

FIGURE 10
Montgomery Open Air Class

removed allowing greater floor space for exercise. The rules governing the classes are that the windows shall be kept open at all times; that the enrollment shall be kept at thirty; that the heat shall be kept turned off; that the pupils shall have an hour's rest in their reclining chair on the roof of each building each day; that no pupil shall be enrolled in the classes or discharged from the classes without the recommendation of the medical inspector and the approval of the Supervisor of Medical Inspection.

Qualification for Entrance to Classes. To be assigned to such a class, each pupil must be subnormal in weight or general health. This includes pupils who are anæmic, frail, under-weight or convalescing from disease. Each pupil is required to submit to a complete physical examination by the medical inspector which includes weighing, measurements, and ascertaining the per cent. of hæmoglobin.

Diet. The only nourishment supplied to these pupils is milk, so that the wonderful gains in weight cannot all be attributed to the nourishment received.

Curriculum. The curriculum of these classes does not differ from the regular class with the exception that they are smaller, ungraded, and time is taken for more exercise and rest in the open air.

The personal equipment consists only of blankets, sitting-out-bags, and reclining chairs. All pupils are permitted to wear their hats and coats in the classroom when the temperature is low.

Health Supervision. This consists of the daily visits of a medical inspector for the detection of contagious disease and general supervision of the health of the pupils; the monthly weighing of pupils and recording of same; the examination of pupils for the detection of disease or defects; the home visits of the nurse to bring about the correction of defects, diseases, and improvement of health of pupils by urging that treatment be obtained, that home sanitation be improved, diet and hours of rest properly regulated.

Analysis of the facts taken from the records of the two classes for the school years 1912 and 1913 are as follows:

Total enrollment for the two school years	124
Maximum enrollment for each class	30
Average " " the year 1912 (for two classes)	25.5
" " " " " 1913 "	28.5
" age on entrance	9.26
" height on entrance	49.5
" weight on entrance	53.33 lbs.
" per cent. of haemoglobin	71.75%
Total number of physical defects	410
Average " " "	3.3
Per cent. of total enrollment that were subnormal in weight (as to height)	82%
Per cent. of total enrollment who were normal in weight (as to height)	15%
Per cent. of total enrollment who were above normal weight (as to height)	.33
Average time on rolls	6⅔ months

RESULTS.

Per cent. of those having physical defects who received treatment directly due to efforts of the Department of Medical Inspection................72.75%
Average gain in haemoglobin...11.15%
" " weight .... 3.47 lbs.
Per cent. of the total enrollment cured 62.5%
" " " " " improved 32.3%
" " " " " not improved 5.2%
" " " " " who were transferred back to their regular class.. 73.5%

COST OF MAINTENANCE OF EACH CLASS.

(Based on the Average Enrollment.)

School	Average Enrollment	Salaries	Text Books Etc.	Misc.	Total Per Pupil
Montgomery....	28	$42.10	$6.41	....	$48.51
Morton	29	42.13	12.31	$0.56	55.00

THE SCHOOL ROOM WINDOW

BY

Byron U. Richards

Soon after assuming the duties of Medical Director in our Public Schools, I found myself confronting a peculiar problem.

The air was hot and dry in many rooms, less objectionable in others, and I was pleased to note almost ideal conditions, in respect to ventilation with reasonable temperature, in many of our smaller outlying school buildings.

As there was no uniformity in this respect to be found, I became interested to know the reason.

I learned that in many instances, the window only, was made use of, for the interchange of outside air, to replace the class room product.

In other buildings, the scientific mechanical system had been installed, but the teachers had never failed to supplement this system, with the open window. And yet in a third class, the holy precepts of the unopened window were observed, the air was thoroughly baked and dried, to the highest degree attainable, and all draughts and variations in temperature carefully avoided.

The teachers followed with commendable zeal the janitors' instructions, falling short in no respect, but exceeding authority in one particular, viz., the temperature, which was nearly always far above that sanctioned by the School Committee.

It was on account of this difficulty, and my desire to obtain improved conditions in our over-heated school rooms, that my attention was directed to the school room window.

In this paper I wish to consider the window only, leaving to other men more able than I, in this Congress, to discuss the merits, if any there be, and also the faults, which are many, of the mechanical system of ventilation.

Architectural writers use much space in describing the theory that we should have in our school rooms just one-sixth as much window space as floor area, and if posts and other obstructions interfere, discussion is lengthened on the subject of position of the windows, in relation to these obstructions.

It is very strange that architects and others often overlook so simple a fact as that the casements and sash take up much space in the window; in the aggregate it has been determined to be about twenty-five per cent. I know an instance, where a room had been guaranteed a certain number of square feet of window space, but by careful measurement of casements and sash, after their installation, they were found to take up about twenty-six per cent. of the opening intended, bringing the real glass area to floor surface not quite one to seven and a half, instead of one to six.

Architects also hold opposing views on the question of window grouping. Some authorities on school room architecture claim the windows should be as near equally distant, the one from the other, as conditions will allow, leaving the strength of the walls unimpaired, while others prefer the effect of grouped windows.

I believe the latter plan is best. Give us more window space, and group the units as far as possible, which can be easily accomplished in these days of steel construction.

The units for window space should be large. This fact is appreciated in studios, galleries, and industrial plants of all kinds, and has been of late approved by leading architects for school buildings.

An objection has been made to the large window group, that heat radiation thereby becomes more rapid. This fault could be overcome if found necessary, by installing the double glazed window pane. If this is done however, care should be exercised in setting the glass very dry and clean on the inside surface, otherwise the lighting will be imperfect.

Buildings with this style of window arrangement are, in my judgment, more artistic without as well as cheerful within.

Altogether too much censure has been made of the rear window light. Light from the left side of the room only is all very well, provided there is enough of it and the room is not too deep, but in this country we frequently have rooms, thirty-six or more feet in depth with light admitted only from one side. This, so far as I can learn, is not the custom abroad, twenty-four to twenty-eight feet being about the limit for rooms lighted in this way.

The principal objection to rear light is that it becomes front light to the teacher. But the evil, if such it is, has been unduly magnified. I have talked with many teachers of experience about this matter, and only one had any objection to make, and that was due to a temporary condition, namely, a glaring white cement wall had just been built near the school, which at first reflected a high light, but took on a subdued shade with a little age, and this teacher could then find no fault.

Teachers want more light in their rooms in which they can be happy, and are too busy to stare at the light in any one direction.

I cannot understand why the top portion of the window opening should be treated so differently from the rest of the window, unless for outside artistic effect. Yet many transoms are not intended to be open, some are made to open, little or much, as the case may be, many so intended are immovable from one cause or another, some have clear glass, some ornamented, and many are plain but opaque. When a transom is open as little as many are made to be, it affords a narrow current of air, which, being colder than that of the room, falls down on the heads of the children, and discomfort ensues. Even this poor use of the top portion of the window is better than to make no use of it at all, but the transom should be a large portion, or component part of the entire window, and its complete opening made possible. To accomplish this the transom should be hung by the center horizontal pivot.

The use of shades for school room windows is an important matter. Nearly all agree that the outside blind and the inside shutter should not be used.

The top hung shade on the spring roller, as now almost universally used, becomes a nuisance if the window is to be opened in the upper half, owing to the rattle and flapping occasioned by the currents of air. The best method for shading depends upon the style of window used. The large horizontal pivoted sash should carry its own shade, including roller, spring and catch, and for other windows the side supported, sliding fixture, as the "Britting" so universally used in Washington seems to answer all requirements.

Windows in our large cities, at any rate in their congested districts, should have sashes either of metal, or wood covered with metal, as a protection from fire. The window is the most vulnerable part of a building, made otherwise nearly fireproof, and when an adjoining stucture burns, the brick schoolhouse becomes a wall of protection in every other part, but no very high degree of heat is required to cause the frail wooden sash to give way. The glass falls in and a current of air is formed which carries the flame directly into the building. The school house belongs to the city and should be made a means of protection in its vicinity, rather than a menace.

We know that fire danger in our public schools is small, but we remember well the holocaust at Collinwood, O., five years ago, where 175 children perished. We are therefore compelled to believe that all urban school windows should be fire proof, not only as to metal sash and casements, but also the wire reinforced glazing should be installed. That this is an important matter, I need only refer to a recent fire in one of the upper floors of the tower of the Metropolitan Building in New York. Such a window installation as I have described, no doubt saved at least that portion of the great building.

What shall we require for school room windows after determining their size, position and arrangement?

First—They must be secure.

Recently a large window of modern type was blown entirely from a Massachusetts school building, and that no accident resulted thereby is truly fortunate. A few years ago the writer was called to attend a child in one of our public schools who had received a fatal injury resulting from the neglect of this cardinal virtue.

Second—All sections of the window should move easily.

I have been greatly surprised to find so many immovable window sections in the school rooms, and also to find so many more that could be opened only a little, or if completely raised, the full strength of a man was required. Such windows may quite as well be nailed down or bolted when their operation is required of a frail school teacher.

The vertical sliding window is an example of this kind, ideal where the style of building will permit of its installation and if it could be made to work easily.

Third—A proper device for locking, either open or closed, must be found.

Obviously the window must be tight when closed that neither water nor dust may gain entrance, and it becomes equally important that the sash should be firmly held when open, for a window sash, or curtain, that rattles in the wind becomes a most disquieting influence in any room.

Fourth—We must insist on a window that can be easily and safely cleaned.

I know of no duty on the part of school officials that has been and is more neglected than that of keeping the school room windows clean, and as this reasonable act of cleanliness will certainly be demanded in the future, we shall need windows that can be cleaned with the least labor and the greatest degree of safety.

Fortunately this important feature has not been overlooked in the development of the modern window.

Fifth—And finally the requisite of paramount importance—The window must allow one hundred per cent. of opening.

Open a window a few inches at the bottom and a current of air blows unpleasantly and I believe dangerously, on the children sitting near such a window, and with a transom only, open, the condition is but slightly better. But with the entire aperture of the window made use of, which can be done in temperate climate to the well being of all, during a large portion of the school year, no unpleasant air currents are felt, and it is the writer's personal experience that children may occupy seats near such windows throughout an entire school year without once complaining of a "draught," their only fear being that they might, against their wishes, be returned to the stuffy school room from which they came.

I am forced, therefore, to the opinion that our school rooms need less artificial heat, and the children more frequent interruptions in their mental work for physical and breathing exercises, and if I am correct in this, then we must have windows that will open, not only readily and easily, but entirely.

Fortunately the architect who is in sympathy with this direct method of ventilation has a large variety of windows from which to choose. Much depends, of course, on the style of building and the character of material used. For the thick walls of brick and stone the inswinging or outswinging window hinged on the side casement, with a large transom pivoted in the center, and used very generally in France, is an ideal window, yet the heavy sash of this type, especially if wooden, occupies a large per cent. of the window opening, and when equipped with proper fastenings is apt to be rather expensive for adoption in public schools.

The sash supported by pivots allowing rotation, either vertical or horizontal, has appealed very strongly to me. Such a window section carries its own roller curtain, and when set at an angle affords an excellent awning. It can be easily kept clean, the work all being done on the inside, thus subjecting the cleaner to no liability to injury. It can be easily opened and as readily closed.

My limited time precludes even a recital of the names of the many window makers who have very kindly given me their assistance on this subject, some of whom are making an exhibit at this Congress.

I prefer the window sash that is held in the desired position by a strip, a spring, a fixture or by friction, rather than by the cord and weight, as the latter takes up much space and the casements must therefore be made correspondingly large.

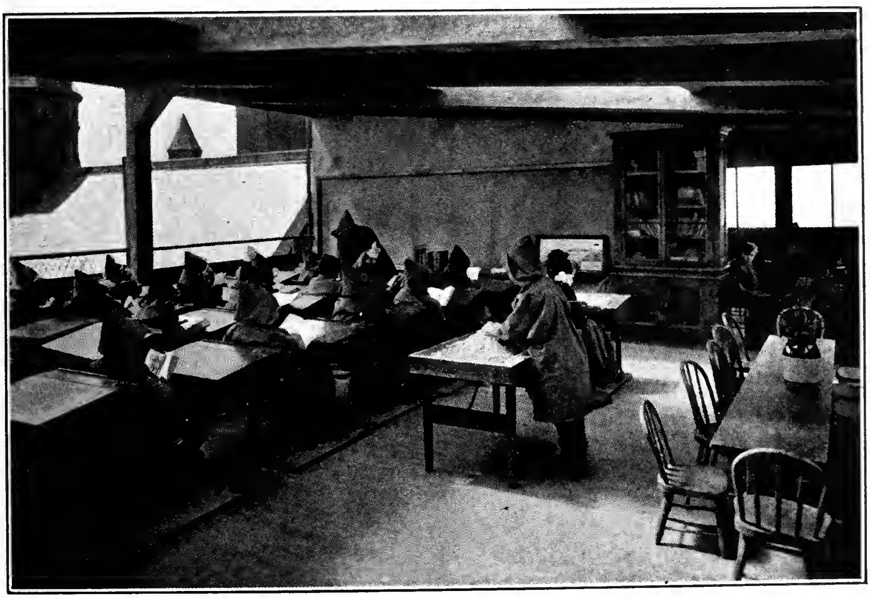
Much time and thought has been given to this subject in recent years and while it is too much to believe the last word has been spoken, or perfection attained in window construction, yet we believe much has been accomplished and when the ideal window, as to style, material and operation has been devised and its adoption in our public schools made general, its beneficial and far reaching influence will equal that of any factor in the entire field of school hygiene.

EFFECT OF OUTDOOR AND INDOOR SCHOOL LIFE ON THE PHYSICAL AND MENTAL CONDITION OF CHILDREN

BY

HAROLD BROWN KEYES

In one of the highest sections of New York City exposed to the air from ocean, river and country, there are located on the roof of Teachers' College, New York, two open air school rooms. These are an integral part of the Horace Mann School. One accommodates sixteen children in the fourth grade, the other seventeen children of third grade rank and eleven children of second grade rank. These open air rooms are of permanent structure, each with one side completely open to the outdoor air, and with at least one other side so built with windows that more than half of the side can be completely exposed to the elements, and always to early sun. The roofs contain each a large window somewhat shaded from the glare of the sun. The sides which are completely open face to the south and are never closed off except when rain would beat in upon children and furniture. At such times a canvas covering serves to shut out rain.



Open Air Class

A seating scheme is so arranged that desks can be moved to any part of the floor space at will and in addition when the sunshine does not reach all the children at once the desks most in the sunshine are occupied first by one-half the children, then by the others, so alternating that each child is exposed to as much healthy sunshine as is possible to obtain. Care is always taken to guard blackboards and pages from the sun's glare.

A fairly large roof playground immediately adjoins these open air rooms and this is well equipped with playground apparatus. Here the children spend a fair share of their time, here receive their instruction in physical exercise, and also indulge in normal play. Frequent pauses are made in studies to have the children exercise in the room to insure mental relaxation and an active blood circulation.

During the morning lunch is partaken of and each child is urged to drink something hot, and all are expected to do this in cold weather.

All instruction in special branches as well as in the 3 R's goes on in the open air so that the children go indoors only for the general assembly. All children are carried to the roof school in the elevator to eliminate the exhausting and harmful effects of climbing stairs.

In the fall of 1912 the decision was made to carry out accurate comparisons between these outdoor children and corresponding indoor children of the same grades, both as to the physical condition and improvement, and as to mental condition and improvement. For this reason the invaluable assistance of Mr. Pearson, Principal of the Horace Mann Elementary School and of Professor Norsworthy of the Department of Psychology, Teachers' College, Columbia University, was offered to carry out the mental tests. The teachers of the various rooms likewise generously assisted, and the physical examinations were carried out in the Department of Physical Education, Teachers' College.

It seems well to speak of the conditions under which the open air children were selected. In admitting children to these classes the preference was given to those children who seemed to be less robust than their classmates, those who had not gained during the previous year as much as was desirable, those whose past histories showed either physical or nervous weakness or severe illnesses; in short those children who seemed to be especially in need of the most health-giving surroundings. These selections were made by the Principal and School Physician.

The children were examined as follows: Careful physical measurements were taken at the beginning of the year of all the children compared. These measurements were taken with the body stripped, so that no discounts had to be made for clothing. One person did measurements on all the children, both at the beginning and end of the period. The writer made all the physical examinations both at the beginning and

Roof Playground—Open Air Class

end, one person tested all the eyes and ears at the beginning and end. Mr. Pearson and Professor Norsworthy did separate mental tests both at the beginning and end of the year. All these tests were taken as near together as possible. Thus as much as was possible we tried to eliminate the element of personal differences in judgment.

In taking our physical measurements we left out unimportant ones. We recorded only age, weight, height, girth of chest at fourth rib, girth of chest expanded at fourth rib, breadth of chest, depth of chest, lung capacity, strength of forearms, strength of back muscles and chest muscles. Then a routine physical examination followed, including test of eyesight, hearing, condition of eyes, nose, throat, tonsils, teeth, skin, glands, spine, feet, heart and lungs.

At the end of the year all these tests were repeated. The results I will now give you.

In studying the results of the physical tests we found that in all classes the indoor children were older than the outdoor children. Those of the second grade rank were six months older than the open air children, those of the third grade two months older while the fourth graders averaged six months older. These facts, then, bring up the question whether or not the outdoor children, who had originally been chosen because they seemed to be under weight, or less robust, or who suffered in comparison, made the poorer showing because they were compared with children some of whom were half a year older, as well as because they really were below par. Consistent with both these facts we observed that at the beginning of the year the indoor children excelled in height, weight, girth of chest, chest expansion, breadth of chest, depth of chest, lung capacity, strength of arms and strengths of back and chest, in all three sets of rooms where comparisons were made. Furthermore, although the open air children in some cases *gained* more during the year than the indoor children, the original lead was too great to be overcome and so at the end of the period the older indoor children of the same grade rank still had a higher average in all measurements without exception in all rooms.

Let us consider for a moment some of the measurements, first in the second grade, as follows:

Duration of tests—6 months:	INDOOR CHILDREN		OUTDOOR CHILDREN	
Average gain in weight	1.3 K. or	2.8 lbs.	1.3 K. or	2.8 lbs.
" " " height	2.8 cm. or	1.1 inches	3.2 cm. or	1.3 inches
" " " girth of chest	1.0 cm. or	.4 "	1.4 cm. or	.6 "
" " " " " expanded	2.3 cm. or	.9 "	2.7 cm. or	1.0 "
" " " breadth of chest	.3 cm. or	.1 "	.2 cm. or	.07 "
" " " depth of chest	— .1 cm. or	— .05 "	— .1 cm. or	— .02 "
Gain in lung capacity	4. cu. in.		4.8 cu. in.	
" " strength of rt. arm	2.1 K. or	5.1 lbs.	1.7 K. or	3.7 lbs.
" " " lt. "	1.8 K. or	4. "	1.7 K. or	3.7 "
" " " upper back	1.0 K. or	2.2 "	2.1 K. or	4.6 "
" " " chest	1.4 K. or	3.1 "	2.9 K. or	6.4 "

So it is seen that the younger outdoor children, out of doors for the first time in a school year, *gained* consistently more in every direction, except weight, which gain was identical with the indoor gain, and breadth of chest and strength of the forearms.

The records for the third grades expressed as averages were as follows:

Duration of tests—six months:	INDOOR CHILDREN		OUTDOOR CHILDREN	
Average gain in weight	1.6 K. or	3.5 lbs.	1.7 K. or	3.7 lbs.
" " height	2.6 cm. or	1.0 inches	2.8 cm. or	1.1 inches
" " chest girth	1.3 cm. or	0.5 "	1.8 cm. or	.7 "
" " " " expanded	1.5 cm. or	0.6 "	1.7 cm. or	.7 "
" " " breadth	0.9 cm. or	0.37 "	.2 cm. or	.07 "
" " " depth	0.0 cm. or	0.0 "	— .3 cm. or	— .13 "
" " lung capacity	8.0 cu. in.		5.9 cu. in.	
" " rt. arm—strength	1.4 K. or	3. lbs.	0.8 K. or	1.7 lbs.
" " lt. " "	1.4 K. or	3.1 "	2.1 K. or	4.5 "
" " upper back "	2.0 K. or	4.4 "	2.0 K. or	4.4 "
" " chest "	2.8 K. or	6.2 "	3.2 K. or	7.0 "

Briefly summarized, the outdoor class improved more in six of these measurements, the indoor improved more in four and the classes were even on one (strength of back). The outdoor class improved more in height and weight and girth of chest.

The tests in the fourth grades are of especial interest for the following reasons: Some of these outdoor children were spending their second year on the roof school. They had a better attendance record than did the second out-of-door class, which improved so well. Despite these points the indoor fourth grade showed a much better record of improvement than did these outdoor children.

The results are as follows:

	INDOOR CHILDREN	OUTDOOR CHILDREN
Gain in weight	2.1 K. or 4.7 lbs.	1.5 K. or 3.3 lbs.
" height	2.8 cm. or 1.1 inches	2.6 cm. or 1. inches
" girth of chest	1.3 cm. or .5 "	1.6 cm. or .6 "
" " " expanded	2.3 cm. or .9 "	1.5 cm. or .5 "
" breadth of chest	.4 cm. or .17 "	.4 cm. or .17 "
" depth of chest	0 cm. or 0 "	— .2 cm. or — .08 "
" lung capacity	9.3 cu. in.	3.7 cu. in.
" strength of rt. arm	2.6 K. or 5.7 lbs.	1.8 K. or 4.0 lbs.
" " " lt. "	1.9 K. or 4.2 "	2.2 K. or 4.7 "
" " " back	2.5 K. or 5.7 "	1.4 K. or 3.1 "
" " " chest	3.2 K. or 7.1 "	2.1 K. or 4.7 "

Briefly summarized, the indoor class improved in eight of the eleven measurements, one was tied and the outdoor class excelled in two. The indoor class gained more in both height and weight than did the outdoor children. Thus these results are almost the reverse of those found in the other two grades.

The question has come up whether this lack of proportionate gain may not be due to the fact that these children had their best growth the first year they were out-of-doors, or whether they have not yet overcome the condition which caused them to be in the open air originally. A further point will come up under the question of attendance.

We had wondered if the eyesight of the outdoor children would suffer any from added exposure to sun and the necessity of looking at blackboards and books on which sun might shine. In no case did we find any defect coming on during the term such as would be shown with Snellen test type.

I then made a careful study of the attendance records comparing the attendance of the second grade indoor and outdoor children, the attendance of the fourth grade indoor, with that of the outdoor fourth grade, then comparing the attendance of the fourth grade outdoor children with their own attendance record in 1910–11, the last year in which they attended school in an indoor room. The results were as follows: First, the record of the indoor children actually considered in the physical tests showed an attendance of 88.4%, whereas the outdoor children actually tested in the physical examinations showed an attendance of 88.7%, a better record of .3% in favor of the outdoor class. To make the test more distinctly a room comparison we averaged the attendance of the entire indoor second grade to get actual room conditions and found an attendance of only 80.2%, whereas the entire room of outdoor children showed an attendance of 88.7%, a superiority of 8.5% in favor of the outdoor class, so attendance was decidedly better for outdoor children.

The difference in the fourth grades were again, not as striking. The attendance of the fourth grade indoor children actually tested was 95.5%. That of the outdoor children was also 95.5%. But if room conditions were considered, and this seems the fairer test, the attendance for the entire indoor fourth grade was 92.8%, where the entire outdoor fourth grade had an attendance of 95.5%, a better ranking of 2.7% for the outdoor children. In these tests just mentioned, those children who entered school at an extremely late date or who left at a very early date were not included.

To find out the effects on attendance of outdoor and indoor air on the same children the records were searched and fourteen of the present outdoor fourth grade were found to be indoors in 1910-11. Their attendance as a group was totalled and put on a per cent. basis, and was found to be 90.7%. The attendance for these same fourteen children in 1912-13, while out-of-doors, was 95%, a better record of 4.3% in favor of outdoor schools. One must keep in mind, however, the fact that these children were this year two years older than when the first attendance was recorded.

A record of contagious diseases was kept during the year. In the three outdoor classes there were five cases of contagious disease; in the indoor classes there were fourteen cases of contagious disease. Again in this case it is only fair to keep in mind that there were more children in the indoor classes and therefore more opportunities for contagious disease. If these cases are reduced to percentages the record of outdoor children shows that 12.5% had contagious disease while 17.9% of indoor children had contagious disease. Another very significant point is that no contagious diseases "went through" an outdoor room as happened in one of the indoor rooms. This seems to me to be in itself a powerful argument in favor of outdoor schools.

The question of absence for illness came up even in our own tests as we found that when outdoor children were wanted they were present whereas indoor children were absent more often. Indeed at the end of the year we felt that in the fourth grade indoors the more robust children were the ones who were examined because they were the ones in school. This may be a large factor in the excellent showing made by that room and should be kept in mind.

Mr. Pearson and Miss Norsworthy carried out their separate mental tests with these same children in the third and fourth grades on whom we did the physical and health tests. They have kindly allowed me to quote their results. These tests were given at the beginning and end of the year and improvements noted. The identical tests were given to the corresponding indoor and outdoor grades so that valuable results were obtained.

Miss Norsworthy first gave four tests for maturity and intelligence. These were as follows: The children were given a page of letters arranged in rows, but with the letters of the alphabet chosen indiscriminately. They were given a definite time to mark all the letter A's seen. This was repeated at the end of the year and improvement noted. Each child was handed a list of words such as cross, rough, noisy and was asked to write the opposite of the word on the paper. This again was later repeated and improvement noted. The third intelligence test consisted of a harder list of words and the children were asked to write their opposites in a given time.

The fourth test was as follows: The children were shown a large card on which were words arranged thus: "kitten her scratched cat the he because frightened dog the." They were given a definite time to look at the chart and arrange it into a sentence thus: "The cat scratched the dog because he frightened her kitten." A similar test was given at the end of the year and improvement noted. The four tests for memory were given as follows: The children were shown a chart containing forms, thus:

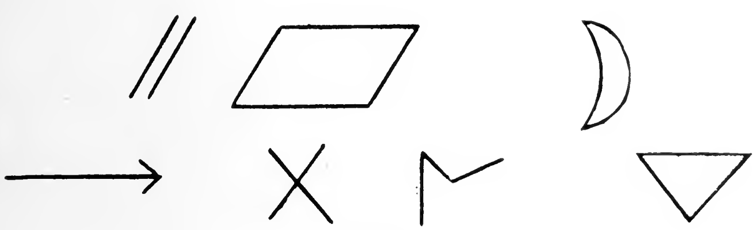


FIGURE 3

They were given a definite time to look at these forms, the chart was removed and they were asked to reproducee the forms. A second test similar to this was given with more difficult forms. The third test consisted in reading to the pupils a memory passage of about one hundred words. The children were then expected to reproduce as many ideas as possible in a given space of time. It was marked on the basis of ideas reproduced. The last test was the addition of columns of numbers in a given time.

As stated above all these tests were repeated at the end of the year to note the improvement as the test was to find whether the outdoor or indoor children improved the more. Thus eight sets of tests have been considered.

In the third grade in the sixteen possibilities the outdoor class had a higher rank in nine instances. But more important the outdoor class improved more during the year in absolutely every case. It will be recalled that these children were two months younger than the indoor children.

In the case of the fourth grades the outdoor children excelled in ten of the tests, but again, what is more important, the outdoor children showed the greater gain in seven of the eight possibilities.

The chart is produced on following page in detail.

Mr. Pearson's tests were of quite a different type as they were given definitely on subjects actually taught in school. They were two in number for each grade, one in formal English, the other in Arithmetic, given to the corresponding grades at the beginning and end of the test time for the purpose of judging the improvements made in actual school subject. The chart is produced on second page following.

Briefly the results were: In formal English the third grade outdoor class not only had higher averages than the indoor class but improved 20% whereas the indoor class improved 13% during the year. The outdoor fourth grade also had higher averages and improved 7% in arithmetic, while the indoor class *lost* 3%. The results in English were only slightly different. The indoor third grade did have higher averages but the outdoor class improved 20% while the indoor class improved only 6%. The fourth grade open air children not only had higher averages in arithmetic than did the indoor children but improved 41% while the indoor children improved 35%. The outdoor children averaged 99% in the final arithmetic tests.

COMPARISON OF OUTDOOR AND INDOOR CLASSES

	MATURITY TESTS				MEMORY AND ASSOCIATION TEST			
CLASS	Perception of Letter A	Selection of (1st) Opposites	Selection of (2nd) Opposites	Arrangement of Sentence	Reproduction of (I) Memory Forms	Reproduction of (II) Memory Forms	Reproduction of Memory Passage	Addition of Column of Numbers
Outdoor III								
1st Test	29	5	2	50%	4½	4	6½	2
2nd Test	36	9	9	80%	6	4½	8	5½
Improvement	(7)	(4)	(7)	(30%)	(1½)	(½)	(1½)	(3½)
Indoor III								
1st Test	28	5	2	44%	5	4	7½	4
2nd Test	34	8½	6½	51%	4½	4	7	6
Improvement	(6)	(3½)	(4½)	(7%)	(0-)	(0)	(0–)	(2)
Outdoor IV								
1st Test	34	7	5½	67%	5	4½	7½	3½
2nd Test	40	12½	9	90%	5½	5	8½	9½
Improvement	(6)	(5½)	(3½)	(23%)	(½)	(½)	(1)	(6)
Indoor IV								
1st Test	32	7½	3½	62%	5	4½	7½	4
2nd Test	39	10	8	60%	5	4½	7	6
Improvement	(7)	(2½)	(4½)	(0–)	(0)	(0)	(0–)	(2)
Total Improvement								
Outdoor	13	9½	10½	53%	2	1	2½	9½
Indoor	13	6	9	7%	0–	0	0–	4

RESULTS OF COMPARATIVE TESTS

Formal English

GRADE	Number of Pupils	Average Dec., 1912	Average May, 1913	Improvement
III Open-air	Dec. 18 May 12	37%	57%	20%
III Indoor	Dec. 22 May 27	35%	48%	13%
IV Open-air	Dec. 15 May 15	64%	71%	7%
IV Indoor	Dec. 29 May 22	63%	60%	— 3%
		ARITHMETIC		
III Open-air	Dec. 14 May 12	48%	68%	20%
III Indoor	Dec. 28 May 24	69%	75%	6%
IV Open-air	Dec. 14 May 14	58%	99%	41%
IV Indoor	Dec. 28 May 23	53%	88%	35%

I owe special credit to Miss Janet Seibert of the Department of Physical Education for help in the compilation of these statistics, and to Miss Maud March for the assistance in the examinations.

VITALIZING SCHOOL CHILDREN

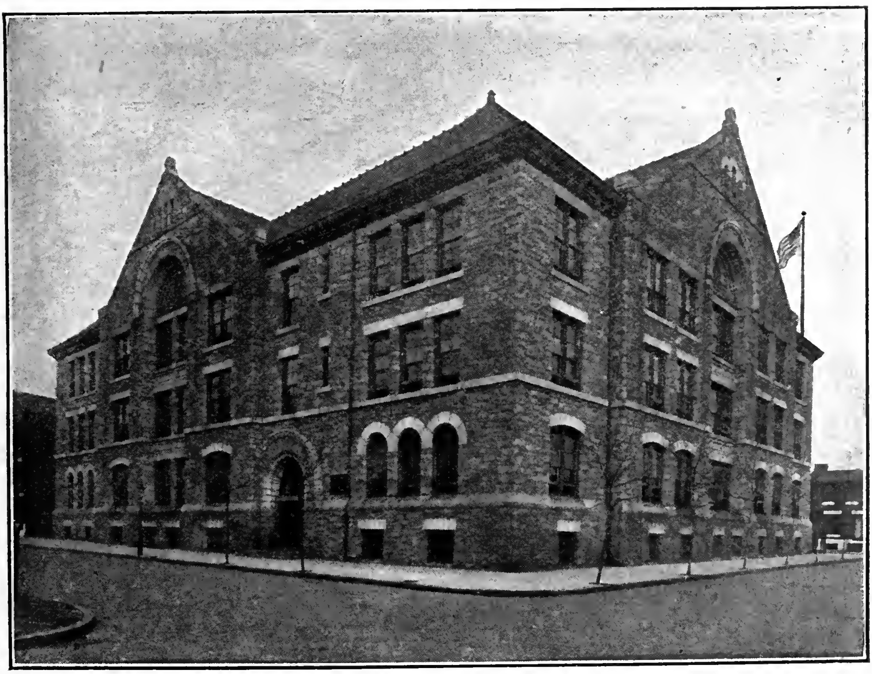
An Open Window Experiment in Philadelphia

BY

WALTER W. ROACH

As parents realize more and more the value of fresh air, there is a growing demand for the teaching of their children in open window class rooms. It is a logical process of reasoning, easily understood, that since fresh air has been found a boon to invalids and sickly children it is even more important to supply an abundance to well children that they may remain well.

At the Alexander Dallas Bache School in Philadelphia, September, 1912, we decided to study the effect of low temperature class-room work on the educational processes of the children. Two groups of normal third grade pupils were available for the test; one group occupied a room heated and ventilated in the usual manner, and the others, with the



Bache School

consent of their parents, were taught all through the winter in a class-room with the windows wide open. Both groups of children followed the regular school program, and we observed their work closely.

The windows of the one room were kept constantly down from the top and up from the bottom, and the room was cut off from the regular heating plant of the building. The ordinary desks were removed, and replaced with chair desks which could easily be moved by the pupils themselves to clear the floor space for frequent physical exercises. As cold weather approached the children were provided woolen sweaters, worsted caps, soft woolen blankets and knitted woolen gloves. Thus their lower extremities were protected from the cold floor, with no disturbance of the circulation.

Week by week during the Fall and Winter and Spring we weighed and examined these pupils, watched their study and their play and compared their scholarship with that of the children in the warm air room. The children from both rooms came from the same kind of homes, so that the test was as fair and as accurate and searching as possible. As might have been expected, we found at the end that the pupils in the open-window room had gained on an average more than twice as much in weight as those in the warm air room. They kept wholly free from colds, and were much more regular in attendance than the others. They were also more alert, free from day dreaming, quicker to learn, needed less review work and were better behaved. In health and happiness, in development both of mind and body, the children of the room with open windows had a clear advantage over the others.

At the end of the Winter term these facts were reported in a Public Health Journal and the information there contained was passed on in a gratifying way by many daily newspapers in different parts of the country to their readers and to members of school boards generally.

The experiment was not made primarily to prove that fresh air is good for healthy normal children in school. In these days the gospel of sunshine and pure air is accepted and ought to need little preaching. Many school boards do not however, practice the doctrine that their members believe in and preach. The average school-room is maintained at too high a temperature, and ventilation as a rule is poor.

But there is nothing original or remarkable in giving to a child the fresh air that Nature intended it should have. It might with truth be said that the opening of a school-room window is the simplest thing in the world. As a muscular act, it is. But this experiment was directed toward *legislating* school-room windows *open*, and it is the result of that, that I wish to inform you to-day.

There are in our city 298 school houses, with 4,000 class-rooms for about 180,000 children, and these class-rooms have 12,000 windows. In many of these the ventilation was poor. Day after day I visited different schools of the district and found the temperatures ranging from 68 degrees Fahrenheit to 76 degrees. High temperatures and low relative humidities were frequent. In but two schools of my district was the air washed and humidified.

The suggestion of an open-window room found response from one Principal with an open mind, and the experiment started. I knew from the experience of Mr. Watt of the Graham School, in Chicago, and the fresh air schools at Charlottenberg and other places, that the pupils would become accustomed to the cold air as the season advanced and like it. That their parents would note the physical improvement in

The class seated. These photographs are intended primarily to show the open windows and are purposely taken against the natural light, without flash powder.

their children and like it. That under out system of mid-winter promotions these third grade youngsters would be promoted and compelled to enter a fourth grade warm-air room, and we would hear from them, and from their parents in protest. And this is just what did happen.

Let me read a few letters—samples of many received by that Principal during the first week after the promotions were made.

"Mr. Bishop: Will you please keep Bessie in the open air room as her health is greatly improved since she has been in it. She has not had a cold all winter. The fresh air agrees with her so well I would be thankful if you could keep her there still." Signed by Bessie's mother.

"Miss Adams: Will you please to put Sadie in the open air room. She does not like the warm air room, some how or other." Signed by Sadie's mother.

Mr. Bishop: Dear Sir: "I am so sorry since Earl has got out of the open-window room. He ate so good and seemed to have such good health, while he was there, and if it would be possible for you to put him back again I certainly would be glad and I know he would be glad himself for he was always telling me how good he felt. Please let me know if you can put him in the fresh air room again." Signed by Earl's mother.

"Mr. Bishop: Please let Ellsworth go back in the cold air room whatever you do." Signed by his father and mother.

"Mr. Bishop: Would you kindly put my boy John back in the open-air room again, as I think it is not healthy for him in the closed room." From his mother.

These children have learned from experience what ventilation of a room really meant, and what proper ventilation of their lungs meant; By using that which Nature furnished from day to day in the matter of fresh air and humidity we had set an example to the children in ven-

Pupils moving their desks to side walls to clear floor space for physical exercises. Time necessary, one minute. After exercise it takes one minute to replace them and resume class work.

tilation which they carried to their parents at home. By giving them cool, fresh air five hours a day, five days a week at school, and showing their parents that they thrived on it, we secured for them twelve or more additional hours each twenty-four in fresh air by inducing those parents to keep their bedroom windows wide open at night.

At the same time we were driving home to the school authorities the idea that this group of normal and subnormal children could be taught better in fresh cool air than in warm vitiated air, and that by simply throwing open the school-room windows we could secure ideal conditions.

Almost anyone on reflection, will be impressed with the futility of expecting a maximum progression, physical and mental, when children are housed in overheated rooms, with little or no moisture, compelled to sit in uncomfortable positions and perform tasks prodigious and complicated to feeble and inactive minds resulting from undernourished and devitalized bodies. It so impressed the District Superintendent of Schools of this District, for about this time he wrote to Dr. Martin G. Brumbaugh, the Superintendent of Schools of Philadelphia somewhat as follows:

"The splendid results achieved in the open-window class at the Bache School, lead me to file this application for the establishment of the following additional classes of this nature (with a list).

"It is our intention that children be admitted only on the recommendation of the Medical Inspector, approved by the Medical Supervisor, and further approved by the District Superintendent. This is one of the new movements in education that is recognized as worth while. Properly organized it permits the Medical Inspector to fortify the body structure without interrupting the mental training of the child. The beneficial results of the work are at all times visible to teacher and parent alike. The class at the Bache School was largely visited and favorably commented on by many of the visiting Superintendents in February." (The Annual Meeting of School Superintendents of the National Educational Association.)

The Director of Physical Education of the Board of Education was favorably impressed and observed these children with helpful interest, and the school authorities acted favorably on resolutions to organize such classes as an integral part of the system, and provided finances for equipment.

The experiment was a complete success, in that it resulted in *ruling for open windows.* If its recounting to-day may result in opening more windows for equally deserving children in other places than Phila-

Class at exercise—Chest lift. Arms up and back to Y stretch position.

delphia we will be gratified indeed. And if a few more words will add to such possibility, pardon my expressing these conclusions:

The beneficial effect of open windows on the health and scholastic progress of pupils can be attributed to the following:

Volumes of pure, fresh, cool air roll into the room with none of its vital qualities impaired by artificial handling.

Nature's proper proportion of moisture is mixed with this atmosphere, and Nature's variation is a beneficial change. Ventilating engineers have made the mistake of trying to establish a norm, and sticking to it.

The bracing effect of cold is stimulating to health and renders children more resistant to infecting bacteria and disease. It creates a desire for exercise—a natural physiological demand for increased circulation. To meet this need a series of short physical exercises are provided at frequent intervals between lesson periods, but never prolonged to cause fatigue nor violent enough to excite perspiration. There are also marches and drills which prevent air stagnation in the room by breaking up convection. The lungs are thoroughly ventilated as well as the room. Expired air at body temperature and exhaled gases at over 90° Fahr. set free in the *cold* room, rise to the ceiling and pass out the upper window openings, being replaced by the pure air coming in the lower window openings.

The physical exercises are designed to maintain chest elasticity, affording opportunity for normal lung expansion and the children are encouraged to a better breathing habit. This means more thorough aëration of the blood, with resulting mental stimulation.

We attribute their freedom from "colds" to the following:

Children from close, overheated rooms passing on dismissal into cool, moist atmosphere outside the building have the respiratory mucous membrane suddenly chilled and do "catch cold;" whereas these children in the open rooms breathe a mixture of air and moisture at a temperature more near that of the outside atmosphere. They do not encounter such a sudden change at recess or on the homeward journey and do not "catch cold." They keep well, like school, and are more regular in a attendance. It can safely be said that the chief cause of "colds" is not exposure to cold as such, but on the contrary depends on exposure to the over-heated and confined air of close school-rooms and living rooms.

Our Bache School children, both classes, were carefully weighed each week. The physical gains are a matter of record at the school. It was found that the children in the warm-air room gained less than half as much in the average, pound for pound, as the children in the open-window class, and the latter grew as would naturally be expected of children of their ages living a robust outdoor life. The mental tests were made by the school principal through a series of memory exercises, and spelling and arithmetic examinations which eliminated the question of the merit of teaching. The averages were calculated for each group, and the open-air children showed emphatically the greater advancement. Percentage of promotion January 1913, 3rd grade warm room 75.0; 3rd grade open window 88.1; January 1914, 3rd and 4th grade warm room 76.4; 3rd and 4th grade open window 82.8.

In order to show the children themselves actually at work, and the nature of the physical exercises employed, we took a moving picture of the class at the school, and through the kindness of the Congress management we are able to give you a clear idea of *how they do it in Philadelphia*, by the lantern.

Personnel of the Two Third Grade Classes.

There was no selection of the pupils except that those in the open-window room were placed there on the written request of their parents, following a circular letter explaining the purpose of the experiment.

OPEN WINDOW CLASS.

	Age.		Wt.	High.	Chest.
1 Charles A...	13 yrs.	1 mo.	82 lbs.	57 in.	27 in.
2 Edwin B....	13	2	73	58	24½
3 James G....	9	9	71½	54¾	24¾
4 John K.....	12	0	71½	56	25½
5 Howard A..	10	6	65¼	53⅝	27
6 Milford B...	9	10	67¼	54	24⅝
7 Otto C.....	9	11	68¼	54¾	24⅜
8 Maurice C..	9	3	69	55½	24⅛
9 Raymond C.	9	9	62	49¼	25¼
10 Earl S......	9	6	59	51¾	23¼
11 Raymond H	9	8	59	51¾	23 3/16
12 George G...	8	8	58	52	23⅛
13 John Z.....	9	8	57¾	49½	26½
14 William D..	9	7	57¼	51	24 3/16
15 Thos. O'D..	9	2	57¾	51¼	24⅞
16 David A....	10	2	56½	52	23⅝
17 Bruce McF..	8	2	55¼	51¼	22⅞
18 John B.....	8	4	58½	50½	23¾
19 William S...	8	4	56½	56	23 9/16
20 Charles V...	10	0	60	50½	24⅛
21 John Bd....	8	11	54	48	23⅝
22 Frank B....	8	4	54¼	49	22⅝
23 Herbert R..	9	10	55	53¼	25½
24 James L....	8	8	49	48¾	21 15/16
25 William M..	8	8	48½	51	23⅛
26 May L.....	11	0	75	60	21½
27 Ray W.....	12	0	68¼	58	24⅝
28 Mary K....	10	8	67¼	54½	27⅛
29 Agnes S.....	9	8	65½	54	23¾
30 Cath. McC .	11	0	63¼	55½	23⅛
31 Rebecca B..	8	2	62½	52	25⅛
32 Evelyn S....	11	0	62½	51	25⅛
33 Ada M.....	11	0	61¼	53	25¼
34 Mary A.....	9	10	60¾	49½	23⅝
35 Florence E..	10	0	63½	54	27½
36 Eva G......	9	0	56¼	50½	23½
37 Alberta H...	9	3	58¼	50¾	23¾
38 Agnes M....	10	4	58¼	51½	24⅜
39 Bessie N....	9	3	52½	52½	24½
40 Marie M. L.	10	5	41½	45	21⅞
41 Dorothy M .	9	3	46½	49½	22 3/16
42 Rachel G...	10	6	59¼	54½	24¼
43 Gladys A...	8	8	49¼	47½	21⅞
44 Sadie T.....	11	10	69	54	27

Total 2669 lbs.

Avg. wt. 60 29/44

25 Boys 1526 lbs.=Avg. 61 1/25 lbs.

19 Girls 1143 lbs.=Avg. 60 3/19 lbs.

WARM ROOM CLASS.

	Age.		Wt.	High.	Chest.
1 George B...	12 yrs.	0 mo.	88½ lbs.	61 in.	26 in.
2 Bernard H...	12	0	88¼	60	26¾
3 Joseph A....	12	8	80½	56½	25½
4 Joseph O....	12	1	79½	55	26⅛
5 Edward J...	12	1	70½	55	24½
6 George A...	9	8	69¼	53¼	24⅛
7 Harry W....	10	0	69	52½	25¼
8 William G..	9	0	68¾	53½	24⅛
9 James F....	10	0	68	53	24¼
10 Thomas B..	11	6	67¼	55	27½
11 Edward A...	10	1	67¼	52½	24¼
12 Joseph McF	12	9	67¼	53½	24½
13 Frances E...	10	2	66½	54	27
14 William O...	10	4	64½	51¼	23¼
15 Alex. B.....	8	11	62¼	53	24½
16 Amerego S...	10	5	61¾	50½	23¼
17 Lewis R....	9	10	61½	50½	24¼
18 Warren McC	10	8	61½	53	24⅛
19 Gilbert M..	8	8	61	52¼	23¼
20 Edward N..	11	3	60¾	52	23½
21 William R..	8	2	60½	51½	23¼
22 George D...	10	0	60	51	22½
23 Lewis D....	9	0	59	50	23½
24 Thomas M..	9	0	59	53	25⅛
25 Raymond B.	9	3	56½	49½	23¼
26 Hy. T......	10	8	56¼	50	24¼
27 William A...	9	11	55¼	50¾	22½
28 Joseph G...	9	1	52½	50	25½
29 Emil A.....	8	5	53	48½	23⅛
30 William G..	9	6	47	48	21¼
31 Harry F....	12	2	61¼	52¼	23¾
32 Ruth R.....	13	1	105½	54	32
33 Olga U.....	12	0	99½	60½	28¾
34 Ruth K.....	11	9	75½	56	25¾
35 Mildred D..	8	10	69¾	55	23⅛
36 Marian A...	12	5	69	55½	26
37 Jennie U....	10	10	67	53	26
38 Mildred M..	8	8	61	51¼	23½
39 Carrie C....	8	10	59	51	23¼
40 Lillian P....	9	1	58½	49	22½
41 Katie T.....	9	9	57½	51	23⅛
42 Marg. McC.	10	9	49¾	48¼	22¾
43 Ethel K....	9	0	49¾	48¼	23¼
44 May N.....	10	7	67	53½	23½

Total 2893 lbs.

Avg. wt. 65 23/44

31 Boys 2004 lbs.=Avg. 64 20/31 lbs.

13 Girls 889 lbs.=Avg. 68 5/12 lbs.

To plainly illustrate the physical condition of the two classes of children the following charts are submitted. Vertical lines represent the years of age, horizontal lines pounds of weight, and the curved lines the normal average weights of children for different ages. The physically sub-normal or under-weight-for-age of each class are shown by the irregular lines joining the numbered black dots below the curves in each chart. The numbers alongside the dots correspond to the number opposite the children's names in each class list of pupils.

It will be noted (Chart A) that there were eighteen markedly underweight children in the open-air class, three of them between eight and nine years, the normal age for this grade, three between nine and ten years (one year retarded), five between ten and eleven (two years retarded), three between eleven and twelve years (three years retarded) and four from twelve to thirteen years (four years retarded.)

CHART A.

Open Window Class

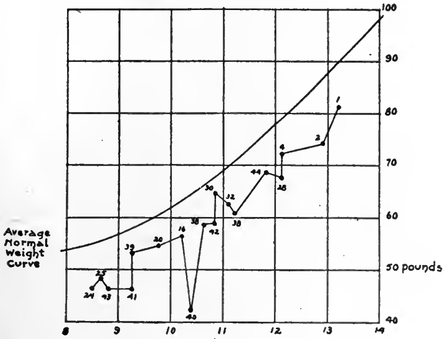
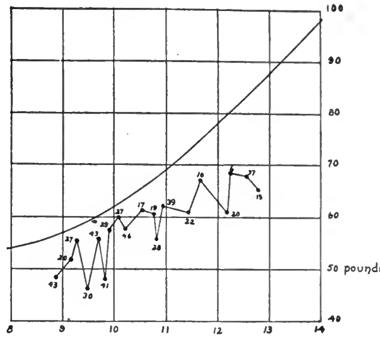


CHART B.

Warm Air Room



In the other class (warm room) (Chart B) there are nineteen physically sub-normal pupils, six between nine and ten years of age (one year retarded), six between ten and eleven years of age (two years retarded), two between eleven and twelve years of age (three years retarded) and four between twelve and thirteen years of age (four years retarded). These retarded children, waterlogged at third grade when they should have reached the sixth or seventh, had already lost many years of opportunity, and cost the board of education many, many dollars more than necessary.

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POR

LUIS MIRO QUESADA

El niño, que como alguien ha dicho, "es un pájaro de los campos más que un pájaro de jaula," necesita del aire, de la luz, y de la libertad, para conservar la salud del cuerpo y del espíritu. Y es esto tan cierto, que las escuelas al aire libre prueban que basta llevar á ellas á los escolares enfermos de las ciudades para que allí curen ó mejoren. Los informes respecto á éstas coinciden todos, con una uniformidad que causa impresión, en el punto relativo á los provechosos resultados en ellas obtenidos; cualquiera que sea el país y la escuela de que se trate. Si tales son sus benéficos efectos en el limitado radio que hoy tienen, parece indicado ampliar su esfera de acción. Más concretamente: el régimen higiénico y el aire puro que son, en la actualidad, privilegio de los niños enfermos, han de proporcionarse, también, á los sanos, para impedir que enfermen. Lo que ha sido, hasta ahora, solo labor curativa de carácter restringido, debe convertirse en una gran obra de índole preventiva, llamada á evitar los peligros que la escolaridad urbana entraña.

En el momento presente, la escuela al aire libre ha salido yá del campo de las experiencias y ha dejado de constituir un problema para la higiene escolar. Diversa en su modalidad en los distintos países, tiene, en el fondo, el común objetivo de dirigirse á la misma clientela de niños débiles, escrofulosos, anémicos, cardiacos y, principalmente, pretuberculosos no contagiosos; y, coincide siempre, como hemos dicho, en el resultado satisfactorio que en su propósito alcanza. Este hecho, anotado invariablemente, explica el unánime entusiasmo que las escuelas al aire libre despiertan y la rápida propagación de ellas. Estudiémolas, pues, en sus rasgos generales y veámos, luego, la conveniencia de aplicar la esencia del sistema á las necesidades de la enseñanza popular.

La escuela al aire libre nace, como se sabe, en Charlottenburg, Alemania, en 1904. Con análogo objeto al sanatorio para niños, establecido dos años antes en Pankow-Schoenhausen, pero con un carácter escolar de que éste carecía, la escuela de Charlottenburg está destinada "á todos los niños que no pueden soportar una presencia de cuatro ó cinco horas en las aulas comunes muy pobladas, en razón de su debilidad general ó de defectos de constitución (anemia, escrófulas) ó de enfermedades especiales de ciertos órganos (corazón, pulmón, etc.)." La escuela de Charlottenburg está situada en el bosque y su tipo es de externado; los alumnos desde que ingresan á ella, muy de mañana, hasta que la dejan, á las siete de la tarde, pasan la mayor parte del dia y juegan al aire libre, hacen cinco comidas sanas y nutritivas, estudian, solamente, dos horas y media los más avanzados y dos horas los que lo están menos. El feliz éxito de este sistema no se hizo esperar y la escuela de Charlottenburg que el primer año fué abierta por muy corto tiempo lo es, más tarde, desde el mes de Abril hasta fines de Diciembre. "Los resultados obtenidos desde el punto de vista de la mejoría de la salud de los niños fueron tan satisfactorios, dice el Doctor Dufestel, que se decide desarrollar esta institución y que la escuela de bosque de Charlottenburg ha servido de prototipo á muchas otras." (1) En estos cortos años, en efecto, se crean en Alemania las de Mulhausen, Munchen-Gladbach, Eberfeld, Magdebourg, Leipzig, Dresden, Lübeck, Dortmund, Buckow, etc., inspiradas en las mismas tendencias que aquélla.

Se establecen, luego, escuelas análogas en Suiza, (Zurich, Glarisegg, Grunau). La primera de estas, la de Zurich, es interesante porque crea el tipo de la escuela de internado de este género, que había de ser luego imitado, en cierto modo, en Alemania (Hohenlychen) en Inglaterra (Knolls Green, Londres), en Austria-Hungría (Szombatchely) y, principalmente, en Francia, en la escuela de Vernay (Lyon). Responde esta escuela á la idea del Doctor Grancher, cuando escribía: "los niños reconocidos como atacados de tuberculosis en sus comienzos, deberían ser colocados en un sanatorio escuela, donde ellos continuarían sus estudios bajo la vigilancia estrecha de un médico que viviera allí." Se escoje, pues, para la de Vernay, los niños de las escuelas lyonesas pretuberculosos, no contagiosos y con posibilidad de curarse, que deben permanecer tres meses en aquélla, haciendo vida al aire libre, tomando cinco comidas por dia y estudiando sólo tres horas. La estadía en la escuela de Vernay, ha producido, según el Doctor Vigne, médico en aquélla, un importante aumento de peso (2 kilos 800 por término medio) y modificaciones favorables obtenidas en los síntomas pulmonares, perceptibles á la auscultación y á la mensuración torácica; en todos los niños, aun en los más gravemente atacados.

En Inglaterra, el London County Council, fundó, en 1907, alentado por los resultados favorables de la escuela de Charlottenburg, una semejante en Bostall Wood. Como en aquélla, sólo fueron admitidos los niños enfermos, pero curables ó susceptibles de aprovechar los beneficios de su estadía en la escuela. Al año siguiente se abrían dos nuevas escuelas de la misma índole en Londres, una en Halifax y otra en Bradford. Debemos citar, también, las recientes de Marblethorpe (Leicester) la de Roby (Liverpool) la de Uffculme (Birmingham) la de Warwick etc., y, particularmente, la de Sheffield, más antigua que estas últimas, y de cuyo buen éxito, semejante por lo demás al de todas las otras, informa el Profesor Williams, de Londres, diciendo que los niños "ganaron en peso, en perímetro torácico y en aparencia, acrecentándose su poder de observación."

En los Estados Unidos, prescindiendo del ensayo hecho en 1904 en Puerto Rico, la primera escuela al aire libre, en forma, fué fundada el 27 de Enero de 1908, en Providence (Rhode Island) por las autoridades escolares y debido á los esfuerzos de la "League for the Suppression of Tuberculosis," para niños sospechosos de hallarse atacados de este mal. Los favorables resultados alcanzados, indujeron á imitar este ejemplo y á establecer esculas análogas, á iniciativa de las ligas contra la tuberculosis, en Boston, New York, Chicago y en Hartford, Rochester, Pawtucket, Buffalo, Cambridge, Pittsburgh, etc. Lo que llama la atención es la variedad de sistemas empleados en los Estados Unidos. Así, en Providence, fué establecida la escuela en un segundo piso de una construcción de ladrillo, con una gran sala abierta por uno de los costados, para recibir el aire y la luz en abundancia; en Boston, se le sitúa en un parque público; y, en Nueva York, la escuela al aire libre se crea en conexión con el "Out Door Camp" mantenido por el "Bellevue Hospital," sobre un "ferry boat" (barca ó chata de rio, á vapor) en el "East River." Tres escuelas más, semejantes, se abren en New York en otros tres "ferry boats" y una en el tejado del edificio que ocupa la "Vanderbilt Clinic;" y en este camino de crear nuevas escuelas al aire libre en que ha entrado New York, lo siguen, también, los otros estados de Norte América.

Pero, aunque diversas en sus modalidades, en este país, las escuelas al aire libre, el sistema, en el fondo, es el mismo: abundancia de aire y de luz, buena alimentación y poco trabajo intelectual; y, los efectos producidos son siempre altamente satisfactorios. Ya en Providence se había observado que las pruebas de la hemoglobina hechas con los niños manifestaban una variación de 74 á 84, desde la entrada á la escuela, en el mes de Enero, hasta la salida en el mes de Junio; y, el profesor Thomas E. Balliet, dice que "los resultados obtenidos en éstas, han sido, en todos los casos, favorables, en grado verdaderamente notable;" y, agrega que; "los niños, con raras excepciones, ganaron rápidamente en peso y condiciones de vitalidad y el proceso de la tuberculosis, frecuentemente se detuvo" (2) Y, cosa análoga sucede en Italia; ya sea en Roma, donde siguiendo el ejemplo de los Estados Unidos, se crea en 1910 una secuela de ese género sobre la terraza de un edificio escolar y en vista de lo satisfactorio del ensayo realizado, ocho escuelas más; ya, en Génova, donde se establece una escuela al aire libre, en el campo, en 1910 y otra en 1912; y, en Milán, Brescia, Venecia, Padua y Verona, ciudades que también las tienen yá; y, lo que Italia á este respecto acontece, no es sino una nueva prueba del feliz éxito que las escuelas al aire libre en todas partes alcanzan.

Ahora bien, los sorprendentes resultados obtenidos con las escuelas al aire libre se deben, sencillamente, á que éstas responden á las necesidades de una educación dada en condiciones higiénicas y racionales. Proporcionar á los niños que ingresan á ellas el aire y el alimento que les falta y reducirles el trabajo que les sobra, he aquí el secreto que explica el invariable y favorable éxito de esas escuelas. Pero y es esto lo que más debe llamar nuestra atención, si el triumfo de la fórmula: "doble ración de aire, doble ración de alimento y media ración de trabajo," aplicada á las escuelas al aire libre, es la prueba de la bondad de éstas, significa, á la vez, la contra-prueba de que la enseñanza en las escuelas comunes se dá en condiciones antihigiénicas y desfavorables.

Es, precisamente, la carencia, en las escuelas, del aire puro indispensable, la mala alimentación de la mayoría de los alumnos y el excesivo trabajo que éstos realizan dentro y fuera de aquella, lo que caracteriza hoy, con diferencias de simple detalle, la enseñanza pública obligatoria en todos los países, y lo que explica los perniciosos efectos que ésta produce sobre la salud de los escolares.

Es indudable que, el aire que en las escuelas urbanas respiran los niños; lejos de ser provechoso para su salud les es perjudicial. El aire, en efecto, no muy puro de las ciudades, se altera aún y vicia rapidamente en las salas de estudio de aquéllas, donde, la exhalación pulmonar de los escolares, los gases que se desprenden de las funciones de digestión, las secreciones cutáneas, el polvo y los micro-organismos contenidos en la habitación y en los vestidos, las combustiones debidas á los aparatos de alumbrado y calefacción, etc., producen necesariamente ese resultado. Este natural efecto de la aglomeración de alumnos, en recintos por lo general estrechos y cerrados, es tanto más difícil de salvar cuanto que la ventilación artificial de las clases, costosa y delicada para establecerla, no da, frecuentemente, el fin deseado y, que la ventilación corriente, efectuada cuando los estudiantes abandonan las salas de estudio, tiene el inconveniente de que el remedio se aplica cuando el mal que resulta de la permanencia, más ó menos larga, en recintos cerrados, está yá producido. Ahora, segun refiere el Dr. L. Henchoz, las observaciones hechas en Paris, por el Observatorio Municipal, han venido á descubrir una proporción media de 192 litros de ácido carbónico por 100 ms. de aire en los diversos establecimientos escolares; habiéndose, en la sala de estudio de un liceo constatado, asimismo la presencia de 352 litros de ácido carbónico por 100 ms. de aire; y, las experiencias de Scharling, que ha encontrado 2.9% de ácido carbónico en la exhalación horaria media de un escolar y de Fischer, que ha comprobado que en una sala de clases cuyas puertas y ventanas permanecen cerradas durante dos horas, se halla, á los cinco minutos 1% de C.O2, despues de 50 minutos 2.9%, y á las dos horas 4.3%, demuestran que el aire que los alumnos respiran es, frecuentemente, nocivo. Y tanto lo es, que los experimentos de Brown Sequard y de Arsonval inyectando á conejos los productos de la exhalación pulmonar del hombre, han venido á probar la toxidad del aire expirado.

No es necesario detenerse á examinar los desastrosos efectos que el aire viciado, cargado de ácido carbónico ejerce sobre el organisno, ya que es sabido que él produce debilitamiento en las funciones de nutrición, disminución de vitalidad y aun la anemia misma; que tiene una influencia perniciosa sobre el sistema nervioso y sobre los glóbulos rojos de la sangre y que, lo que es más grave aún, predispone á la tuberculosis; porque, como lo hace notar el Dr. Bewhest, médico inspector y profesor de higiene en Budapest, "la respiración en el aire insalubre se efectúa sólo superficialmente, de suerte que los pulmones y particular mente el vértice de éstos no se llenan suficientemente de aire y vienen á ser así un terreno propicio á la formacióny aumento de los bacilos de la tuberculosis."

Contribuye, también, y de manera capital, al debilitamiento general orgánico de los alumnos, estado preparatorio de las más graves enfermedades, el excesivo trabajo mental y aún material, realizado por éstos dentro y fuera de las escuelas. "Ciertamente que Uds. no sabrán nada nuevo, exclamaba el Dr. Mathieu, presidente del Congreso Internacional de Higiene Escolar de Paris (discurso pronunciado en la sesión solemne de apertura) si yo les digo que los programas están en gran medida sobrecargados. La pedagogía de mañana que será la pedagogía natural, la pedagogía fisiológica, deberá resolver este problema, mejorar la educación intelectual y disminuir el tiempo consagrado al estudio y á la enseñanza." No voy á insistir en este punto, ya que higienistas y pedagogos están, unánimemente, de acuerdo en la necesidad de aligerar los programas; pero, quiero sí hacer notar que el mal enunciado por el Dr. Mathieu se aumenta con la viciosa costumbre de dar á los alumnos labor escolar para realizarla fuera de la escuela y con el hecho, más grave aún, y bastante frecuente, de que los niños trabajen en la industria á la vez que concurren á aquella.

Ya en el Canton de Vaud, en Suiza, se había notado que en el campo, muchos niños "en pié desde las 5 de la mañana, rendidos por los duros trabajos agrícolas, ingresaban á la clase á medio despertar, incapaces de todo esfuerzo intelectual que hiciera su enseñanza provechosa." (3) Una investigación general hecha por la "Société Suisse d' Utilité Publique" y á la cual respondieron trece cantones, puso de manifiesto que "de 280,000 niños, 118,000 trabajaban en explotaciones agrícolas;" y, que "de 30,000 ocupados en las industrias de la paja, de la pasamanería, del tabaco, del bordado y de la relojería, 825 trabajaban diariamente 6 horas, y 1,100 más aún; mil niños, más ó menos, trabajaban el domingo, 109 á partir de cuatro de la mañana, 576 á partir de las cinco, 206 hasta las diez de la noche, 121 hasta las once y 35 hasta después de las once."

El Dr. Platzhoff Lejeune, hacía notar, con este motivo, en el seno de la "Societé Vaudoise d' Utilité Publique" la "insuficiencia de las disposiciones de la ley sobre las fábricas;" pero, en realidad, el caso enunciado se presenta aun dentro del respeto á aquella ley misma, siempre que el límite de edad para trabajar en una fábrica sea menor que el fijado para la escolaridad obligatoria. Tal sucedió en Zurich, en que una comisión escolar del Canton pretendió inutilmente prohibir á un alumno de 14 años trabajar en una fábrica, fundándose en una ley escolar de ese Canton que prevee la circumstancia de que un niño no puede ser obligado á labor superior á sus fuerzas, sea en el seno de la familia, sea fuera de ella; decisión de la que protestó el padre de aquél, haciendo presente que la ley federal sobre las fábricas autoriza á los escolares de 14 años a trabajar en un taller, siempre que no pasen de 11 las horas diarias de labor; (4) y, esto acontece, también, en todos aquellos Cantones de la Suiza, en que se fija en 15 años la obligación de concurrir á la escuela, mientras que desde los 14, en virtud de la ley citada, pueden los niños emplearse en trabajos industriales.

Este mismo y delicado problema lo tienen planteado todos los países; pues cuando se prolonga como es debido los años de enseñanza obligatoria, como sucede en Suiza, se tropieza con el inconveniente señalado y, cuando se restringe ésta hasta hacerla coincidir con la edad determinada para el trabajo industrial, se resiente la instrucción; como lo expresan uniformemente los pedagogos en los países en que tal cosa acontece y como lo manifiesta, también, el hecho de tenerse que recurrir, más tarde, á las clases para adultos, como medio de completar la primera y deficiente enseñanza recibida. Hay pueblos en que no se osa llegar siquiera hasta la obligación escolar completa y se buscan soluciones á medias, como la de exigir que los niños frecuenten la escuela durante un cierto número de dias consecutivos cada año (de dos á cuatro meses generalmente); ó, despues de haber aceptado, en principio, la regla de la asiduidad escolar, se admite, sin embargo, la posibilidad de sustituir la frecuentación de las clases de dia por los cursos de noche; ó, se exige, por último, un certificado de escolaridad, limitado al conocimiento de la escritura, la lectura y de algunas nociones elementales.

En esta oposición entre las necesidades de la enseñanza y las exigencias del trabajo industrial, resulta siempre aquella, en una ú otra forma, sacrificada á éste; y, menos mal, cuando se establecen límites precisos entre ambos de manera que no puedan confundirse, porque fácil es comprender cuál ha de ser el funesto efecto ejercido sobre el débil organismo de los niños por un trabajo material duro que viene á agregarse á una labor mental, generalmente recargada; ya que como es sabido, la fatiga muscular y la fatiga intelectual, producen los mismos fenómenos de desasimilación y de depresión orgánica.

Por otra parte, muchos alumnos van á la escuela, sin haberse desayunado. "Frecuentemente para el niño pobre, la mejor comida es aquélla que toma en la cantina de la escuela." El Dr. Mathieu refiere que un maestro de Paris le manifestaba que tenía comprobado que "los niños no podían trabajar sino á partir del momento en que estaba abierta la cantina escolar." Podrá resistir un escolar en estas condiciones, y sin respirar siquiera el aire puro que le es tan necesario, la excesiva labor intelectual que se le impone?

Los resultados no se hacen esperar. La escuela es hoy el peor enemigo de la salud de los niños. Schmid Monard, despues de haber examinado más de 10,000 niños de ambos sexos, en las escuelas de Italia, ha podido constatar que "los males é indisposiciones de todo género aumentan con la frecuentación escolar;" y el Profesor Shuyten, al estudiar las enfermedades que la escuela produce ó desarrolla, llama, particularmente, la atención respecto al hecho de que "existe entre los alumnos una fatiga crónica es decir, permanente, que crece á través del año escolar y se localiza en el hemisferio cerebral izquierdo." El Dr. Grancher había ya encontrado en las escuelas de Francia un 15% de niños pretuberculosos y esta cifra aumenta, enormemente, si consideramos en ella los niños atacados de otras enfermedades, ó cuyo estado de debilidad los prepara para contraerlas. "Si examinamos la juventud de las escuelas de la edad de seis á catorce años, dicen los Drs. V. Klima y F. Hanza; (5) notaremos que ella sufre de un cierto debilitamiento y que ella misma está amenazada por los primeros síntomas de enfermedades. El porcentage de los niños débiles y enfermizos es enorme y, en ciertas escuelas llega, del 80 al 90%."

Si tenemos actualmente escuelas, como las ordinarias, en que lo general es que los niños pierdan la salud y lo excepcional que la conserven; y, escuelas, como las de aire libre, en que al contrario lo raro es que los niños enfermos no sanen, está indicada la urgencia de inspirar aquéllas en el modelo de éstas. Combatir la tuberculosis y las enfermedades infantiles en la escuela, no es contentarse con pretender curarlas cuando ellas aparecen, sino evitar que ellas se presenten. La higiene escolar debe tener un carácter preventivo antes que curativo. Mientras no se destruya la causa del mal poco haremos con combatir el efecto; y, la causa, ya lo hemos dicho, está en la inaceptable base antigiénica en que reposa hoy la enseñanza obligatoria.

Y, tocamos aquí un punto en que la higiene escolar se confunde con la pedagogía social. Las democracias que gozan del derecho indiscutible de imponer la enseñanza, tienen el deber de fundar ésta al suministrarla sobre bases higiénicas y humanas. Est a obligación es tanto más imperiosa, cuanto que la mayor parte de los niños que se ven precisados a aprovechar de la instrucción publica y gratuita pertenecen a las clases pobres y, están por esta causa más predispuestos a las enfermedades escolares.

Las condiciones generalmente anthigiénicas en que viven los obreros, su mala alimentación, el esfuerzo exajerado que la moderna industria les demanda, la existencia febril que llevan en las ciudades congestionadas en que habitan y trabajan, reperecuten dolorosamente sobre sus hijos; que van a la escuela sin haber gozado de su infancia, con una naturaleza pobre y debilitada por la herencia recibida y por el medio insalubre en que se han desarrollado, para acabar de perder en aquélla lo poco de salud que les resta. Son conocidas las observaciones de Niceforo en las escuelas de Lausanne, que demuestran que los niños pobres tienen "la talla, el peso y el perímetro toráxico inferiores á los de las clases acomodadas;" y, los médicos escolares tienen ya comprobado que es dentro de las clases mas necesitadas que deben buscar el contingente para las escuelas al aire libre y los sanatorios, porque alli se encuentran los enfermos de todo orden y, principalmente, los candidatos a la tuberculosis.

Las escuelas al aire libre para todos los niños resolverían el problema, ya que ellas son, no simplemente mas higiénicas sino también mas pedagogicas, como lo hacen notar entre otros, Balliet, Dufestel y Lacabe Plasteig, que ponen de manifiesto el hecho de que los progresos realizados desde el punto de vista intelectual son sensiblemente superiores en aquéllas que en las urbanas, y que "con sus dos horas de labor cotidiana, se conservan los niños al mismo nivel mental que los de las escuelas de la ciudad, y pueden asi pasar, fácilmente, su certificado escolar."

Se dice, sin embargo, que las escuelas al aire libre son costosas. No lo son tanto, en verdad. En Charlottenburg, se ha llegado á reducir á un franco cinco céntimos, el gasto diario por niño; cantidad bien pequeña, por cierto, si se tiene en cuenta la importancia del fin que satisface. Con la quinta parte de lo que inverten las naciones de Europa en sostener la paz armada, podrían realizar la indicada reforma en la enseñanza popular. Pero, es preciso reconocerlo, por una de esas curiosas anomalías de la civilización actual, los países soportan bien hoy en el mundo, los gastos, por excesivos que sean, cuando ellos tienen por objeto ponerlos en aptitud de destruir vidas humanas, pero no cuando van dirijidas á salvarlas.

Por lo demás, lo importante no es adoptar exactamente el tipo de las escuelas al aire libre en las escuelas ordinarias, sino adaptar éstas de acuerdo con las necesidades de la enseñanza general, á la esencia del sistema que ha producido en aquellas tan provechoso resultado y, así, suministrar á los niños el aire puro que necesitan, dar á los que tienen necesidad de ello, el indispensable alimento, y, establecer para todos una labor mental adecuada, excluyendo por completo todo trabajo industrial son los principios racionales higiénicos en que la enseñanza, y particularmente la popular y obligatoria, debe estar fundada.

Algo de esto se está haciendo teóricamente, el Congreso Internacional de Higiene Escolar de Paris, sancionó el principio de que, "en las escuelas ordinarias seria util abrir clases de aire puro;" y, prácticamente, se realiza ya esto en algunas escuelas públicas, particularmente en las norte-americanas; y, las cantinas escolares, hasta hace poco desconocidas, se desarrollan, rápidamente, en todos los paises, al extremo de que una sola de las veinte cajas de distrito existentes en Paris, la del distrito 15, repartió en un año á los escolares, 547,352 comidas gratuitas y 203, 947 de paga. Pero, la obra de reformar la escuela popular, desde el punto de vista higiénico y social, no puede quedar reducida, como actualmente sucede, á esfuerzos aislados y á una acción, con frecuencia de carácter privado, necesariamente restringida y deficiente, sino que ella debe corresponder á los poderes públicos, que tienen el deber de organizarla de modo integral y con índole de generalidad. A ellos toca en efecto, velar porque el trabajo del taller no venga á sumarse al de la escuela para aniquilar á los niños; á ellos interesa, asimismo, que reciban éstos el aire puro que su salud demanda; y, ellos, por último, están llamados á acudir en ayuda de aquellos pequeños infelices para quienes existe la obligación de asistir á la escuela, pero no el derecho de ir á ella sin debilidad y sin hambre.

Se impone, pues, la necesidad de convertir la higiene escolar en una verdadera función social de protección á la infancia. Si hoy el estado se cree en la obligación de dictar leyes á favor del proletariado, á fin de reparar las desigualdades sociales injustas de que este resulta víctima, ¿que de extraño tiene que procure reparar, también, las que sufren los niños pobres, más dolorosas aún por tratarse de seres inocentes, que perdieron desde el nacer el derecho á la felicidad? Y, en este caso, la ciencia viene en apoyo de los sentimientos humanitarios, porque ella demuestra que sólo una enseñanza sujeta estrictamente á los principios de la higiene fisica y mental, es capaz de impedir que se malogren o pierdan en la escuela tantas vidas en flor. Ahora bien, al estado interesa primordialmente, protejer y defender la infancia, porque así "salva la semilla" y asegura su propio porvenir. Es, en efecto, á la postre un negocio productivo, cualquier dinero invertido en la escuela en la defensa de la salud y de la vida humana. Es por eso, que debe aprovecharse de ésta á donde concurren los niños diariamente y por largas horas, y de los seis á los catorce ó quince años, es decir, en ese período de la vida en que "la más potente regeneración natural se manifiesta," para afirmar su buen desarrollo físico y psíquico.

Cuando estas ideas se apliquen, poco importará que la trasformación se efectúe adaptando á las nuevas necesidades las actuales escuelas; ó, lo que es mejor, llevando éstas fuera de los centros muy poblados, al campo si posible fuera, donde los niños encuentran el aire puro, la luz solar y los espacios abiertos que tanto necesitan. Lo que interesa es que la escuela sea más libre y alegre y que la enseñanza se dé con "un minimum de claustración y de sedentaridad escolares." Y, lo que es más sustancial aún, es que se asegure más que la instrucción la salud física y moral de los alumnos. La higiene escolar y la pedagogía social tienen á su cargo, de consuno, la tarea de realizar esta noble obra; altamente útil para toda democracia, que debe aspirar á que los niños, sus ciudadanos del mañana, sean y se conserven sanos y felices y amen á sus semejantes y al país en que han nacido.

(1) Dr. L. Dufestel.

Hygiène Scolaire.

(2) "*Open-Air Schools and the Children Who Should Benefit From Them.*"

Informe presentado por el Prof. Thomas B. Balliett, Decano de la Escuela da Pedagogia de la Universidad de Nueva York, al Congreso Internacional de Higiene Escolar de Paris.

(3) *Annuaire de l'Instruction Publique en Suisse* (1912).

(4) *Annuaire de l'Instruction Publique en Suisse* (1913).

(5) "*Programme des Colonies Feriales (de vacances) et Sanitaires des Enfants.*"

Informe presentado al citado Congreso por los Dres V. Klima, medico de la ciudad de Praga y F. Hanza, Consejero Imperial y Director del Sanatorio Real para los niños escrofulosos.

EL AIRE LIBRE DE LA PEDAGOGIA CIENTIFICA LA TUBERCULOSIS-PROFILAXIS ESCOLAR

Creaciones e impulsiones en el Sistema Escolar Argentino

POR LOS DELEGADOS ARGENTINOS
A. VIDAL Y C. ROBERTSON

(Exposición del Dr. Antonio Vidal: Sesión 29 Agosto.)

La "Escuela al aire libre" (Open-air schools: Ecoles en plein air: Scuole all' aperto: Waldschuelen), han atraido estos ultimos años y continuan atrayendo poderosamente la atención de higienistas y pedagogos. Las instaladas hasta la fecha han mostrado á la evidencia sus ventajas. Debido á ello y á los juicios emitidos con respecto á su porvenir por autoridades no contestables en materia de fisiología pedagógica é higiene escolar, juicios invariablemente favorables y con frecuencia entusiasticos, el conjunto ó sistema de esas fundaciones ha crecido notablemente. La base cientifica en que el sistema asierta, va entretanto y por modo progresivo, adqueriendo consistencia. En los relatorios y trabajos presentados á la sesión ultima del "Congreso Internacional de Higiene Escolar:" Brannan y Balliet (Nueva York); L. Williams (Bradford); R. P. Williams (Sheffield); Randi (Padua); Vignes (Lyon); Sisto (Buenos Aires); Lacable-Plasteg (Paris); Neufert (Charlottenburgo); Querton (Bruselas); Wolff (Muelhausen); Tlúchor (Vienna); Bexheft (Buda-Pesth); Kirkby (Bradford), etc., pueden hallarse con datos descriptivos sobre las obras existentes, elementos constitutivos de dicha base. Pero no es solo este Congreso el en que se refleje interés por cuestión de tanta actualidad. Ella se ha ventilado asimismo con empeñosa atención en diversas asembleas de ambos mundos. Uno de nosotros, Dr. Antonio Vidal, habia seguido y tratado personalmente (introducida bajo enunciados distintos), en varios congresos Americanos, de medicina y de ciencias: Montevideo (1907); Santiago de Chile (1908); Rio de Janeiro (1909) y Buenos Aires (1910), tuvo ocasión de reanudarla en la ultima asamblea internacional contra la Tuberculosis (Congreso de Roma; Mayo de 1912). Las observaciones bibliográficas y críticas sobre la elucidación y amplia y brillante que del asunto se hiciera en Roma, consignaronse en un trabajo que bajo el titulo: "Organization Prophylactique des Ecoles" se publicó en los "Archives internationales d'Hygiene Scolaire." En dicho estudio, mostrábase la estrecha vinculación creada hoy en día entre ambos grandes problemas técnicos y sociales: el problema escolar, higieno-médico-pedagógico, y el problema profiláctico de la Tuberculosis; y, señalabanse, además, ciertos aspectos nuevos del magno asunto, encarado de modo á destacar los lazos de conexión existentes y á crearse, entre las direcciones de acción que expresan estas dos palabras "Tuberculosis" y "Escuela."

Si se hiciera el computo preciso (La operación no ha sido hecha que sepamos) de las escuelas que funcionan hoy en día en Alemania, Estados Unidos, Francia, Inglaterra, Austria-Hungria, Italia, Suiza, Argentina y otros paises, bajo el principio general del "Aire libre," se obtendría una cifra importante.

Pero esa cifra no nos revelaría sino una parte de la obra reformadora que viene realizandose á partir del precioso experimento escolar de Charlottenburgo, en 1904. Nos reflejería solo el movimiento habido en cuanto concierne á establecimientos de instrucción, á escuelas propiamente dichas. Transformaciones materiales y funcionales de mucha importancia y de dirección muy pratica, quedarían excluidas. Esas por ejemplo, que no afectando sino parcialmente la escuela publica, común, habilitan en esta una ó mas "Secciones" ó "Clases al aire libre" (Fresh-air rooms). Hay pues que poner en cuenta esta reforma, de efectuación relativamente fácil; mas hay otras todavia que, en el mismo sentido, contribuyen á mejorar, á higienizar la vida escolar, en las grandes ciudades sobre todo.

Nos referimos ahora á las distintas obras ó instalaciones complementarias que sin ser propiemente escuelas al aire libre, proveen á los escolares de aire puro y de alimentos á la veces, proporcionandoles además siquiera en una parte del día, espacio para sus juegos y un sitio de sano reposo y esparcimiento después de la tarea.

La naturaleza y amplitud de estas instalaciones, como sus otros rasgos, son variados, como es vario el nombre que llevan: "Recreaciones;" "Jardines;" "Estaciones;" "Campos de Juego;" "Plazas." Hay algunas que representan una adoptación feliz: Bastiones abandonados, trozos de ribera, cubierta de barcos, etc. Todas y cadauna representan organos que integran el "*Sistema de aire libre.*" Prestan servicios de utilidad suma á los centros densamento poblados, allí donde las creaciones anteriormente aludidas son dificiles.

Finalmente para caraterizar de modo completo el movimiento reformador, es absolutamente preciso acordar sitio á la serie de reformas materials (aireación y ventilación, ampliación de locales, etc.) y funcionales, que, si bien pertenecen por su indole á la higiene escolar común, han sido en realidad y siguen siendo impulsadas, sobre todo por la creciente propaganda surgida á raiz de la fundación de Charlottenburgo.

Efectivamente, es menester convenir en que ha sido poderosa esta influencia demostrativa, que ha logrado vencer la indiferencia de muchos espíritus, atrayendolos a la causa de la instrucción saludable. Tanto es asi, que acaso pudiera estimarse de mas ventajas todavía para la colectividad esa acción indirecta que la muy feliz directamente ejercida por las escuelas de aire fresco y puro. A ese título solo, valdría la pena de sostener con ardor su instauración.

Es, pues, concibiendo unidas todas estas transformaciones ventajosas que en vigor no se prestan a una apreciación numérica, que debemos apreciar la positiva significación del movimiento reformador.

En el momento actual, pensamos que el estudio general de la cuestión aparte las reseñas descriptivas siempre utiles de esta ó aquella fundación comporta el logro de los tres objetivos que siguen:

1. *Definir y clasificar* (dando los antecedentes de cada uno y la razón de su origen) los diversos tipos de escuelas y de instituciones varias, parecidas ó formando unidad, á que antes aludieramos, asignando á cada tipo sus condiciones materiales y sus carácteres y modos funcionales.

2. Prescribir-labor concretamente técnica, con destino á una determinada colectividad escolar ó aun, con alcance mayor, á un sistema pedagógico dado. El plan de creaciones, reformas é instauraciones de aire libre que sea conveniente imponerla. Clara indicación será hecha en eses plan de las determinaciones correspondientes á cada una de las técnicas: médica, arquitectural, pedagógica, y

3. Estudiar, con amplitud un tanto mayor que la habitual el movimiento cientifico que está produciendose en torno á las realizaciones pedagógicas en cuestión, que las impulsa y determina.

En lo que dejamos dicho y á lo que va á seguir, procuraremos esbozar las tres direcciónes de labor, deteniendonos algo más en la ultima. A propósito de la segunda, nos permitiremos presentar rapidamente las instituciones "all'aperto" de la ciudad de Buenos Aires, cuya más adelantada expresion constituyan la sus *Escuelas Para Niños Débiles.*

Las fundaciones al aire libre dejimos, son variadísimas. Lo son en cuanto á su magnitud y rango, á su naturaleza y fines, medicales y pedagógicos; á los atributos físicos del medio que las circunda; á su manera de funcionar; al regimen de trabajo y de vida á que están sujetos los pupilos. Si no todos, casi todos, además, poseen modalidades propias, rasgos fisionomicos característicos. Radicadas en plena ciudad, ó en los suburbios ó alrededores, ó en plena campaña; en el bosque, en la playa, en el llano ó la montaña. Emplazadas en distintas latitudes ya funcionan en verano, ya en inverino; en dos ó tres estaciones; ó bien combinados los medios, durante todo el año. Sea que forman unidad en lo pedagógico, ó que sean solo fracciónes de unidad, destinanse á niños de tierna ó media infancia, á adolescentes; á niños sanos puramente; ó á predispuestos y enfermos ó á dos ó tres de estas categorias, con ó sin determinadas maneras de separación. La permanencia de los niños es solo de horas-externado ó de todo el dia, no reintegrándose al domicilio sino para el descanso nocturno; ó, enfin, igual á la de un franco internado.

La matrícula del escolar es anual ó es periódica, de algunas semanas para que se renueven los grupos beneficiados, como proceden ciertos establecimientos franceses é italianos, etc. Si penetrando más en el detalle nos deuvieramos en otras, particularidades; y si sobre todo atendiesemos, en lo pedagógico y social, á la formas y maneras posibles de realización, multiplicariamos las variedades.

Que clasificación hacer de estas fundaciones? Tenemos recojidos y ordenados los elementos que tal vez nos permitirían arribar á una aceptable, si siquiera provisoriamente. Preferimos, no obstante diferir el proposito. Habiendo uno de nosotros, el Dr. Vidal, llevado á cabo personalmente el año anterior (1912), en cumplimiento de una misión oficial que le confiara el gobierno Argentino, el examen detenido de las principales escuelas é instituciones europeas de aire libre, poseemos datos suficientes para un ensayo de ese genero; ensayo comparativo y de clasificación que acaso pudiera rendir algun servicio. Pero optamos por hacerlo conocer cuando lo hayamos madurado más.

Ha de permitirnos, sin embargo, anticiparnos aquí una sugestión nacida de esas observaciones sobre el terreno y que ha podido ya rendirnos fruto. Esta era la idea sugerida: reunir hasta donde posible, en creaciones ulteriores, los elementos de bondad, de superioridad, comprobados en el propio funcionamiento de las distintas obras. Porque no tomar, pensamos entonces y seguimos pensando hoy, lo bueno que en tal ó cual orden de cosas, respectivamente tienen, v. gr: la escuela histórica de Charlottenburgo; la recreación de Padua, impulsada por el Dr. Randi, y que ha iniciado el movimiento en Italia; las escuelas de Roma; la magnificamente instalada de Muelhausen; la de Lyon con larga permanencia en la campaña, que el Dr. Vigne nos ha descripto, etc.?

Las obras de aire libre en la ciudad de Buenos Aires, y sobre las cuales ha de permitirsenos algunas referencias, contienen incluidos armonicamente recompuestos elementos de probada significación. Tanto como la previsión del cuerpo medico escolar y de las autoridades de la enseñanza, en primer termino del Presidente del Consejo de Educación, el Dr. J. M. Ramos Mejia, que las sustubiera y ejecutara con inteligente decisión-han cooperado á ello, tal vez, diversas circumstancias ocasionales.

Entre esas obras, tienen el primer rango en el sentido que tratamos las *Escuelas para niños débiles.* Su nombre solo, define uno de sus caracteres mas salientes, el de ser destinadas á la infancia debilitada, fisiológicamente deficiente, y, por lo mismo, predispuesta. . Mediante riguroso examen médica, se extraen de la masa escolar los sujetos que han de ser los pupilos del establecimiento escogiéndolos de entre los niños que más necesidad tienen de recibir esa suerte de beneficios. Es pues un severo y lógico criterio selectivo, selección á la inversa, naturalmente el que guía el procedimiento.

Otros caracteres acentuados de estas Escuelas (ellas son al presente dos, en pleno funcionamiento; dos por instalarse y varias más, proyectadas, en el molde ya creado) son los que brevemente se marcan en seguida: emplazamiento en parques centrales y subrubanos; instalación, moblaje y utilaje, adecuados; observación médico-fisiológica y antropometrico constante, por especialistas; personal enseñante escogido á prueba de competencia; exposición al aire libre y á la luz, alimentación ejercicios y juegos; reposo y sueño, empleo del tiempo; programa y horario de trabajo; todo esto, prescripto y fijado mediante observación y prolijo discernimiento; en síntesis, para no deternernos en detalles: *Son componentes de la institución aquellos elementos cuya bondad, cuya excelencia aun ha sido ya verificada,* sea en el estranjero, sea en el propio terreno de la experiencia: y su combinación, búscase obtener la maxima eficiencia.

Si bien ninguno de esos componentes elementales, como se podía colegirse de lo dicho, tenga en rigor derechos de originalidad, es lo cierto que el conjunto resultante de su recomposición, en lo material y en lo funcional, tal como en el momento actual hállase efectuada, imprime á las escuelas al aire libre para niños débiles de la ciudad de Buenos Aires, una fisonomia genuinamente propia. Y por lo que hace á la eficacia de los medios empleados, á la regularidad y valía de los resultados obtenidos, las comprobaciones son eternamente demostrativas. Ellas se muestran á lo vivo, por así decir, en el niño mismo: a aspecto exterior, disposición al trabajo, presteza en los movimientos; alegría, vivacidad de espíritu, etc. Pero se las inquiere y recoge también regularmente, con precisión técnica, en el curso del periodo escolar. Regístranse así periodicamente datos y cifras correspondientes al examen médico-fisiológico, y antropométrico de todos los escolares.

El aumento en el peso los diametros toxucicos y capacidad respiratoria, en la acción omamométrica y en la riqueza globular de la sangre, interpretado en el conjunto de la población escolar hase manifestado muy satisfactoriamente (fuera de algun interés, sin duda, analizar con la luz de una de estas manifestaciones parciales en su generalidad, frecuencia, grado, sentido progresivo, oscilaciones, etc., compararlas entre sí e interpretarlas tomando en cuenta los distintos factores individuales; pero deseamos no particularizar nuestro estudio en punto alguno).

Sobre todo si se consideran, como debe hacerse los cambios notados, en relación á los antecedentes individuales de cada niño, á sus lesiones ó enfermedades anteriores, á sus modalidades fisiológicas o tendencias hereditarias. Pues, como facilmente se alcanza, en buen número de niños escogidos en la forma que lo están estos, la simple detención de un proceso denutritivo, y más un mejoramiento siquiera ligero, denotan una transformación definidamente favorable. Transformación que en muchos casos habría sido notable. Por cierto que los efectos ventajosos alcanzarían grado mayor si se obtuviera la permanencia continua de los niños. Pero no; la influencia favorable se interrumpe durante horas; el regimen saludable de la escuela altera con el con tanta frecuencia malsano en lo físico y en lo moral también del propio hogar. Ello no obstante por más que deba primar aquí la razón de salud y de vida, el hecho es que practicamente, la transformación en internados de las escuelas de aire libre, es problema casi insoludable. Más adelante vozaremos de nuevo el punto. (Los razgos y carácteres de las "Escuelas para niños débiles" de la ciudad de Buenos Aires, son expuestos con detallada precisión en la memoria que con destino á la presente sesión del Congreso ha redactado el Dr. Cassinelli, médico que está desde años al servicio de aquellas.)

Hecha así brevemente la presentación de la más importante y avanzada, entre las obras del aire libre creadas en la Republica Argentina, examinaremos algunos aspectos de la cuestión que no hemos considerado todavía, ó solo muy ligeramente.

La proporción en que los grupos escolares son beneficiados por las instituciones de aire libre, es uno de esos aspectos. Todos habrán de reconocerlo, sea cual fuese el punto de observación, una ó más ciudades alemanas, francesas, italianas, etc., la cifra de niños favorecidos por las nuevas escuelas es bien pequeña. Lo es en absoluto; lo es en relación á la cantidad de sujetos que han menester premiosamente de medios reparadores; y lo es sobre todo en atención á la población infantil en conjunto. La cual, si no en su totalidad, en su fracción mayor, hállase expuesta en las grandes urbes a la influencia debilitante, destructora, del aire impuro y de elevada termalidad. ¿Será, pus, necesario fundar mas escuelas del género? Ciertamente. Pero ello no bastaría, por mucho que se recurriese, como está indicado proceder, á instalaciones de reducido costo, y aun cuando se llegará al limite razonablemente permitido. ¿Que hacer entonces? Recurrir á las instalaciones parciales y complementarias de que antes hablamos, instalaciones parciales al servicio de una agrupación infantil limitada, de una ó mas escuelas, v. gr: espacios libres y jardines, altillos y azoteas ("roofs"). Clases al aire libre, de modo general (fresh air rooms). Instalaciones complementarias, al servicio más bien de una colectividad de cierta consideración, como la población escolar de una ciudad: estaciones, plazas, jardines, etc. Pero aun con eso realizado en la posible escala, no se habría satisfecho sino parcialmente las indicaciones. Una amplia prescripción se impone, modificar las clases de las escuelas publicas y privadas, y modificar estas escuelas mismas, en lo que toca á higiene material y funcional. Las modificaciones, es claro, serán dictadas con arreglo á los mismos principios fisiológicos que hicieran nacer. Mucho puede con la constancia lograrse en tal sentido la personal experiencia nos lo ha probado. En la ampliación de ventanas y aperatura de nuevas bocas de aire; en las realizaciones que operen cambios favorables en la termalidad y ventilación de los locales; en la obtención de combinaciones favorables, en punto á numero, situación, tiempo y modo de trabajo de los niños; en la ejecución de reformas varias, que no podriamos especificar aqui, hay todo un programa de labor tecnica, ingrata y dificil no pocas veces, pero positivamente util. Labor tecnica en la cual tienen su parte el arquitecto, el medico, el institutor, y el á los funcionarios que gobiernan la enseñanza. Y, naturalmente, la dirección, la orientacion de ese programa no deberia ser otra que la instrucción sana, reparadora, fisiologica; la misma por consigniente que las obras y escuelas de aire libre. Se observará por alguien, tal vez, la poca significación que tienen casi todas las reformas que acabamos de hacer referencia; y ello es verdad. Pero lo es si se las considera particularmente, una á una, y en los casos singulares; deja de serlo, si ellas, por la constancia y generalidad con que se ejecuten, se adicionan en un vasto conjunto. Entonces los efectos pueden alcanzar notable cuantía. Claro es que para obtener efectos asi adicionados se precisa contar con una fuerte organizacion de la higiene escolar. Organizacion á la vez técnica y ejecutiva. Queremos decir que sepa desprender con precisión y amplitud las prescripciones del caso, pero que también pueda cumplirlas y hacerlas cumplir. No hay duda que ello va obteniéndose con lentitud, pero progresivamente, á medida que los modernos conceptos de sanidad infantil, salvando la esfera limitada de los profesionales y especialistas, penetran en el espíritu de los gobernantes, de los hombres con influencia en el manejo de la cosa pública. Precisamente para lograr esa difusión y penetretación de nociones y conceptos utiles á la comunidad, nada tan eficaz como la efectuación misma de las transformaciones vinculadas con las ideas que se trata esparcir, nada como la ejemplificacion. Y esa sin duda que radica el principal beneficio de las obras al aire libre. Con las ventajas que aportan a la salud de un grupo de niños, cuentanse las que traen á la colectividad, imponiendo á los ojos de todos su incontestable eficacia. Por ello es que no subscribiriamos sin alguna reserva la proposicion del Dr. Stokler de Paris, para condena, el costo excesivo tratandose de las nuevas escuelas. Porque si bien convenimos en que del combatirse lo inmoderado y lujoso, pensamos tambien que a una colectividad, una ciudad, convienele, aun á costa de erogaciones, ofrecer realizaciones que contengan excelencias de todo orden, las cuales constituiran la mejor de las propagandas.

Hemos hablado en lo anterior de instalaciones materiales y de cambios funcionales y de regimen. Una explicación es conveniente. El aire puro y fresco, por más que sea el primer elemento constitutivo de una "Escuela al aire libre," no es el único. Con el se combinan el alimento reconstituyente y sano; el reposo, el sueño prolongado; los ejercicios y juegos espontaneos á sus horas; la labor intelectual reducida, fácil, distribuida, etc. En una palabra, sabiamente recompuestos, los elementos de un buenregimen; derivados de claras normas fisiológicas. Regimen de prevención profiláctica; de reparación ó curación; de labor escolar y de vida: conteniendo en su unidad resultante, mas ó menos, según los casos de cada una des estas direcciones ó necesidades. La ya abundante literatura científica registra en el particular regimenes excelentemente condicionados para los diversos tipos des establecimentos.

De la propia manera, al considerar como al presente lo hacemos no una determinada fundación al aire libre, sino el propio AIRE LIBRE, en distintas ó en todas las fundaciones (escolares principalmente, se entiende), entendemos comprender bajo el título de este trabajo todos aquellos componentes del regimen.

Hasta aquí el asunto que nos ocupa se ha venido tratando de modo particular y concreto; limitándose los autores al examen definido de tal ó cual escuela ó instalación, ó aun al conjunto de escuelas de una ciudad, parte de nación, o nación. Por cierto que no desconocemos el loable fin de esos trabajos de presentación y descripción. Por el contrario los reputamos de suma utilidad. Tanto es así, que uno de nosotros tiene publicados algunos y en preparacion otros de tal orden (Estos ultimos, con la valiosa colaboracion del Dr. L. Mathe, de Paris).

Pero juzgamos que en el actual momento científico y pedagógico, se impone de veras la tarea de abordar además el vital problema desde otros puntos de vista, mas amplios y generales. Agrupar los hechos, fundamentar y detallar las indicaciones y necesidades; formular netamente las prescripciones, las realizaciones aconsejadas; pero, sobre todo, coordinar las ideas de suerte á ir elaborando lo que no ha de tardar en constituierse firmemente: un *cuerpo de doctrina;* tales seran los objetivos. Ya que no pudiesemos pensar en satisfacerlos, medianamente siquiera quisimos por lo menos indicarlos, esbozando aunque pobremente los rumbos de la investigación técnica y de la aplicación practica.

Por lo que hace á la base científica que substenta ó habra de substentar al referido cuerpo de doctrina; pensamos, sin que nos sea dado detenernos en mayores desarrollos, que está en vias de adquerir la firmeza que hoy le falta. Los progresos de la fisiología experimental y de la fisiquímica biológica, penetrando en la intimidad de los cambios organicos, nos pondrán en términos científicos lo que hoy en parte no pequeña poseemos tan solo empericamente. Y, dominando que sea el mecanismo en la acción del calor de la luz y de la radiación solar, del aire, de los agentes físicos que rodean al hombre, no es posible dudar que un fuerte, incontenible movimiento se ha de producir; hacer la vida natural simple, higienica. La escuela, pensamos, la pedagogía, si es previsora, si quiere llamarse "fisiológica," si quiere merecer la calificación de "Nueva," debe seguir ese movimiento; aun propusarlo.

En trabajos sucesivos, uno de nosotros (Dr. Vidal) proseguirá esta faz fisiológica de la gran cuestión á la par de la faz técnica que más de inmediato interesa a esta asemblea. Aspecto este último, en el que serán comprendidas, aparte las direcciones y formas de acción más arriba señaladas, las prescripciones diferenciadas en atención á las condiciones de salud de la población. De las poblaciones escolares de cierta importancia, entendemos decir, cifrando decenas ó centenas de mil; como v. gr: las de grandes nucleos urbanos. Es en parte de estas vastas colectividades, efectivamente, estudiadas con criterio técnico en cuanto hace relación á la defensa de los débiles, al tratamiento de los enfermos y á la graduada y sana instrucción de todos, que nos debemos plantear el problema práctico de las prescripciones de aire libre.

Mas para arribar con acertado y práctico criterio á prescripciones útiles, precísase antes clasificar en grandes secciones categorías de niños ó masas escolares. Estas serían, anticipandonos á lo que ha de fundarse más tarde seriamente, las primeras grandes divisiones á trazar:

(*a*) *Niños sanos en medio normal.* Niños en buena situación de salud, instruyéndose en un medio que pueda ser calificado "normal" ó en todo caso que no sea parte mayormente de la normal; y cuyo labor se ejercite en condiciones fisiológicas-sanitarias aceptables.

(*b*) *Niños sanos en medio predisponente ó nocivo.* La salud de los escolares de este grupo es buena también, pero las condiciones de labor ó el medio físico, ó ambos son malsanos, sino determina damente, predisponentemente.

(*c*) *Niños debiles, predispuestos, hallándose en la zona límite.* Entre los sujetos definidamente sanos y los enfermo, reconócese la situación de gran número que encuéntranse en una como "zona intermediaria;" niños orgánica, herediteriamente "predispuestos," con lesiones ganglionares, otros, fisiológicamente débiles."

(*d*) *Niños positivamente enfermos,* que requieren para su instrucción y vida un mediofísico y condiciones especiales, pero pudiendo convivir y formar clase con otros escolares.

(*e*) *Niños enfermos que requieren regimenes particulares y aun establecimientos especiales.* Los procedimientos de instrucción y los procedimientos de curación deben actuar conjuntamente; por consiguiente, horario de labor, empleo del tiempo, curriculum todo debe ser singularmente compuesto y aplicado.

Por supuesto con esta división debe vincularse otra de orden que diremos nosológico-fisiológica de los escolares, en cuyo, detalle no podríamos entrar ahora. Del propio modo, nos limitaremos á advertir que dentro de esas grandes divisiones, caben subdivisones ordenadas (El criterio práctico, apenas si es necesario indicarlo, es el que ha de primar; pues, en materias de este orden, no cabe extremar el rigor científico.)

Ya que no podemos detallar en esta ocasión procedimientos en medios, se nos ha de permitir que, rapidamente, refiramos los desarrollos explicativos que acabamos de hacer á la situación real, concreta que los sugiera. Es a la población escolar de la ciudad de Buenos Aires que aludimos, á su estado ó situación con respecto al problema en estudio. (Avancemos desde ya, como información útil, que por lo que hace á dicha situación, comparativa á la de otras grandes ciudades, ocupa la capital Argentina, una posición relativamente ventajosa.)

Buenos Aires tiene hoy aproximadamente 1,400,000 habitantes. Su población escolarizada (totalizando, desde nustros puntos de vista: escuelas privadas y públicas; maternales é infantiles; primarias, elementales; de labor u oficio; secundarias y normales; especiales; varias es de 200,000 unidades-Ahora bien, de esa suma, puede estimarse como resultado de examenes y observaciones realizadas en años, consecutiva y sistematicamente, por los médicos de ambos cuerpos técnicos (enseñanza primaria y secundaria y especial) que de 3,500 á 3,800 niños 1.8% pertenecen a las últimas categorias de nuestra división de más arriba. Son niños positivamente enfermos, necesitando de un cambio de medio y de regimen. En una cantidad más de vez y media mayor que esa: de 5,500 a 6,000 (2.8%) apreciamos la de escolares de toda condición que se encuentran en la zona límite entre salud y la enfermedad, escolares débiles y predispuestos que han menester también de un cambio en sus condiciones de trabajo y de vida. Finalmente, apreciamos en una cantidad mucho mayor: alrededor de 15,000 niños (7.5%), los que, aunque sanos, necesitan en grado y modo varios, les sean cambiadas las condiciones defectuosas en que cumplen la labor escolar (aquí no son predispuestos los niños, pero el medio los esta predisponiendo, cuando no enfermandos. Si, pues, adicionamos los tres guarismos, tenemos que, en cifra entera veinticinco niños necesitan más ó menos premiosamente que les sean impuestas transformaciones ventajosas en orden á higiene material y funcional. De otro modo en armonía con las ideas que substentamos: 25,000 niños que reclaman para sí los beneficios de la instrucción nueva y sana, del regimen de aire libre.

Ahora bien que cantidad de esos niños es la que hoy realmente obtiene esos beneficios? La vigésima parte apenas, pues no sobrepasan de 1,200 los escolares que obtienen provecho de las distintas obras de aire libre instaladas untimamente en la ciudad de Buenos Aires. Que indicación subsiste, entonces? La de estudiar y trazar en concreto y con la amplitud requerida el cuadro de prescripciones que realizan las deseadas transformaciones. Se está en la obra y confiamos decididamente en su inteligente realización.

Anticipariámos con agrado que algunos puntos de ese cuadro prescriptivo; más preferimos resumir de modo general, teniendo siempre en vista las necesidades de una colectividad escolar de cierta importancia, las indicaciones relativas al sistema de creaciones nacidas en Charlottenburgo.

Pero antes ha de permitirsenos decir una palabra aunque tal vez no fuera precisa despues de las consideraciones en que hemos abundado para justificar el título que hemos dado á la presente contribución. Título que, aparte de aparecer a primera vista un tanto pretensioso difiere de los comunmente empleados para tratar la materia en estudio. Es que, propiamente, como se ha visto, nuestra mente no ha sido tanto presentar uno ó muchos establecimientos, una ó muchas obras, ó aun un conjunto de obras: sino, más bien contribuir á que se inicie la coordinacion en sistema de esas obras. Ciertamente, debían interesarnos las instalaciones á cielo descubierto; pero lo que más nos atraía y queríamos examinar era la propia instrucción al aire libre. Por eso hemos tomado á este "Aire libre," substanciandolo en cierto modo, asignandole calidades y formas diversas de realizaciones y hécholo el objeto de nuestro modesto esfuerzo. Si hay una ciencia del aire libre segun el tan justo concepto de la pedagogía nueva, si quiere ser renovadora y grande realmente, debe asimilarse sus indicaciones y preceptos.

Conclusión: Indicaciones Generales.

1. Crear con destino á la educación comun de niños, predispuestos, débiles y aún definidamente enfermos de cierta categoría, anémicos, escrofulosos, pretuberculosos y aún determinados tuberculosos, etc., un número suficiente de escuelas bien situadas, salubres al maximum y provistas de los elementos materiales y de otro orden que requiera su funcionamiento en el modo y caracter que hoy en día, bajo el doble aspecto, fisiológico y pedagógico, se asigna á la "Escuela al aire libre."

Con los actos de creación, los de perfeccionamiento, de suerte á exaltar y á combinar en lo posible, los buenos rasgos de las escuelas de Charlottenburgo, Muelhausen, Padua, Lyon, Boston, Chicago, Buenos Aires.

2. Fundar en plena campaña, á título de establecimientos dependientes del conjunto escolar urbano, y bajo regimen del internado modelo,

una ó mas escuelas, de grado y tipo destinto, para alumnos predispuestos y enfermos á quienes esté particularmente indicada la vida fuera de la ciudad.

Algunos de estos internados, conviene sean el nucleo de colonias de funcionamiento estacional ó periodico, y al servicio de los mismos propositios.

3. Afectar, originariamente ó por transformación de estos establecimientos ex-urbanos, uno de los mismos ó más de uno (de situación ventajosa en montana, valle salubre, etc.), á la instrucción de niños tuberculosos y padeciendo otras enfermedades, que les obligue á excluirse del regimen común.

4. Habilitar sobre todo alrededor de ciudades importantes en parajes bien escogidos, en jardines y parques; en la proximidad de bosques, en riberas y playas, estaciones, recreos, plazas, espacios destinados al reposo, recreo y juegos, y que bajo modos y nombres distintos, constituyan fundaciones complementarias del sistema escolar.

5. Incluir en el plano de toda escuela que se constituya, un local ó mas de uno, destinado á las clases al "aire libre."

6. Habilitar para dichas clases en las escuelas ya construidas, los sitios que mejor puedan llenar el fin espacios libres, altillos, y azoteas, glorietas improvisadas, etc.

7. Realizar, con las anteriores creaciones é instalaciones, en el conjunto de las escuelas comunes, en todas, transformaciones que se fundamenten en los mismos principios. De modo general; cada escuela debe sufrir en grado mayor ó menor reformas que la orienten hacia el "pleno aire."

8. Dedicar atención singular á la formación personal capaz de llenar debidamente las funciones que el funcionamiento de estas escuelas é instituciones requiere.

9. Contener las indicaciones y acciones anteriores dentro de un Plan Técnico, que armonice las faces del problema: fisiológica y médica; arquitectural; pedagógica; administrativa y social.

(Este plan adoptado á una ciudad, no puede ser igual á los "Esquemas defensivos: v. gr: los de Londres, Paris, Edinburgo, Roma y otros ultimamente hechos conocer, en la mira principal de la Tuberculosos.)

10. Propiciar, en fin, el estudio de la justamente nombrada "Ciencia del aire libre," cuya amplitud venidera se advierte claramente y cuyo justo concepto conviene difundir: es de ella que provendrán buena parte de las reformas las más definidamente utiles acaso inscriptas en el programa de la Pedagogía fisiológica.

THE "OPEN-AIR SCHOOL" IN SCIENTIFIC PEDAGOGY

Initiatives of the Argentine School System

BY THE ARGENTINE DELEGATES

ANTONIO VIDAL AND CHARLES ROBERTSON

The "Open-Air Schools" (Ecoles en Plein air, Scuole all'Aperto, Waldschuelen) have during the last few years drawn the special attention of hygienists and educators throughout the world. Those already established have shown to be of great advantage. Due to the high and competent opinion, and the enthusiasm of the authorities on physiologic pedagogic and school hygiene, the "Open-Air Schools" have greatly increased. The scientific basis and the progress of these has gained consistency.

The works presented at the last "International Congress on School Hygiene" are works of reference, containing descriptive data: Brannan & Balliet (New York); L. Williams (Bradford); R. P. Williams (Sheffield); Randi (Padua); Vignes (Lyon); Sisto (Buenos Aires); Lacable-Plasteg (Paris); Neufert (Charlottenburg); Querton (Brussels); Wolff (Muelhausen); Tluchor (Vienna); Bexheft (Buda-pesth); Kirkly (Bradford), and others. The interest was not only shown at this last mentioned Congress, but is noticeable at the various educational meetings throughout the world. One of us, Dr. Antonio Vidal, has personally followed the movement, and has attended several American conferences dealing with this most important subject, having presented papers under different titles, but all referring to the same subject. He attended for instance, the Medical and Scientific Congress in Montevideo in 1907, Santiago, Chile, in 1908, Rio de Janiero in 1909, Buenos Aires in 1910, and also presented a paper referring thereto to the International Congress against Tuberculosis, Rome 1912. The bibliographic and criticisms of this last Congress are contained in a work entitled "The Prophylactic Organization of Schools," published by the International Archives of School Hygiene. In this work up-to-date technical and social informations are given in detail, with special reference to tuberculosis as related to the school system.

If an accurate account could be given of the "Open-Air Schools" operated to-day in Germany, the United States, France, England, Austria, Italy, Switzerland, the Argentine Republic and elsewhere, facts and figures of the greatest interest could be given. But these facts and figures would represent only a minimum part of the progress made since the experiment of Charlottenburg was established in 1904.

We shall refer here to some auxiliary works and installations which are not strictly "Open-Air Schools" but having similar features and functions.

The character of these auxiliary installations, such as "Recreation Grounds, Gardens, Stations, Play Grounds, and Squares" is similar to the "Open-Air Schools," and are considered most practical. Riversides, decks, and so forth, are all included in the "open-air system," rendering valuable services wherever a dense population is found, and where it is difficult to establish the "Open-Air Schools." In order to characterize more fully the reformatory movement, it is necessary to mention the real and material reforms taking place, such as improved ventilation, increase in the size of the buildings, and their rooms, etc. Based upon the experiment of Charlottenburg. The demonstrative effects have been eminent and powerful, and above all convincing in favor of sanitary education. The actual up-to-date movement has three leading features to be considered:

1. To define and classify the various types of schools and institutions which are similar and forming units. Designate to each particular type its material conditions and functions.

2. Prescribe the technical work collectively and within a pedagogic system.

3. To study in detail the scientific movement produced in favor of the pedagogic problem. We shall attempt to outline the various details of the aforesaid movement, referring more specially to the "Open-Air Institutions" of the city of Buenos Aires (The School for Feeble Children).

The open-air institutions are varied as to their magnitude and rank, medical and pedagogic character, according to their environment and management, some of them, if not all, have subdivided and special characteristics. They are established in the center of the cities, in the suburbs, or in the country, in the forests, on the beach, or in the mountains. Working according to the various latitudes, in the summer, or in the winter, some throughout the year. They are designed for the infant of delicate health, or children predisposed to sickness, and also for healthy children. The children are subject to some hours in the open air, or during the whole day. The registration of the pupils is annual or periodical, for some weeks, in order to renew the various groups benefited by the institution.

In 1912 Dr. Antonio Vidal had the special and official mission to visit the leading European "Open-Air Schools." He investigated the institution of Charlottenburg, the Recreation Institution of Padua, the schools in Rome, the magnificent institutes of Muelhausen and Lyon. His observations have been to some extent applied to the various institutions of the Argentine Republic, and have so far given the best of results.

The "Open-Air Work" in the city of Buenos Aires has become very important and have received the support of the medical body of the city, of the authorities of the Department of Education in general, of the President of the Council, Dr. J. M. Ramos Mejia. Others have also given their valuable support and coöperation. The schools for the feeble children, already referred to, are the most prominent of the open-air institutions.

The children are selected, undergoing a severe medical examination. Two of these schools are about to be established, and others are under consideration, to be erected in central parts or suburbs, with adequate furniture and fixtures, constant medical attention (specialists), and a competent staff of teachers.

These pupils will be exposed to the air and light, receive special nourishment, exercises and diversions, rest and sleep. In one word these institutions are based upon foreign models, and if possible improvements are introduced by local experience, in order to obtain maximum efficiency. Notwithstanding the fact that there is nothing original attached to the "Open-Air Schools for Feeble Children" of the city of Buenos Aires, yet they have their own characteristics. Their results are positive and demonstrative. This is noticeable through the appearance of the pupils: their willingness to work, alertness of movement, joyfulness, vivacity of spirit. The increase in their weights and measures, the remarkable improvement of the respiratory organs (breathing capacity), the omanometric actions, the globular richness of the blood, as manifested in general is very satisfactory. The changes are favorable, considering each individual child, its previous sickness, and its physiological and hereditary tendencies.

It is easy to observe the improvement among the special selected children, and if it was possible to keep them for a longer period of time, the improvements, the advantages, and the results would be even greater. But the process of improvement is interrupted by the home, where unhealthy physical conditions are prevailing, and at times the moral influence has an adverse effect. The paper presented by Dr. Cassinelli to this Congress, refers in detail and accuracy to the activities of these schools for feeble children of the city of Buenos Aires. Considering the various "Open-Air Schools" established throughout Germany, France, Italy and elsewhere, the amount of children benefited by them is limited. Limited if considering the quantity requiring such schooling. It is therefore necessary to establish a greater number of these special schools, and should this be impossible in some sections of the world, it would be of value to establish, and make use of the auxiliary institutions already referred to, such as gardens, roof-gardens, open-air classes (fresh-air rooms). In a general way make good use of the open air spaces available in the various cities. It is also necessary to modify and improve the class rooms of the private and public schools through larger windows, and other air channels, and in general modify the present ventilation system if defective, through favorable combinations, designed and organized by professionals: Architects, medical doctors, teachers and other officials of public education. But, in order to materialize all of these favorable features, a perfect organization of school hygiene is indispensable, and whatever progress is made at the present time in this direction is due to the broad-mindedness of public men, taking a keen interest in the childhood of the various nations.

Thus far we have referred to the material part, and the functions of the various "open-air" institutions, but it is of greatest importance to explain, however, that the fresh air obtainable everywhere is not the only factor. The nourishment, the rest, prolonged sleep, physical exercises, diversions, reduction of actual intellectual work are factors of the greatest importance, in one word a regime composed of physiological elements, a regime of prophylactic prevention. In some future work one of us (Dr. A. Vidal) will pursue the physiological features of this question, together with the technical features of interest to this Congress, including the forms of actions, co-ordinating, and classify the various centers of population, also classify the different sections of the school masses, divided as follows:

(*a*) Healthy children in normal centers. Educated in centers classified as "normal," under acceptable physiological and sanitary conditions.

(*b*) Healthy children educated in centers lacking proper sanitary conditions, or at least are so predisposed.

(*c*) Feeble children, predisposed to sickness, living in the limited zone, between healthy and sick children. In other words, living in a intermediate zone.

(*d*) Sick children, requiring special physical conditions, yet able to be with other children.

(*e*) Sick children requiring special regimes, even special establishments.

The above-given division is, of course, subject to some subdivisions. While unable to enter here into details, we beg to submit, however, some of the figures relating to the school population of the city of Buenos

Aires. With a population of about 1,400,000, the school population as distributed, in private, and public schools, infantile or kindergartens, primary, elementary, secondary and normal schools, is about 200,000. It has been observed through medical and technical investigations that 3,500 to 3,800 children, or about 1.8%, belong to the last divisions given above of the total school population. They are positively sick children requiring special regimes. About 5,500 to 6,000, or about 2.8%, are in the limited zone; 15,000 or 7.5% healthy children, yet requiring improved conditions. A total of about 25,000 should receive the benefit of the "Open-Air Regime." Of this total, however, only 1,200 children are benefited by the open-air institutions of the city of Buenos Aires. In order to remedy this deficiency, it will be necessary to study and materialize the various transformations, based upon the experiences of the institution of Charlottenburg and others.

Conclusion and General Indications.

To establish "Open-Air Schools" as forming part of the general educational system, in favor of feeble and predisposed children, and in favor of those suffering anemia and predisposed to tuberculosis, and even those having tuberculosis. These schools to be established in a sufficient number, well situated, and disposing of all the necessary elements, both from a physical and pedagogic point of view. In building these schools, the advantages of those already established in Muelhausen, Padua, Lyon, Boston and Chicago, should be taken into consideration.

To establish in the country, and as forming part of the urban school system, one or more schools for feeble children, or in favor of those predisposed to sickness, requiring out-of-town life.

To establish similar institutions in the mountains, in favor of children predisposed to tuberculosis, those having tuberculosis or similar sicknesses.

To establish in or within the limits of the larger cities: Gardens, playgrounds, if possible in the neighborhood of forests, rivers or beaches. To be considered as auxiliaries of the general school system.

To establish in each ordinary city school to be built, fresh-air school rooms.

To use in the city schools already established, all available open spaces, such as courts and roofs, etc.

Give special and careful attention to the selection of competent staff required by these special institutions.

DISCUSSION OF

Papers on Fresh Air Schools

BY

Dr. John W. Brannan

Dr. John W. Brannan of New York, in reply to a question from some one in the audience as to what the good effect of the cold fresh air could be due to in the case of children who were so thoroughly wrapped up with extra clothing that the air could not touch their bodies, suggested that possibly the observations of Howland and Hoobler made several years ago in the children's service at Bellevue Hospital, might furnish an explanation. These physicians placed children suffering from acute pneumonia upon the open balconies of the hospital, and left them there throughout the twenty-four hours. They found that the cold fresh air had a remarkable effect in raising the blood pressure to a high level and maintaining it there throughout the period that the children were in the open air. Supposing that the blood pressure had fallen to 70 when the patients were in the ward (the normal level at a given age being 80) the pressure rose to normal soon after the children were removed to the balcony and remained there so long as they were left in the outer air. If the children were returned to the ward, the blood pressure dropped to its previous level. If cardiac stimulants, such as strychnine, caffein, whiskey, camphor, etc., were given the pressure would rise, but drop again as soon as the effect of the drug had passed, but if the patients were returned to the balcony the pressure rose and remained high without any drug stimulation. Doctors Howland and Hoobler attributed this rise of blood pressure when the children were on the balcony to the stimulating effect of the cold fresh air upon the vasomotor system, the stimulus being transmitted through the nerve filaments in the mucous membrane of the nose and mouth and in the skin of the face. They noted that the sicker the children and the colder the air the more marked the effect on the blood pressure. Therefore, it is in the winter months that the open air treatment is especially indicated. Naturally the good effect of the open air upon the blood pressure is reflected in the mortality. Whereas the percentage of deaths among the children which has been treated in well ventilated wards was about 25%, it fell to about 12% when the children were placed out of doors and kept there. It is possible, therefore, that the effect of cold fresh air is somewhat similar in the case of the anaemic children whose bodies are so thoroughly wrapped up that the fresh air can only exert its effect through being breathed, and by stimulating the mucous membranes of the mouth and nose, and the skin of the face.

SESSION THREE

Room A. **Wednesday, August 27th, 9:00 A.M.**

THE VENTILATING, HEATING AND CLEANING OF SCHOOL BUILDINGS (Part One)

J. H. McCurdy, M.D., *Chairman*

Joseph Dana Allen, Buffalo, N. Y., *Vice-Chairman*

Program of Session Three

J. H. McCurdy, A.M., M.D., M.P.E., Young Men's Christian Association College, Springfield, Mass. "Ventilation of Gymnasia."

D. D. Kimball, Consulting Engineer, New York City. "Some Phases of Ventilation."

Luther H. Gulick, M.D., New York City. "Ventilation and Recirculation."

Herbert M. Hill, Ph.D., City Chemist, Buffalo, N. Y. "The Ventilation of School Buildings."

C.-E. A. Winslow, M.S., Associate Professor of Biology, College of the City of New York, Curator of Public Health, American Museum of Natural History, New York City. "Studies of Air Conditions in the New York Schools."

George C. Whipple, Professor, Harvard University, Cambridge, Mass., and

Melville C. Whipple, Harvard University, Cambridge, Mass. "Air Washing as a Means of Obtaining Clean Air in Buildings." Joint Paper.

Papers Presented in Absentia in Session Three (Read by Title)

Charles H. Keene, A.B., M. D., Supervisor of Hygiene and Physical Education, Minneapolis, Minn. "The Effect of Conditions of School Room Heating and Ventilating on School Attendance."

Theodore Hough, Ph.D., Professor of Physiology, University of Virginia, Charlottesville, Va. "The Primary Purpose of Ventilation to Facilitate the Maintenance of the Constant Temperature of the Body."

VENTILATION OF GYMNASIA

BY

J. H. McCurdy

I. *Introduction.*

Habitations—houses, factories, schools, gymnasia, offices, theatres, trains, street cars, etc., are largely good or bad dependent upon the air conditions. Dissatisfaction with the air in buildings is prevalent. The advocates of the open air schools and of the outdoor treatment of tuberculosis tell us to live out-of-doors. The architects and engineers tell us they have given us just what the doctors ordered, which is true. Some of the doctors are disgusted with their prescription. They have opened the windows in certain hospital wards with good results. Some architects say cut out all mechanical ventilation systems and they will save 25% to 30% (Gardner 1) on the first cost and on maintenance. The inference of the architects and engineers suggests the solution of all our difficulties if we would throw out all artificial systems and simply open the windows. Most children and adults could not do the work required of them under the temperature conditions of the open air school of the tubercular hospital during the winter season in northern climates. All the textile industries, for example, require warm, humid air. Dust and noise from the street often compel the closing of windows in school buildings even when outside temperature is high enough to allow them to remain open without uncomfortable drafts.

Most of the men here assembled could not do their work in temperatures much below 60° F. The Chicago Commission on Ventilation(2) in their 1911 report recommend 60° to 68° F. as the proper temperature for the schoolroom. They designate as a cold room, one with a temperature of 55° to 60° F. Under these conditions of temperature (60° to 68° F.) it is impossible to keep the normal humidity of outside air during cool weather up to the normal amount without adding moisture artificially. With atmospheric pressure at approximately 30 inches and the temperature at 0° F. a cubic foot would hold 0.481 grains of moisture, at 32° F. it would hold 2.113 grains of moisture.
" 60° F. " " " 5.745 " " "
" 70° F. " " " 7.98 " " "

Vapor or space at 0° F. and 50% relative humidity would contain approximately 0.24 grains of moisture per cubic foot. This vapor on being heated to 70° F. would still contain its absolute humidity of .24 grains of moisture per cubic foot, but its relative humidity would drop from 50% to 3% except as the air passages and skin of pupils become water jugs which were continually emptying water from the bodies of the pupils into the air of the room. Air at 32° F. and 50% relative humidity would contain approximately 1.056 grains of moisture per cubic foot. This air on being heated to 70° F. would then have a relative humidity of 13% unless moisture was added from the pupils, walls or fixtures in the rooms. I have not found any figures showing the effect on room humidity of varying moisture conditions in different types of walls, e. g., concrete, brick, etc.

The text books of physiology assert that all expired air is warmed nearly to body temperature and is nearly saturated with water vapor at about body temperature. If this is true under all outdoor and indoor conditions the amount of moisture needed to saturate each respiratory volume is the same whether the air breathed in be cold air at 10° F. or this same air warmed up to 70° F. without the artificial addition of moisture and then breathed. Before much more is said we need to know *first*, whether expired air is always saturated; *second*, whether it always approaches body temperature; *third*, whether dry air is harmful to bodily tissues or functions.

The school room relative humidity does not ordinarily rise above 25%. More often its range is from 16% to 23%. Tuttle(3).

II. *Description of the Springfield Ventilation Plant.*

I will not attempt more than a general description of the plant, as a careful description has already been given by Professor Affleck(4) in a preliminary report. The College aimed in building its two gymnasiums to make them halls of health in fact as well as in name. The architect and engineer coöperated with the owners in considering the building as a health factory. In building factories the use of the building is the first consideration. This is not always true with public buildings. Architectural beauty is often put before utility or health.

In the general instructions of the committee to the architect and engineer the owners insisted upon thorough ventilation. Basing their idea of the needs of the individual upon Smith's statement concerning the production of CO_2 during active exercise they(5) found that

a man at rest produced........	161.6 C C	of CO_2 per minute
walking two miles an hour....	569.3 C C	" " " "
" three " " "	851.2 C C	" " " "
during tread mill work..... ..	1581.9 C C	" " " "

They asked the architect and engineer to build a ventilating plant which would handle 300 cubic feet per minute per individual. The owners were told that this was ten times the present requirements for school buildings, and that it would be necessary to nail the pupils in their places to prevent their being sucked into the ventilating plant; that the scheme was prohibitive from the expense standpoint. Dartmouth College they said had just put in a ventilating plant which furnished double the amount required by school room law, or 60 cubic feet per minute per individual.

The ventilating plant according to anemometer tests made by R. D. Kimball Co., April 8th and 9th, 1913, introduced 21,430 cubic feet of air per minute into the West Gymnasium, or 306 cubic feet per minute per individual with a class of 70 men as a basis. The air motion was never uncomfortable for gymnasium classes. Double this amount of air, or 600 cubic feet per minute per individual was moved without uncomfortable sensations for a class of 50 by turning all the air from the East Gymnasium into the West Gymnasium. An interesting experiment was tried on a Public Recreation Congress assembled in the West Gymnasium in April, 1912. With all the doors and windows closed 30,000 cubic feet of air were introduced each minute at 63° F. The baldheaded people vainly tried to find the open window. A little later the air temperature was raised to 65° F. This gave apparent comfort even to the baldheaded members of the audience.

The expense item at first could only be answered by saying that good things came high. After the building was practically complete the author suggested to the engineer to connect the plenum and exhaust rooms so that the air could be recirculated in warming the building for early morning use in cold weather. So far as I know this is the first time air has been washed, treated and returned regularly for use during the active exercise period. The significance of this innovation is shown by the studies of Whipple and Kimball. The idea of recirculation of the air during the active use of the building came later as a result of committee discussions, and an examination of the work particularly of Flügge and Paul. Dr. Luther H. Gulick, President of the American School Hygiene Association, in 1911 appointed a committee on ventilation. As chairman of the committee he presented to us a manuscript résumé of the literature by Flügge(6), Paul(7), Heyman(8), Ercklentz(9) and Hill(10).

A careful study of the literature indicated that the essentials in good ventilation were maintenance of proper room temperature, a perceptible air motion and adequate moisture content rather than keeping the CO_2 content of the air down to four to six parts in 10,000. According to Flügge(6) the regulation of the heat, moisture, circulation, odors and amount of organic matter are more essential to health than CO_2 content.

Fortunately the ventilation plant which was arranged to keep down the CO_2 content in the gymnasium by furnishing over 300 cubic feet of air per minute per individual could also control temperature, air motion, moisture content, odors, bacteria and dust. It was found that the recirculation scheme which had already been arranged for economy in early morning heating could also be used during the periods when the gymnasium was in active use.

III. *Striking Features of the Plant.*

1. Its flexibility.
   (*a*) The air entering the rooms may be, aside from leakage,
      1. Entirely outside air heated, washed and humidified or not as desired.
      2. Entirely air drawn from the room heated, washed and humidified or not as desired (recirculated air).
      3. Any percentage combination of outside and recirculated air.
   (*b*) The air leaving the room may be, aside from leakage,
      1. Exhausted from the rooms directly outdoors.
      2. Exhausted from the rooms into the plenum fan room for return back to the gymnasium. This recirculated air may be heated, washed and humidified or not as desired.
      3. Any percentage combination of this air may be delivered outdoors or returned to the rooms through the plenum fan room where it may be heated, washed or humidified or not as desired.
2. The large volume of air supplied per minute per person.
   An estimate based on the classes for 1912-13 in the West Gymnasium gives for the junior class of fifty men 400 cubic feet per minute per individual, freshman class of ninety men 222 cubic feet per minute per individual. Ordinary school requirements you will remember are 30 cubic feet per minute per individual.
3. Appreciable air movement.
   The rate of air movement at the inlets to the room is 350 feet per minute and at the outlets 400 feet per minute as tested by R. D. Kimball Co.(11).
4. The intake of large volumes of air at a low temperature, 60-65° F., rather than a small volume of air at a high temperature, 100-140°F.
5. The low room temperature, 60° F. prevailing during the exercise periods from 1.30 to 6 p. m.

6. The moderately high relative humidity for indoor winter conditions, 46% to 50% (Knapp, p. 54) as compared with averages in nine school rooms ranging from 16% to 23% (Tuttle, p. 35).
7. The removal of dust, bacteria and odors.

Professor Whipple(12) in his conclusions states "That air washing makes use of a process very efficient in nature, and is capable of removing from air a large proportion of dust, bacteria and solid particles, and further that there are absorbed nitrous and ammoniacal vapors and organic compounds of uncertain composition which impart odors and unpleasant qualities to the air." He further says, "That recirculation as practiced at this institution has provided a plentiful supply of air with no apparent sacrifice of wholesome properties. It is a safer source of supply than outside unwashed air and has further effected a decided economy in the consumption of fuel for heating purposes."

8. The possibility of using recirculated air, or canned air as it has been called, without any dangerous increase in the CO_2 air content and without any personal discomfort.
9. The inexpensiveness of recirculation as compared with pumping through the building outdoor cold air continuously.

The total cost of recirculation with the external temperature at 0° F. was estimated by R. D. Kimball Co. as 52 cents per hour as compared with $1.07 per hour for using outdoor air. The computation was based on a room temperature of 65° F. The figures include the cost of steam, electricity for fan motors and the interest and depreciation on the plant.

IV. *Résumé of Work at the College Gymnasium by Samson* ('13) *and Knapp* ('14).

Samson's work was presented in June, 1912, and Knapp's in June, 1913. Each represents thesis work at the College for that current year.

Outdoor dry bulb temperature range:

	Range	M F V
Samson, Jan. 26-Mar. 20	18–56° F	25–42 or 29 out of 38 observations
Knapp, Jan. 16-Apr. 10	16–63° F	30–49 or 77 out of 127 observations

Analysis of Knapp's range of outdoor temperature:

	No.
10–19° F—	4
20–29 —	22
30–39 —	41
40–49 —	36
50–59 —	19
60–63 —	5
	127

Indoor dry bulb temperature:

	Range	M F V
Samson,	54–70° F	59–68 or 25 out of 38 observations
Knapp,	51–72° F	60–69 or 85 out of 127 observations

Analysis of Knapp's indoor temperature:

	No.	
50–59 °F	— 37	
60–69	— 85	
70–72	— 5	
	——	127

Outdoor relative humidity range:

	Range	M F V
Samson,	29–100%	46–78% or 24 out of 38 observations
Knapp,	43–100%	evenly distributed over 127 observations

Analysis of Knapp's outdoor humidities:

	No.	
40–49%	— 8	
50–59	— 22	
60–69	— 32	
70–79	— 21	
80–89	— 30	
90–100	— 14	
	——	127

Indoor relative humidity range without humidification:

	Range	M F V
Samson,	29–56%	29–44% or 7 out of 10 observations
Knapp,	17–49%	even distribution 18 observations.

Analysis of Knapp's indoor humidities without humidification:

	M F V	No. observations
(d) Fresh air direct	17–49%	13
(f) No artificial ventilation doors and windows closed	19–35%	2
(g) Air recirculated and mixed with fresh air	33–39%	3

Indoor relative humidity range with humidification:

	Range	M F V
Samson,	36–90%	44–71% or 19 out of 28 observations
Knapp,	23–64%	30–59% or 75 out of 93 observations

Analysis of Knapp's indoor humidities with humidification:

(a) Air recirculating: 32–63% 40–59% or 40 out of 56 observations

		No.
Humidity	32–39%	9
	40–49%	16
	50–59%	24
	60–63%	7

(c) Fresh air direct: 23–53% 30–39% or 14 out of 29 observations

	No.
23–29%	8
30–39%	14
40–49%	5
50–53%	2

(e) Air recirculated and mixed with outdoor air: 50–64% even distribution, 8 observations.

	No.
50–57%	4
58–64%	4

A still further analysis of Knapp's data shows that 14 out of 18 observations without humidification had a relative humidity below 40%, while 62 out of 93 observations with humidification had a relative humidity of 40% or above. Four out of five observations with the outside air below freezing without room humidification showed a relative humidity below 22%, while 28 out of 33 observations under similar temperature conditions with humidification showed a relative humidity above 40%.

An analysis of men's choices concerning the best temperature and humidity may be summarized (according to Knapp, p. 64) as follows:

Temperature

Min.	Max.	Range	Mean	M F V	Median	A D	S D
53°	67°	14°	60.3°	62°	60.3°	$\pm$ 2.30°	$\pm$ 2.9°

Humidity

Min.	Max.	Range	Mean	M F V	Median	A D	S D
17%	68%	51%	44.2%	46% 50%	46%	$\pm$10.2%	$\pm$12.4%

The men preferred a temperature of about 60° F. and a relative humidity of from 46% to 50%. A comparison of the freshman and junior classes shows no class variation. Both the freshman and junior median temperature choices were 60°, the freshman median relative humidity value was 46.5%, the juniors 47%.

Outside vs. recirculated air choice, both humidified.

	Min.	Max.	Range	Mean	Median	A D	S D
				Temperature			
Recirculation	53	67	14	60.3	60.3	$\pm$2.1°	$\pm$2.9°
Outside air	54.5	63.5	7	58.8	59	$\pm$1.9	$\pm$2.4
				Humidity			
Recirculation	36%	68%	32%	53.1%	53%	$\pm$5.9%	$\pm$7.1%
Outside air	27%	53%	26%	36%	34%	$\pm$5.8%	$\pm$7%

You will note that the outside air relative humidities are lower than the recirculated air. This is due to the fact that the humidifier was set for a lower humidity when the observation was taken. In spite of this difference in humidity the men were unable to differentiate between outside air and recirculated air. The outside air forced into the building without washing or humidifying had a median temperature of 60.5° and a relative humidity of 30%.

Effect of Recirculation on the Temperature and Humidity with the Air Washer Running.

The question has been asked whether the temperature and humidity rise with continued recirculation. Twenty observations were taken between January 16th and February 19th, 1913, in the exhaust duct where the air would be throughly mixed. The first readings were taken after the fans and washer had been running one hour and forty-five minutes. The class session began at the time of starting the fans and continued throughout the tests. The second reading was taken on the average two hours after the first one. The temperature fell in 14 out of 20 observations from 5° to 2° between the first and the second test. It remained the same in three observations and rose in three. The variability in any case was never more than 2° F. Both the relative and absolute humidity increase slightly but not more than 2% of relative humidity, or .1 of a grain per cubic foot of absolute increase.

Recirculation has effected real economy in operation. Body heat from the men has required us to turn off all direct and indirect radiation from the gymnasiums and fan room during the periods of exercise. As a matter of fact we have had to run the air through the air washer water at about 50° to 54° F. to keep the room temperature down.

At the discussion of Affleck's report on the first year's work by Samson at the Montreal Convention of the American Physical Education Association in 1912, Prof. T. A. Starkey of McGill University raised a question regarding the accuracy of the government sling psychrometer for low humidities. Geer in his study last year found the error of the instrument not to exceed 2% for ordinary room temperatures when compared with chemical hygrometry. For temperatures around the freezing point he found the instrument inaccurate, first, because of the long time of whirling needed to reach the low temperature point with the wet bulb, second, because a small error in reading, e. g., .5 of a degree would change the relative humidity 5% or 6%. At room temperature a .5° error would only change the reading about 2%. He compared the results by chemical absorption of a known quantity of air with those of the sling psychrometer in a closed room where temperature could be accurately controlled. He used the dehydrating power of concentrated sulphuric acid as the method of removing the moisture from the air. This moisture was then weighed and the relative humidity computed and compared with the records of the sling psychrometer taken at the same time (see Geer, p. 16).

Effect of Recirculation on CO_2 Content.

Recent studies by Flügge, Paul, Erklentz, Benedict and others seem to have shown conclusively that a considerable increase of CO_2 content has no relation to immediate bodily comfort even if it rises high as 100 to 150 parts in 10,000. Provided the temperature, humidity and air movement be kept at the proper points, the school laws requiring that the CO_2 content be kept down to eight parts in 10,000 have now no reason for existence.

We found the College plant at Springfield during recirculation of air could control within normal limits temperature, humidity, air movement, bacteria, dust and odors. The actual determination of the CO_2 content in the gymnasium while recirculating the same air during the active exercise of large groups of men seemed the next step. It seemed necessary to determine how much the CO_2 would increase in the room with the large output from the men during active exercise, and whether it might not even increase above the high limit of 150 parts in 10,000 set by Flügge and others. The determination of CO_2 during these experiments was made by Peterson and Palmquist apparatus as modified by Dr. Rodgers of the New York State Labor Department. (Horne, p. 3.)

We found by experimentation the following facts: This data is taken from Horne's thesis for the current year 1912-13. The men were doing vigorous exercise, calisthenics, dancing and apparatus exercises, for one and one-half hours. The observations were taken after the men had been working for one hour.

CO_2 Tests Before the Use of the Gymnasium.

TABLE I

CO_2 PER 10,000 OF AIR

Date	Time	Track Av CO_2	Track No. Tests	Floor Av CO_2	Floor No. Tests	Remarks
1913						
Jan. 21	12–1	4.–	3	3.8	3	Tests on floor were made about 3 feet above the floor
Jan. 22	11–12	3.8	2	4.–	3	
Jan. 31	11–12	4.–	3	3.5	3	
Feb. 3	11–12	3.4	2	4.2	2	
Feb. 4	11–12	3.5	2	3.5	2	
Feb. 18	11.30–12	3.5	2	3.5	2	
Average		3.7		3.75		

These tests show that the CO_2 content in the gymnasium air before use is practically that of outdoor air. The fans were not running during these tests.

Direct Ventilation.

The air was drawn from out doors and forced directly through the ventilation system to the rooms. The plenum exhaust fans handled enough air to change the entire amount in the room (180,000 cubic feet) every nine minutes.

TABLE II

CO_2 PER 10,000 OF AIR

Date	Time	Track Av CO_2	Track No. Tests	Floor Av CO_2	Floor No. Tests	No. Men Exer.	Remarks
1913							
Jan. 31	4.15–4.30	6.5	2	7.–	2	30	
Feb. 3	4.20–4.30	7.–	2	6.–	2	35	
Feb. 20	4.55–5.25	8.–	4	8.–	4	40	
Feb. 21	4.25–4.55	7.5	2	7.6	3	34	
Feb. 28	4.50–5.10	7.8	2	8.–	2	30	
Mar. 3	5.15–5.40	6.9	2	6.8	2	25	
Mar. 5	4.40–5.00	6.5	2	6.5	2	35	Exams*
Mar. 4	2.45–4.45	7.–	3	6.7	3	35	
Mar. 7	4.00–4.30	5.6	2	5.9	2	35	Tests taken on floor were
Mar. 10	5.30–5.40	8.2	2	8.–	2	35	taken at 5 ft. 5 in.
Apr. 7	4.50–5.20	6.9	2	7.–	2	30	
Apr. 8	5.00–5.15	7.–	2	7.1	.	..	
Average		7.21		7.16			

*This test is not included in average.

The CO_2 content of the gymnasium air during exercise is nearly double that of the gymnasium air before the gymnasium has been used. The increase on the breathing level (5 ft. 5 in.) was from 3.75 to 7.16 parts in 10,000. On the gallery level the increase was from 3.7 to 7.21. An examination of the table shows that only once did the CO_2 rise above 8 parts in 10,000, and then only up to 8.2 parts in 10,000. The tests showed the CO_2 content ordinarily between 7 and 8 parts in 10,000.

Recirculation Tests.

In these tests the air was returned from the gymnasium to the air washer where it was washed and partly refrigerated by passing through vat water at 50-54° F. This cooling was necessary to keep the relative humidity from increasing.

TABLE III

CO_2 PER 10,000 OF AIR

Date	Time	Gallery Level Av CO_2	Gallery Level No. Tests	Breathing Level Av CO_2	Breathing Level No. Tests	No. Men Exer.	Remarks
1913							
Jan. 20	4.30–6.00	10.–	2	8.–	2	39	
Jan. 21	4.00–4.45	8.–	3	8.3	3	33	
Jan. 22	4.30–5.15	7.5	2	7.9	4	35	
Jan. 25	3.20–5.00	13.–	2	9.6	5	36	
Jan. 29	4.55–5.00	8.5	2	7.5	2	34	Fan not running*
Feb. 4	5.00–5.30	14.–	5	13.–	5	38	
Feb. 5	5.00–5.45	9.–	3	9.–	3	26	Tests taken on floor were taken at a height of 5 ft. 5 in.
Feb. 6	2.15–3.55	11.5	2	8.5	2	70	
Feb. 7	4.25–4.50	10.–	2	9.–	2	27	
Feb. 10	4.55–5.35	6.–	2	6.5	2	25	
Feb. 13	4.40–4.55	8.–	2	7.–	2	26	
Feb. 18	3.55–4.05	8.5	2	7.5	2	35	
Feb. 18	2.25–3.10	7.6	3	8.2	2	30	
Feb. 19	4.35–5.05	8.7	2	8.–	2	28	
Average		9.33		8.33			

*This test is not included in average.

As the table shows, there is a fairly constant variation between 7.5 parts and 9 parts in 10,000. The gallery level shows an average of 9.33 parts in 10,000 as compared with 8.33 parts on the breathing level. I have no explanation for the gallery level being regularly higher. These figures are not about the safety range on the old basis. Richards & Woodman state in their text "Air, Water and Food," p. 26, that the CO_2 in school rooms should not rise above 8 or 9 parts in 10,000 and in lecture halls not above 9 to 11 parts.

Window Ventilation.

(Fans not Running.)

All the windows, 56 in number, with 415 square feet of window surface, were open wide.

TABLE IV

CO_2 PER 10,000 OF AIR

Date	Time	Track Av CO_2	Track No. Tests	Floor Av CO_2	Floor No. Tests	No. Men Exer.	Remarks
1913							
Apr. 10	2.55–3.15	5.9	2	5.–	2	64	Strong breeze from west
Apr. 14	3.20–3.30	5.7	2	5.4	2	41	No wind
Apr. 22	3.00–3.30	6.–	2	5.6	2	70	
Average		5.8		5.3			

This table shows the lowest CO_2 content of any of the exercise tests. These observations were unsatisfactory because of the warm outside air which allowed all the windows to be opened wide. It is hoped we can follow through tests next year under winter conditions which will show temperature, humidity, CO_2, odors, bacteria and dust conditions.

Diffusion Test.

TABLE V

Feb. 18, 1913 West Gymnasium

Hour	Place	CO_2	Remarks
3.55	Track on east side	8.5	About 50 men on floor exercising since 2 P. M.
4.05	Center of floor 5 ft. from floor		
		7.5	As men were leaving floor just before ventilation plant shut down
4.30	Same	6.5	Plant shut down at 4.5 and everyone was kept off floor
5.00	Same	5.–	Same
5.30	Same	5.–	Same
6.00	Same	4.5	Same
6.30	Same	4.5	Same

This test was undertaken to find how long the CO_2 content would remain up to a high level. You will note that the CO_2 content sank down to 5 parts in 10,000 in less than an hour with all windows and doors closed. At the end of another hour and a half it had only sunk to 4.5 parts in 10,000. Apparently the diffusion is slower at the lower levels.

Conclusion.

1. Research workers should determine more definitely what changes take place in the air breathed in under varying air conditions of temperature and humidity. We need to know definitely whether air is always saturated and raised to body temperature on leaving the air-passages.

2. We need to know whether dry air is harmful to bodily tissues or functions.

3. Considerable air movement in rooms unquestionably adds to the comfort of the occupants.

4. Drafts are not uncomfortable if the moving air is near room temperature. Ten times, 306 cubic feet per minute per individual, the air required by school law, was moved, not only without discomfort but with increased comfort.

5. Expense can be materially reduced by using recirculated air even when the entire cost of ventilating machinery and its upkeep is included. Kimball's figures show the cost for recirculated air to be 52 cents, for direct ventilation of the same thoroughness $1.07 in the plant at Springfield.

6. The most comfortable air for gymnasium use has a dry bulb temperature of 60° F. and a relative humidity of 46 to 50%. Bald headed people suffer some discomfort with large air movement if the dry bulb temperature goes as low as 63° F. They seem comfortable at 65° F.

7. Proper room temperature, perceptible air movement, adequate moisture content, low bacteria and dust content, and the elimination of body odors are the essentials in healthy air.

8. Large CO_2 content in the air does not seem to render it unhealthy, at least so far as immediate discomfort or efficiency are concerned.

9. This series of studies shows that a recirculation plant is possible which will furnish air like the best outdoor air, *i. e.*, after it has been washed by rains, cheaper than by ordinary means of ventilation.

10. With recirculation the CO_2 content never rises above 14 parts in 10,000, and ordinarily not above 9 parts in 10,000.

11. It is possible to control humidity, keeping it up near average outdoor conditions. This means raising the relative humidity roughly from 25 to 50, or as some authors suggest, to 70%.

12. The government sling psychrometers are accurate within 2% for ordinary room temperatures.

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DISCUSSION OF
J. H. McCURDY'S PAPER
BY
DR. A. CASWELL ELLIS

Dr. McCurdy, what was the cubical content of the room, what were the exposures, and what number of students were in the room while the experiments were made?

Dr. McCurdy.—The cubical content of the room was 185,000 cubic feet, it was exposed on three sides, with large windows on each side, and a skylight. From fifty to seventy students at a time used the room.

Dr. Ellis.—A room with 185,000 cubic feet cubical content holds enough air to give 50 students 30 cubic feet each per minute for two hours and three minutes without a particle of leakage. Furthermore, it is found in ordinary engineering practice that, in loosely constructed buildings, the leakage from the outside equals the volume of the room every thirty minutes. This gymnasium is very large, but it is unusually exposed and has many windows. The leakage would, of course, vary with the temperature, but, if it were one-fourth of what engineers have found it wise to allow for, there would be a leakage of more than 30 cubic feet per minute for each of fifty students. The experiment therefore shows nothing whatever as to the effect of recirculated air, as there was enough fresh air either already in the room or leaking in to supply more than the standard requirements of fresh air.

I want to emphasize the warning of Prof. Winslow that the greatest care to be exercised both in making and interpreting ventilation experiments, and in talking to laymen. Real harm is being done. For instance, it was reported around this Congress that Dr. McCurdy had proven that washed and recirculated air could be breathed all day without harm. You see now that such conclusion is not justified.

In my efforts to secure a school hygiene law in Texas, I was met by the statements that a man in a box had breathed the same old air over and over again and suffered no harm as long as it was stirred and the heat and moisture removed from his body, and that some distinguished hygienists had said that there was no evidence that we need fresh air in school rooms, that all we need is to stir up the air and carry off the body heat and moisture. Such statements are wholly unwarranted. It is true that it has been shown that a strong healthy man can remain comfortable in foul air, if it is cooled and stirred much longer than we thought, and that no immediate evidence of injury is noticeable. But, our methods of determining when one is injured by such experiences are wholly inadequate. I can take arsenic or chlorate of potash for a day or so and no evidence of injury is noticeable, but if I keep it up for several months, serious injury results. Children are in school five hours a day, for nine months a year, for twelve or more years. Furthermore, some of these school children are diseased, all are throwing off gaseous body sewage from lungs, alimentary tract and skin to such extent that within half an hour the average unventilated school room has distinct odor of putrifying organic matter. The fact that some investigators fail to find any volatile organic poison in such putrid air, while others do find it, would seem to indicate that our methods of determining the presence of such poison are inadequate rather than that such poisons are not present. All other body excreta are poison and it would be passing strange if these were not.

Until the known facts are very different from what they are now, it would seem to be criminal folly not to furnish school children the present standard requirement of thirty cubic feet of fresh air per pupil per minute.

Undoubtedly the experiments of recent years have valuable results that cannot be questioned, such as the need for holding down temperatures, removing body heat and moisture, for stimulating the skin by slight changes in temperature and for properly humidifying the air. All of these can be accomplished without lessening the supply of fresh air and without any serious changes in our present systems. We need more of careful experimentation and less of rash conclusions.

DISCUSSION OF J. H. McCURDY'S PAPER BY JOHN W. SHEPHERD

Dr. McCurdy's experiments have shown that it is possible to recirculate air in a gymnasium occupied by men at exercise, without the carbon dioxide content rising above a percentage that is usually considered a safe index, provided *the air be washed during the recirculation.*

I should like to point out two other possible conclusions than the one which Dr. McCurdy has reached, neglecting the factor or air leakage. These conclusions are:

1. That the system of air washing which he used is efficient in preventing the carbon dioxide content from rising higher than it did and also efficient in removing the objectionable products of respiration formed during the exercise and expelled into the atmosphere.

2. That a person may use air with a lesser percentage of oxygen than that usually found in out-door air, provided the air containing the lower percentage of oxygen is free from possible contamination through rebreathing, and furthermore, provided one does not continue in this atmosphere for a period longer than an hour or two.

The point upon which I wish to insist is that the experimental work reported in this paper is not necessarily evidence in favor of restricting a supply of air for ventilation purposes; neither can one conclude that people may breathe recirculated air over and over, even for a short period of time, unless it is efficiently washed between successive recirculations.

SOME PHASES OF VENTILATION

BY

D. D. KIMBALL

Possibly the most important phase of the problem of ventilation at the present time is the very general spirit of inquiry and investigation which is so manifest. But while many of its important problems are being attacked, but little effort is being applied to, and but little progress is being made in, the question of what really constitutes the best ventilation, that is, what is the most desirable atmospheric condition for various classes of people in different kinds of buildings. This would seem to be the fundamental problem in ventilation, for with this question answered the problem of how to maintain the most desirable condition becomes a question of engineering only, and hence a problem very easy of solution.

During recent years many experiments have been conducted to determine the effect of different elements of ventilation, such as temperature, humidity, air movement, air volume, ozonization, recirculation, etc., but none of these investigations have seriously attacked the problem of the fundamentals of the optimum atmospheric conditions, that is, the most desirable combination of these various elements for all conditions.

It is quite probable that the collection and correlation of all of the data secured in all of these investigations would go far towards clearing a much befogged subject. Genuine coöperation between the many investigators in the field of ventilation might, and doubtless would, go far towards making possible some sound conclusions, or at least it would give to all a great deal of helpful information and furnish guidance and suggestive material in many cases for the further prosecution of investigations.

For the purposes of collection and correlation of data, and the dissemination of the same, it may be that the recently appointed and organized New York Commission on Ventilation would serve as the most efficient medium. It is probably the only investigating body now at work on this problem which is provided with means (both in a financial sense and in the sense of having a sufficient organization) to properly carry out such a plan and to carry on investigations and research work aiming to prove or disprove the varying theories advanced, and to undertake such further experiments or investigations as may be necessary to fill in the voids between experiments previously or concurrently made by other investigators, or to do such other experimental and research work as may be necessary to complete the solution of a many-sided and perplexing question.

Through the generosity of Mrs. Elizabeth Milbank Anderson, The New York Association for Improving the Condition of the Poor has been provided with a fund of $50,000, or such a portion thereof as may be required, to cover the expense of a thorough study and investigation of this problem. At the suggestion of this Association Governor Sulzer appointed the following gentlemen as members of the commission:

Prof. C.-E. A. Winslow,
Prof. F. S. Lee,
Dr. J. A. Miller,
Prof. E. L. Thorndike,
Prof. E. B. Phelps,
D. D. Kimball.

The problem involves public health, physiological, medical, psychological, laboratory and engineering phases, and therefore an expert in each of these branches is included in the make-up of the Commission.

An office of the Commission and laboratories have been secured at the College of the City of New York. Two adjacent rooms are available, one of which is to be used as a Control Room and the other as an Observation Room, although subjects under observation may be placed in either or both of the rooms, with the same or different atmospheric conditions in the two rooms.

These rooms are inside rooms, lighted from the ceiling, so located as to be entirely unaffected by outside weather conditions. In the Control Room there is now being installed a complete model or experimental ventilating plant, including a motor driven fan supplying fresh air which is to be taken in through the roof. From this fan the air will pass over heating coils and thence through an air washer and humidifier, or through a dryer, and from either of these devices, as desired, or in mixed quantities from both, the air passes over reheaters which may or may not be in operation, and thence into the two rooms. The system is divided into two parts, each part serving one of the rooms, so that the atmospheric conditions in the two rooms may be different or the same, as willed, for the purpose of making comparative tests. Temperatures ranging from that of out-of-doors to 106 degrees in zero weather and humidities ranging from nothing to saturation can be provided in these rooms.

Another fan, with direct connected motor, is provided for maintaining an exhaust from both rooms. This may discharge out through another portion of the building or back into the intake duct for tests on recirculated air.

The air may enter or be exhausted from the Observation Room at any or all of four levels in the height of the room.

Speed control devices are provided in connection with the motors, so that any quantity of air may be supplied or exhausted, from 800 cubic feet per minute (400 for each room) down to practically nothing.

An elaborate system of automatic temperature and humidity controlling devices is provided to maintain any desired temperature and humidity conditions in both rooms.

Provision is made for the installation of disk fans to provide air currents as desired.

Provision is also made for the introduction of ozone or ozonized air at various points of the system or directly into the rooms. Observation and measuring openings are provided.

The system is so arranged that there may be readily combined therewith a cooling plant for experimentation in artificial cooling.

The atmospheric conditions in the Observation Room will be controlled entirely from the Control Room. Direct means of communication are provided between the two rooms.

A complete outfit of instruments is being provided, including several Peterson and Palmquist CO_2 determining machines (Rogers modified pattern, Sling Psychrometers, wet and dry bulb thermometers [direct reading and recording], Pitot tubes, Annemometers, Ergometers, etc.)

Auxiliary to the above apparatus three animal cages are provided, two to be located in the Observation Room, and one in the Control Room, so arranged that differing atmospheric conditions may be maintained in each.

This plant will be used in an effort to determine the effect of any possible chemical or physical condition of the atmosphere upon human or animal subjects. Both physical and psychological effects will be measured, mental and physical tests being applied. Blood pressure, pulse and respiration rates, bodily temperature and other desirable measurements and records will be made.

Supplementary to the work done in this laboratory other experiments will be conducted in a respiration calorimeter to be constructed by the Commission at the College of Physicians and Surgeons.

For the purpose of a practical application of the results of the experiments above contemplated arrangements have been concluded to install an experimental ventilation plant in two rooms of a new school building in New York. These rooms will be so arranged that air may be supplied through the ceiling or floor, immediately at the desks, or through either of two of the walls of both rooms. Likewise, the air may be exhausted through floor or ceiling or through either of the two walls.

Window ventilation may be tested here also. Two similar rooms occupied by a similar class of pupils will be used as controls.

In coöperation with this Commission, Dr. J. H. McCurdy, at the International Y. M. C. A. College, at Springfield, Mass., will continue and extend his experiments of the last two years with recirculated air. Also Prof. Phelps will continue at the Mass. Inst. of Technology his experiments upon moisture elimination and absorption, the effect of different clothing materials, and the study of other physical problems. Other tests and experiments in coöperation with the Commission are being arranged. Open air schools and hospitals will be studied.

This Commission seeks and offers coöperation from and with all who are investigating this important problem. It is believed that much time may thus be saved in reaching satisfactory results, and that the work of every investigator will be greatly facilitated.

During the last two years a most interesting and extended experiment upon the use of recirculated air has been conducted at the International Y. M. C. A. College, under the immediate supervision of Dr. J. H. McCurdy and Prof. G. B. Affleck. During the heating season of 1912-13 a serious effort was made to cover as many phases of the problem as possible. To this end a voluntary association was formed to coöperate with Dr. McCurdy and Prof. Affleck, including Prof. G. C. Whipple, Mr. M. C. Whipple, Prof. C.-E. A. Winslow, Mr. C. E. Pearce and the author. The air when recirculated was passed through an air washer and special attention was given by Mr. Whipple to chemical and microscopical studies of the water and air. Mr. Whipple performed a vast amount of work, both at the college and in his laboratory at Harvard University, the results of which he can give in detail.

Messrs. Horne, Knapp and Geer, seniors at the College, gave valuable assistance throughout the season by making and recording carbon dioxide, temperature and humidity tests, and also "comfort" records of the students. Some very conclusive data as to the most comfortable atmospheric conditions in gymnasia was obtained.

While it may not be stated as a result of these investigations that the recirculated air when washed is as good as outside air when washed, it is apparently better than outside air unwashed, being freer from dust and bacteria and not appreciably less in oxygen or higher in carbon dioxide. Increased efficiency in air washing apparatus will improve the quality of the recirculated and washed air.

The fact that the use of recirculated air for ventilating purposes (assuming that its quality is found to be entirely suitable) makes possible a reduction in coal consumption of approximately two-thirds or, in other words, makes ventilation possible without greater expenditure for fuel than that required for direct heating without ventilation, makes the study of recirculated air a most worthy one. Such a reduction in operating costs would eliminate one of the serious objections to the artificial ventilating system. The cost of installing the ventilating system is practically the same whether the air be recirculated or not.

Another set of most interesting tests of the possibilities of recirculated air is that of Prof. Bass, of the University of Minnesota, made in the Jackson School in Minneapolis, described in a paper read before the Summer meeting of the American Society of Heating and Ventilating Engineers. In this series of tests an effort was made to determine also the minimum amount of air which, when introduced directly at or near the pupil's face, would give results equal to the results obtained from standard methods of school room ventilation. The amount of air used per capita was approximately seven cubic feet per capita. With this amount of washed and recirculated air introduced directly in front of the pupil's face, no appreciable effect was noticeable on the pupil's school room work. If the air used in either method of ventilation were outside air the reduced cost of operation (*i. e.* coal used) due to the less amount of air used would be an important factor but with the use of the recirculated air the difference in operating costs largely disappears. The less amount of air to be handled would reduce slightly the cost of installation but the elaborate duct system required would make the difference slight.

It is doubtful whether the length of the time involved in these tests warrants definite conclusions, or whether a study of what is ideal school room ventilation is not more important at this time than the question of how results equal to the results at present obtained by standard school room ventilation may be secured with a less amount of air.

In Prof. Bass' experiments ozone was regularly used with the recirculated air and it is stated that it seemed essential, the teachers complaining of stuffiness when the fan supplying ozone was out of use for twenty or thirty minutes. In contrast with this experience it is to be noted that ozone was not used at the International Y. M. C. A. College nor did there seem to be any need thereof. This may be due to the vastly greater quantity of air per capita used. The introduction of the air directly at the face, the course of the air then being up and away from the body, raises the question of whether the neglect of air currents about the body for the elimination of heat and moisture, is serious.

Extensive investigations in ventilation have been conducted during the past year by the Chicago Ventilation Commission.

Among other experiments made or contemplated may be mentioned those on ozone in the Schenectady schools, a few tests on school room ventilation in Boston, New York, Toledo and elsewhere, tests on factory ventilation by Dr. C. T. Graham-Rogers and the extended study made by Prof. Winslow and Prof. Baskerville on existing atmospheric conditions in New York City schools, these studies covering both the artificially and naturally ventilated school rooms. In connection with these studies it is to be noted that the best of the artificially ventilated rooms was found to be as good as or better than the best of the window-ventilated rooms. Every school room may, with a proper equipment and a good janitor for the building, be kept at all times as well ventilated as the best ventilated room found, while weather conditions, varying winds, and the impossibility of securing proper attention on the part of the average teacher to the matter of ventilation in addition to other duties make impossible satisfactory ventilation by means of windows, except in rare cases. It should be vastly easier to get one man per building capable of operating a ventilating plant than twenty to fifty teachers.

One of the most important, perhaps the most practical if not the most serious, phase of the problem of ventilation, rarely receiving consideration in gatherings of this nature, is little appreciated by the student or investigator of ventilation, and of it probably little is known by those most concerned or those directly responsible for school building construction. It is a fact that the chief reason for the failure of the artificial ventilating system is, not lack of information as to desirable atmospheric conditions or the inability of the engineer to provide the same, but the attitude of the school boards, building committees and school architects towards the matter of a sufficient expenditure for a complete ventilating plant.

The first responsibility lies with the school boards or their building committees because of their failure to see that the sum allowed for the ventilating plant is sufficient to give the best that science can devise, to see that the architect does not use any of the money which should be spent on the ventilating plant in the enlargement or ornamentation of the building. Criticism of the architect is not intended in the statement that in not one school building in ten is the engineer allowed to work out what he knows to be the best possible ventilating plant for the building. The vast majority of plants are the result of a compromise (some of them very poor ones from the standpont of the engineer) between the request of the engineer for freedom to design the right thing and the insistence of the architect (who is usually in charge of the work) that the amount allowed for ventilation shall be the very minimum so that he may meet the demands of the Committee (often most unreasonable) for more space or equipment than can be properly provided for the appropriation granted.

The engineer is very often obliged to put one radiator in a room where two or three would be much better, is usually obliged to omit air washers and humidifying systems, sometimes is obliged to omit temperature controlling devices, and frequently is obliged to use inferior materials.

And all to enable the architect to give to the board a building as big as he promised, or as big as some other architect offered, or a building as big or pretentious as the citizens expect, or a building as cheaply built per cubic foot as some other supposedly "similar" building in the same, or a neighboring city.

Similarly, through the employment of cheap janitors many good ventilating systems are rendered inefficient. The employment of capable janitors paid proper wages will not only bring about the better operation of the plant but a sufficient reduction in fuel costs to more than pay the increased salary.

Unless the authorities can be made to see the seriousness of these phases of the problem and these difficulties can be eliminated all of the good work in investigations which is being done will go for absolutely naught, for if the schools do not now get the best that may be had what hope is there that they will get better when better becomes known?

VENTILATION AND RECIRCULATION

BY

LUTHER H. GULICK

It is the purpose of this paper to summarize and correlate our present knowledge of what constitutes air at its best for human use and how we may secure these conditions permanently and economically.

I

Air may be considered with reference to its two main functions—

1st. With reference to gaseous exchanges in the body—The *composition of the air.*

2nd. With reference to heat control—The *condition* of the air.

The Composition of the Air.—Oxygen.—It used to be assumed that the exact percentage of oxygen in the air was an important factor in determining the quantity of this element absorbed and used by the body. We now know that within certain rather wide limits the per cent. of oxygen has nothing to do with the case. The "factor of safety" (Meltzer) in the functioning of the oxygen taking and carrying apparatus is such that under any of the conditions found in ordinary life the amount of oxygen taken in and consumed is determined solely by the demands of the body, and not by the percentage in the air, *i. e.*, a horse cannot drink any more out of a lake than he can out of a trough. The experimental data referred to show that the oxygen consumption of the body is not in any way affected by lessening the oxygen in the air till it has been reduced from 21% where it is normally, to about 15%. We also know that such lowering of oxygen is never found except under the controlled conditions of the laboratory. In other words a tight shut school room full of pupils without any artificial ventilation will not suffer from lack of oxygen. They probably will suffer but not from oxygen starvation. The exchange of gases through cracks in doors, windows, as well as through walls, floors and ceilings is so rapid as to maintain a practically uniform atmospheric balance in gases. To be even more explicit the oxygen content in the air in a room or building—even a modern one—cannot be reduced enough through breathing as to lessen the oxygen consumption of those in the room. Hence no attention whatever needs to be paid to oxygen percentage and supply.

2. *Carbon Dioxide.* We used to be told that this gas was a poison and even in minute quantities vitiated the air rendering it harmful for consumption. Later on we were told that while not proven to be harmful in very small percentages that it was our best measure of the extent to which the air had been vitiated by breathing. Indeed people have lived and worked for hours and days in calorimeters with an atmosphere so laden with this gas that a match will not burn in it. In this atmosphere their mental and physical faculties are normal. They have no subjective way of knowing of the presence of the gas.

The oxygen and CO_2 matter is so generally misunderstood that I venture to quote.

The most recent and exhaustive work on this subject is "The Composition of the Atmosphere," by Francis G. Benedict, Director, Nutrition Laboratory, Carnegie Institution. He says in a personal letter summarizing his published findings, "The amount of carbon dioxide and oxygen I found on Washington Street, Boston, in the most crowded part of the city in the middle of the day time was *exactly* the same as that found in the *middle* of the Atlantic Ocean. Also, when I went into the subway shortly after the rush hour, the carbon dioxide in the air was but .06, and the oxygen, 20.90, as against surface air .03 and 20.93. Similarly in the New York subway, at the Grand Central Station and up on 96th Street, or along there we found .06 and 20.90, respectively, showing that there was a very sight vitiation of the air, and there must have been even in these enclosed tubes, tremendous movements of air. * * * "In fact, I believe there is no evidence whatsoever to show that there is any possible increment in carbon dioxide obtaining in school rooms, or any possible decrease in oxygen obtaining in school rooms that, by the widest stretch of imagination, could have any possible effect upon the health of the pupils."

Instead of CO_2 being a poison we now know it to be necessary to life. Carbon dioxide is always found in the blood, respiration ceases when it is removed. The air in the pulmonary alveoli contains 500 parts per 10,000 of it under ordinary conditions. The removal of this gas by modern methods of intratracheal respiration results in the patient ceasing to breath. That is, the body needs to have about 5% of CO_2 in the lungs. In the light of this we see how negligible is the 4 parts per 10,000 found in outside air in altering the 500 parts per 10,000 needed by the body CO_2 in the air seems to have no effect till it reaches a percentage high enough to increase the percentage in the alveoli and thus to alter the CO_2 balance of the organism. It is thus a normal and necessary gas and its presence in the air in used rooms cannot be increased to such an extent as to be of danger.

3. *Organic Matter.* In no field has physiological controversy been more active than with reference to organic matter in the expired air. The more refined methods of physical and chemical analysis possible under modern laboratory conditions have failed to show any toxic organic matter in expired air. Rosenau's work alone appears to raise doubt but it is unsubstantiated and seems by those most competent to speak on this subject to be open to question.

It is true that organic matter is given to the air by decaying matter in the mouth, by pathological conditions in the nares and especially the posterior nares and from the skin. This may be harmful and must be removed but does not constitute the "anthropo toxine" or "crowd poison" usually referred to.

4. *Odors.* Our evidence on this subject is mainly negative. It seems as if unpleasant odors should produce harm in proportion to their unpleasantness. We only know that we rapidly become habituated to such odors and that as yet we have not been able to trace any permanent direct result from them. Through arousing disgust—before habituation sets in—physiological effects may be produced. They should be removed.

5. *Dust and Microorganisms.* Air taken from out-of-doors is often laden with dust. In cities this is most objectionable because of the character of the dust of the streets. Although the recent work by Chapin has allayed our fears from droplet and dust infection nevertheless air should be as far as possible both dust and germ free.

The Condition of the Air.—Temperature Humidity and Air Motion are so related that they should be considered together. The value of recirculation is to be found in the superior control which can be secured through it over these three factors and their relations to each other.

So far I have shown that ventilation has but little to do with helping or hindering the gaseous exchanges of the body *i. e.* with respiration. The world has quite largely assumed the contrary and has thought that because respiration involved air movements in and out of the lungs and ventilation involved air movement in and out of rooms that therefore ventilation was to aid respiration and the factors involved were the same in both cases—namely the composition of air. Hence ventilation investigations have concerned themselves mainly with a study of such composition. Lately, however, owing to the work of Flugge, Hill, Atwater, Benedict and others we see that *the ill effects of badly ventilated rooms are usually to be found related to body heat and the vasomotor system and that hence the primary purpose of ventilation is to aid in the proper control of body heat.*

Temperature, humidity, and motion of air are for this reason matters of primary importance. It is also necessary to consider them together for in this respect they mutually condition each other. Into the complexities of the subject we cannot enter but simply note a few facts.

The hotter the air the less is the body able to rid itself of heat. The colder the air the more heat it abstracts from the body. But—as air becomes heated its capacity for water greatly increases, hence it will the more readily absorb water from any available source. This is the reason why taking air from out of doors, heating it gives us the characteristic hot dry air of the class room. The body evaporates rapidly into this hot dry air—this evaporation has a vigorous cooling effect. This is the reason why a hot dry day is not so exhausting (heat accumulating) as a hot moist day.

A cold damp day seems colder than a cold dry day because the body loses heat to the moisture.

For these reasons a room at 68° with ordinary out door humidity may feel as warm as a dry room at 75°—and far more comfortable for in the latter case the body is rapidly giving off its moisture.

Motion of air still further adds to the complexities of the subject. A person sitting in a closed non-ventilated room will very soon have about himself a slowly changing layer of air which his body has humidified and warmed. On very hot days his breath may not even rise but staying on a level with his head may aggravate the difficulty. Thus there is formed an "aerial blanket" of hot moist air covering him. The real temperature under such conditions is the temperature of the blanket not that of the room. The reason for the cooling effect of a wind or an automobile ride is to be found in the rapid removal of the air from next to the body.

With a low out door temperature we have by means of furnaces increased the heat to about 70° and then sent it to our class rooms. This air while adequately moist at 10° is now exceedingly dry. It abstracts moisture from the skin of the body as well as the mucous membranes of nose, throat, mouth, and air passages of the children thus cooling them off. To keep the children warm under these conditions of excessive dryness the air must be much hotter than it otherwise should be, hot enough in most cases to flush the skin and produce the symptoms of ill ventilation. Errors are commonly made on the side of over heating—this at first seems a lesser evil than does under heating. This overheated excessively dry air is forced through modern school buildings at the rate of 2,000 cubic feet per person per hour and then is forced out, carrying with it the moisture that has been absorbed from the occupants.

The ordinary signs of ill ventilation namely, flushed skin, dull headache, perspiration, somnolence, mind wandering, restlessness are not found where the air is cool, humid, in pleasant motion and free from odors and dust. These are the qualities of so-called "fresh air." It is now my intention to show that such "fresh air" can be better secured by recirculating the air than by other methods.

II.

During the past winter the gymnasium building of the Y. M. C. A. Training College has been ventilated for weeks at a time by using the same air over and over again. It has been renovated only by natural leakages. This building is a large and modern one including two gymnasiums, laboratories, offices, and class rooms. It is used more completely and continuously than any other gymnasium of which the writer has knowledge. This experiment is peculiarly convincing because of the fact that a person doing vigorous exercise vitiates the air from three to eight times as rapidly as a person does at rest. That is, oxygen is consumed and carbon dioxide, sweat and odors are given off from three to eight times as fast as under ordinary conditions of rest.

Extensive and exact determinations have been made as to these various elements as well as to volume of air moved, humidity, and temperature.

The feelings of the students have been regularly ascertained and their health and working capacity, both mental and physical, as carefully measured as was feasible. The various exercise, class rooms and offices have shown splendid air conditions whether the test was the feelings of the students, the impressions of visitors fresh from the outside, or actual examinations of the air itself. This building with its ventilation apparatus and practice was erected and is administered under the direction of Dr. James H. McCurdy, who with Dr. Whipple and Dr. Kimball are presenting reports to this Congress.

The advantages secured by this system are:

1st. As Dr. Whipple has shown the air is kept more free from dust and bacteria than is the air even in their rural situation. This is accomplished by washing the air in the same way that air is washed by rain.

2nd. Soluble odors are removed by the same process. Street odors do not enter the building.

3rd. The great difficulty found in the heat, humidity relation is obviated, for

4th. The expense—including cost deterioration fuel—operation etc., is reduced from $1.07 per hour to 52 cents per hour. This is largely due to the saving of heat units. Under one set of conditions the outside air must constantly be brought up to school room temperature. Under recirculation only the heat losses have to be replaced. When we take this viewpoint—namely that ventilation is primarily related to body heat control we see at once that we are concerned about ventilation in hot weather as we are in cold. In this case however by using cold water to wash the air it may be 10° or so cooler than the outside air thereby greatly increasing its "freshness" and the comfort of the worker.

III

We are now able to account for the prevalent acute dissatisfaction with ventilation. For example, such men as Dr. John W. Brannan and Dr. W. Gilman Thompson are saying that the more perfect the system the worse the results in the great New York hospitals under their charge. We now see that the trouble does not rest primarily either with the ventilating apparatus nor with its operation. The trouble is that we hygienists have set up false standards. We have said, give each pupil 1,800 cubic feet of out door unbreathed air per hour. We now know that the important thing is not either the quantity or the history of the air—the important thing is its condition. We have striven for absolute evenness of temperature although we know well that variation in temperature is a necessary element in vasomotor stimulation. We have been extreme in our endeavors to avoid air that has already been used.

The great change in our standards is due to our discovery that the purpose of ventilation is not at all what we had supposed. The air serves the body in two more or less overlapping groups of ways—one relates to being the means of the gaseous exchanges of the body—the other relates primarily to heat control.

On the other hand the heat control of the body is influenced by the *condition* of the atmosphere in which the body is immersed. This is exceedingly variable and it is to bring about the best *conditions* of air to which ventilation should address itself. To repeat; this fundamental change of standards. Ventilation seeks to control the conditions of the atmosphere in which the body is immersed rather than to control its composition; because its composition is practically stable and needs no attention while its condition is exceedingly changeable as well as important.

The ideal ventilation for a school building consists in recirculating and properly conditioning its contained air. The advantages are that the air may be kept under more health giving conditions through more perfect control of temperature, humidity air movements, dust, odors, and also because of the financial saving.

That is, we have now arrived at such a knowledge of ventilation that it is possible to have indoors and practically all the time these conditions which are found out of doors only when nature is at her best. Man has at last accomplished with reference to the air he breathes and in which he is enveloped what he learned to do years ago with reference to the water he drinks—Have it at its best all the time.

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DISCUSSION OF

LUTHER H. GULICK'S PAPER

BY

CHARLES-EDWARD AMORY WINSLOW

When any new discovery is made, such as the discoveries which have thrown so much light on the subject of ventilation during the last ten years, we are always apt to magnify the novel truth and over emphasize it, so that we tend to lose sight of what is valid in the older body of knowledge. Such discussions as we are holding here to-day have a widespread influence for good and for ill. They will go all over the United States and to other countries and will be studied and quoted by many who are not technically trained and may be misunderstood and may do harm if their bearing is not made altogether clear.

I am sure that Dr. Gulick and I are in close accord as to the applications of recent discoveries to the practical art of ventilation and that he feels as I do that a supply of fresh air by mechanical means is still essential in most school rooms. I fear however that certain phrases in his brilliant address might be understood and may be cited in favor of the view that ventilation is a thing of the past.

What has been made clear during the last ten years is that the chief end to be aimed at in air conditioning is to maintain a cool atmosphere free from excesses of dryness or moisture and more or less actively in motion. As a rule, however, this requires the supply of fresh air just as truly as did the older aim, the removal of supposedly poisonous waste products of respiration. If you calculate the amount of air necessary to remove the heat produced by the body, assuming that the incoming air is to be at 60 degrees and the outgoing air is not to rise above 70 degrees (without allowing for loss of heat through walls), the necessary air supply works out at just about the amount necessary to dilute carbon dioxide, that is, at 2,000-3,000 cubic feet per person per hour. Incidentally such a supply of fresh air, needed under ordinary conditions for temperature regulation, will remove odoriferous organic matter at the same time. We need ventilation, or the supply of fresh air by some means, not less but more than ever. We have simply learned that the quality of the air as well as its quantity is important, that it must be cool and not too moist or too dry, as well as ample in amount.

THE VENTILATION OF SCHOOL BUILDINGS

BY

HERBERT M. HILL

There are still those who believe in the ventilation of school houses by means of open windows, and Buffalo can show an active up-to-date open air school.

An experience covering twelve years as a pupil and ten years as a teacher in a building ventilated by windows has convinced me that notwithstanding the many contrivances to aid window ventilation it is and unsatisfactory means for the attainment of fresh air. I think I may safely venture the assertion that no such means of ventilation can make a building free from the characteristic school house smell.

The use of heated stacks to produce a natural ventilation has been proven to be expensive and dangerous from a sanitary point of view. I have tested one school building in the West in which it was necessary to heat the air in the rooms to over 90° F. in order to produce a reasonable amount of air. I have seen school houses with partition walls nearly three feet thick to accommodate the large flues required in natural ventilation.

I have tested school buildings in Rochester, N. Y., Evanston, Chicago and Peoria, Ill., Cambridge, South Boston and Boston, Mass., and in Buffalo; my experience covering a period of fifteen years. I find that school buildings with a mechanical system of ventilation the only economical and sure ones to furnish certain and continuous air supply. Of the two types of fan ventilation the plenum system rather than the vacuum to my mind best guards against the introduction of cold air from outside and prevents a condition I found in a Boston school where a vacuum fan in a garret was driving foul air from the garret gathering chamber into a toilet room in the school.

My method of testing schools is as follows: On a day when the temperature is below freezing outside I visit the building with a corps of men, one to take and record the pressure of stem at the boilers and the speed of the fan every fifteen minutes; one to take the temperature of the air in the air chamber and to note the condition of the bypass dampers every fifteen minutes; one to take hygrometer readings in all rooms; one to read with an anemometer the amount of air entering each room and to measure the size of the inlets; one to read and measure the outlets and one man to aid in keeping so far as possible the doors and windows of class rooms shut during the time of making the tests.

The men make anemometer readings over the face of each inlet and outlet, five half minute readings being taken along each diagonal of the opening, also obstructions, both gratings and deflectors being removed at the time. When all room have been found to receive their specified amount of air or as nearly as possible to it samples of air are taken from each occupied room with precautions as to distance from pupils and position of inlets and outlets and these samples after about thirty minutes allowed for time for the reagents to absorb the carbon dioxide are tested to find the content of CO_2 in the room from which the sample came. A sample of air is also collected out of doors and this is tested for CO_2 in the same way.

According to the latest specifications in force here the amount of carbon dioxide in a room receiving 3,000 cubic feet of air per seat per hour must not exceed seven parts per 10,000. The tests, however, have to be made from the necessities of the case with the diffusers off the inlets and the results do not fairly represent the carbon dioxide in the room because of lack of proper diffusion. Experience has shown that with inlets the size of those in our schools the diffusion gratings are necessary to prevent uncomfortable draughts and even with them on these draughts are sometimes felt, thus showing that diffusion is not uniform.

Under ordinary conditions I find that the moisture in the air is about 19 per cent. of saturation as shown by the sling psychrometer. The introduction of 60 per cent. or higher gives the rooms a steamy smell causes condensation on the windows, walls and blackboards and makes the clothing feel sticky. 45 to 50 per cent. of saturation causes condensation on the windows in our coldest weather but makes a comfortable and pleasant working atmosphere.

To show the efficiency of plenum ventilation there is appended the record of a grammar school in this city showing as follows:

Room	Inlet	Outlet	
1	2962	2236	cubic feet per seat
2	No seats	....	
3	4628	2801	
4	3371	2360	
5	2559	1716	
6	3273	1835	
7	2856	2206	
8	3641	2740	
9	3363	2185	
10	3841	2664	
11	3391	1998	
12	Inlet covered	....	
13	2979	2760	

Room	Inlet	Outlet
14	2330	1154
15	2819	1912
16	3054	2467
17	3243	2865
18	3788	2772
19	3938	2647
20	3664	2260
21	3349	2673
22	3736	2134
23	3585	2204
24	3512	2030

This building contained 24 class rooms, was well lighted with ample floor space, was direct heated with tempered air and automatic temperature control. The temperature varied from 68 to 72 degrees. A summary shows that sixteen rooms received 3,000 cubic feet of air per seat per hour or better; four rooms received above 2,800 cubic feet; three received above 2,000 and two were not measured.

Of the outlets seventeen rooms passed out over 2,000 cubic feet per seat per hour, 3 more than 1,800 and three less than 1,800. It was thought that the air might be better distributed in this building and a readjustment of dampers was made with tests showing as follows:

Room	Inlet	Outlet
1	3048	2209
2	2668	2289
3	3172	2173
6	2823	1844
7	3059	2034
8	3263	2776
9	2858	2110
10	3085	2206
11	3019	2403
13	3268	2424
14	2667	1938
15	2501	1532
16	3036	1718
17	3258	2960
18	2980	2483
19	2928	2341
20	3418	2253
21	3376	2304
22	3295	2050
23	2842	1882
24	2578	1738

A summary shows there are here twelve rooms above 3,000 and nine above 2,500.

Another grammar school shows results as follows:

Room	Inlets	Carbon Dioxide	Air Space	Seats	Attend
1	3080	6.8	165	35	28
2	3100	6.3	165	54	36
3	3025	8.1	165	54	32
4	3186	7.20	165	54	38
6	2794	7.8	165	54	48
7	3021	5.7	165	54	33
9	3020	7.0	165	54	49
10	3020	6.2	165	54	30
11	3092	6.3	165	54	32
14	3620	6.6	203	45	32
15	3280	6.5	203	45	40
16	3512	7.6	203	45	29
17	3522	6.9	203	45	29
18	3060	6.8	203	45	29
19	3485	7.5	233	40	27
20	3345	7.5	233	40	30
21	3591	5.1	233	40	27
22	3400	8.3	233	40	35
23	3438	9.2	233	40	27
24	3418	7.8	233	40	28

Nineteen rooms show 3,000 cubic feet or better, one room shows below 3,000 but above 2,700.

Room	Inlet	Carbon Dioxide	Air Space	Seats	Attend
1	1566	4.8	165	50	35
2	2074	8.7	165	50	40
3	1567	9.4	165	50	40
4	3236	6.0	165	50	38
5	2924	9.3	165	50	40
6	1255	6.1	165	29	20
7	1497	17.4	165	50	40
8	2129	6.4	165	52	40
9	1848	9.5	165	50	40
10	1737	4.6	165	50	45
11	1866	5.8	165	50	49
12	1544	6.5	165	50	46
13	1733	4.1	165	45	30
14	1980	5.6	165	50	36
15	2176	6.0	165	50	33
16	1395	5.7	165	45	27
17	708	9.0	165	55	52
18	2365	5.8	165	45	38

Specifications for this building were 1,500 cubic feet of air per pupil per hour.

These results were shown in test runs of the school building made to show whether the building specifications had been complied with. Tests made at other times and under conditions of ordinary running show much less efficiency because the fan is run at less speed and the apparatus to supply moisture has in some cases been neglected altogether. Under such conditions I find it customary to open windows and doors into corridors and to generally upset the ventilating system. This matter of operating even a good plant is so much under control of the janitors of the buildings, men with multifarious duties, that it would seem that some means of checking their operation of the plants under their care must be found or the ventilating apparatus is largely useless. I have advocated the use of automatic recorders on each fan and that the reports be checked each week by someone in authority.

My conclusions from what I have observed in this matter of school ventilation are:

First. A mechanical system, preferably a plenum system, is necessary in large school buildings to furnish the required amount of pure air.

Second. 2,500 cubic feet of air per seat per hour is a safe amount to supply in a room with 150 to 200 cubic feet of air space per pupil as it holds the carbon dioxide to safe limits and can be supplied without perceptible draughts and without undue expense for iron and mason work.

Third. All outlet flues should be from one-fifth to one-fourth larger than the inlet flues to care for the reduced temperature and pressure of the outgoing air.

Fourth. The standard for carbon dioxide for the amount of air and the air space specified should be not more than ten parts in 10,000.

Fifth. Each room should be supplied with a hygrometer and the percentage of moisture be kept in each room between forty-five and fifty.

Sixth. If the rooms have direct heat, the control thermostats should be set by a thermometer located near the middle of the room and at about desk height from the floor. The temperature maintained should not be above 68° F. nor below 65° F.

Seventh. The outlet flues from all rooms should be carried through the roof. The flues from the toilet rooms separate from the flues from the class rooms.

STUDIES OF AIR CONDITIONS IN NEW YORK SCHOOLS

BY

C.-E. A. Winslow

There has been wide-spread discussion and vigorous criticism of the conditions of school-room air in America during the past few years but singularly little in the way of actual detailed scientific study. When therefore, my colleague, Prof. Charles Baskerville, and I were invited by the Committee on School Inquiry of the Board of Estimate and Apportionment of the City of New York to undertake a thorough survey of existing conditions in New York school-rooms we gladly welcomed the opportunity to secure a body of data of this kind. The work was planned to give as fair an idea as possible of actual atmospheric conditions in the schools of the city under their normal methods of operation. For this purpose we selected ten typical schools, ranging from modern and well-managed fan ventilated schools, to older buildings in congested tenement districts ventilated without fans, and including buildings of various sizes, from one of the largest high schools down to a four-room country school in Richmond Borough. These ten schools were studied somewhat intensively, being visited once a week between December 2, 1912, and February 14, 1913.

In order to broaden the base of our observations, twenty-two other schools were visited on one or more occasions between February 14 and March 15, 1913. Each "visit" was made by a squad of three men who spent practically the whole school day in making determinations of temperature and humidity and carbon dioxide in the field and in collecting samples for the enumeration of dust particles and bacteria. All together we have made 1854 observations of temperature, and 1845 of relative humidity, with 773 determinations of carbon dioxide, 684 of bacteria and 658 of dust particles.

The classical test for air quality is carbon dioxide, coming straight down to us from the days when the object of ventilation was held to be the removal either of carbon dioxide itself, or of some subtle morbific matter of which it was a measure. It has of course long been demonstrated that carbon dioxide in itself, under natural conditions, never approaches a concentration at which toxic effects are manifest and practically all the experimental work of recent years has tended to show that the supposed organic poisons of respired air are non-existent. The classic conclusion arrived at by Flügge in 1905 has not been challenged with success and may be still quoted with approval, as follows: "Numerous researches, with accurate experimental methods and with exact regard to thermal conditions, on both healthy and diseased subjects, have shown that the chemical variations in the composition of the atmosphere, which occur in inhabited rooms through the gaseous excretions of men, do not exercise an injurious effect on the health of the occupants."

The discussion of organic matter in the air has, however, been given a new turn in recent years by the claim of Rosenau and Amoss that specific proteid compounds of human origin could be detected in respired air by the delicate physiological reaction of anaphylaxis. It should be noted that there is nothing in Dr. Rosenau's work to suggest in any way that these substances are poisonous. Nevertheless, as a test of a special kind of organic pollution of the air the method seemed a promising one and we have devoted considerable attention to the problem. A detailed series of investigations was made under our general direction by Dr. D. R. Lucas in which he was able easily to demonstrate the presence of such specific proteid substances in the saliva under carefully controlled conditions, but was unable to detect them in material condensed from the breath or in air heavily contaminated by the respiration and exhalations of dogs and human beings. We were forced to conclude that "there is at present considerable uncertainty as to the presence of such specific proteid substances in demonstrable amounts in respired air and that there is absolutely no evidence of the presence of any organic substances of a deleterious nature in such air." Similar experiments carried out simultaneously by Dr. Charles Weisman at Columbia University and published as a Doctor's Dissertation have led to the even more definite conclusion that "the results of these experiments disprove the statements of Rosenau and Amoss that the breath contains "volatile" protein and that such "volatile" protein is an important respiratory factor."

In spite, however, of the lack of any evidence as to the presence of organic poisons in respired air, the determination of carbon dioxide is a valuable test, because it is an excellent index of air change. The amount of carbon dioxide formed by respiration and combustion being fairly constant its concentration measures quite accurately the amount of fresh air supplied which is a vital factor in the control of temperature and humidity and is also of importance in the removal of offensive odors, from mouths, bodies and clothing.

Our determinations of carbon dioxide were all made in the field with the portable Petterson-Palmquist apparatus made by Eimer and Amend, modified and improved for our special purposes in certain minor details. 773 determinations in all were made with this apparatus and the distribution of the results is indicated in Table I below and, graphically, in Figure I, where are plotted distribution curves for all our five routine determinations in the whole series of 32 schools.

TABLE I

Distribution of Carbon Dioxide Determinations in Air of New York Schools.

Carbon dioxide, parts per 10,000.	4	5	6	7	8	9	10	11	12	13	14	15–17
Per cent. of observations in each class	4	11	15	17	19	12	8	6	3	3	1	2

The general average value for all schools was 8.1 parts per 10,000. Sixty-six per cent. of the observations fell below 8.5 parts which may be considered a very satisfactory result on any standard. Twenty-nine per cent. of the tests showed between 8.5 and 12.5 parts, which would have been considered high on the older standards established when carbon dioxide was held to be a measure of some mysterious poisonous matter in the air. The present tendency among physiologists and sanitarians is to allow a more liberal standard, however. Dr. J. S. Haldane, Dr. Leonard Hill and Dr. M. S. Pembrey in testifying before the English Departmental Committee on Humidity and Ventilation in Cotton Weaving Sheds favored a standard of 12 parts per 10,000 for factories and I see no reason why a more rigid standard should be enforced in school rooms. There remain 6% of the tests, however, showing over 12.5 parts, which are clearly excessive. These were associated, of course, with overcrowding and deficient air supply in individual rooms.

Supplemental observations made in four schools during evening sessions (when there is no artificial ventilation) showed some very high carbon dioxide values ranging in one case with gas burning up to 26.0 parts. This is a special problem which deserves more attention than it receives in many cities.

Passing from the gaseous to the suspended constituents of the atmosphere, dust particles and bacteria are the principal objective points in air analysis. We have made routine determinations of both in all our work, although their sanitary significance is somewhat dubious. Dust particles were enumerated by counting the particles visible under a two-thirds inch objective, the method recommended by the Committee on Standard Methods for the Examination of Air of the American Public Health Association. This seemed to us preferable to the counting of ultra miscroscopic particles by means of the koniscope since it is presumably only the comparatively large fragments which are important; and we preferred counting rather than weighing the particles because the sanitary significance of dust in the air depends apparently on the irritating effect of sharp particles upon the respiratory tract and a number of fairly large fragments must be much more harmful than a single very big one. The dust particles were collected by means of a sugar filter, air being drawn through by an ordinary double suction pump (the air being measured by a standard Brazilian meter) or by an ingenious combined pump and meter manufactured by Wallace & Tiernan of New York City.

The general distribution of dust counts for all schools (658 observations) is shown in Table II and in the second curve of Figure I. It will be seen that the largest number of samples showed between 200,000 and 400,000 particles per cubic foot. The general average for all schools was 601,000 particles and twenty per cent. of the samples showed 800,000 or less, with a few values ranging up to 2,000,000 and over.

TABLE II

Distribution of Dust Determinations in Air of New York Schools.

Dust particles per cubic ft........	Under 200,000	200,000 to 400,000	400,000 to 600,000	600,000 to 800,000	800,000 to 1,000,000	1,200,000 to 1,400,000	Over 1,400,000	
Per cent of samples in each class....	8	34	25	13	9	3	3	5

The sanitary significance of these results is probably not great. Dust particles constitute a serious menace to health in industrial establishments, grinding shops, granite cutting sheds and the like since the hard metallic or mineral particles which are found under such conditions form a controlling cause in the development of industrial tuberculosis. The particles which we found, were for the most part minute and chiefly organic in nature. In the counting cell they separated into two layers the greater number, floating on the surface, being barely visible under the microscope and consisting in large part of mold spores, while the less numerous particles settling on the bottom included larger shreds of vegetable fibre and inorganic particles. There is no reason to suppose that particles of such small size and of such nature as were found exert any influence on health.

In certain cases we found higher numbers of dust particles due to special local conditions. One school where a great deal of building and paving was going on in the neighborhood showed less than 500,000 dust particles per cubic foot in only 44 per cent. of the samples taken, over 1,000,000 particles in thirty per cent. of the samples taken and over 2,000,000 particles in four per cent. Another school, near a large power house, always showed a characteristic prevalence of coal particles in the air. On the other hand, certain schools in very clean districts were notably free from dust, as was the one school studied which was provided with an air washer. In this latter case, sixty-six per cent.

of the samples showed less than 500,000 particles per cubic foot and only nine per cent. showed over 1,000,000.

An air washer might well be installed in any school where the air is loaded with a special excess of dust from any local cause. Where, however, such conditions as we have observed in most of the New York schools obtain, that is, where the air contains half a million to a million particles of very fine, largely organic, dust per cubic foot, it does not seem to the writer that there is any sanitary warrant for demanding its elimination. So far as we now know such dust is entirely normal and innocuous.

Our determinations of the microbic flora of the schoolroom air were made, after a number of preliminary tests of other methods, by filtering the air through fine sand, shaking up the sand in water and plating the water—the procedure recommended by the Committee on Standard Methods for the Examination of Air of the American Public Health Association. Samples were collected with the same pumps used in the dust determinations. The plates were made on litmus-lactose-agar and incubated at the room temperature for five days. At the end of this time all visible colonies were counted, includ-

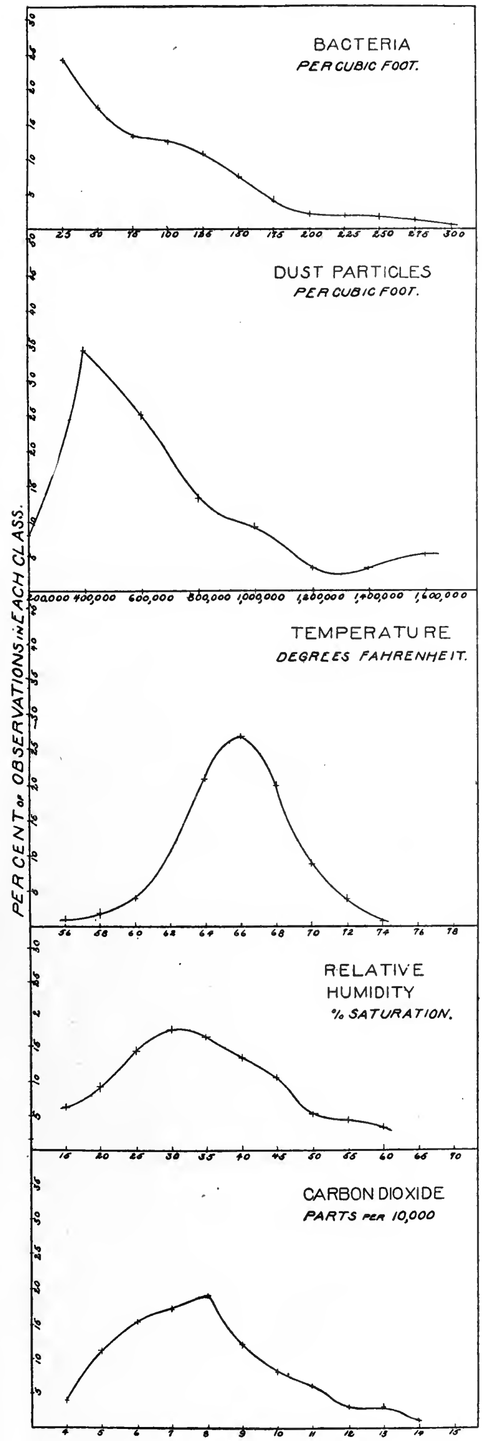


FIGURE 1

ing, of course, many molds and yeasts, as well as bacteria. The curve on the chart is labeled "bacteria" but the counts include all microbes capable of development under the conditions used.

We examined in all 684 samples of school room air for microbes, the general distribution of all results being indicated in Figure I. The most frequent result is twenty-five microbes or less per cubic foot, but the rarer high results pull the general average up to 96. As indicated in Table III, however, 68% of the samples showed counts of 100 or less, and only nine per cent counts over 200.

TABLE III

Distribution of Microbic Counts in Air of New York Schools.

Bacteria per cubic foot	Under 50	51–100	101–150	151–200	201–250	251–300	Over 300
Per cent. of samples in each class	41	27	17	6	4	2	3

These counts include all sorts of organisms, from all sorts of sources, which are able to withstand drying long enough to be lifted up and blown about in the air. Most of them, of course, are of no sanitary significance; and the values, averaging under 100 per cubic foot and in most samples much less, must be considered satisfactory by comparison with the results reported by Tenon (40-60 bacteria per cubic foot in quiet hospital air) by Hesse (60 bacteria per cubic foot in a class room before the students arrived, raised to 430 during the hour and 1,000 just after the class had left), and by Soper (140 bacteria per cubic foot at remote end of Fulton Street subway station).

In order to obtain an estimate of the bacteria of human origin which might at times include pathogenic forms, we made all our plates on litmus-lactose-agar as noted above and isolated all red colonies which appeared on the plates. It is well established that acid forming streptococci are among the most abundant forms in the human mouth, while they are absent from sources which have not recently been exposed to human or animal pollution. The numbers of these organisms in school-room air was found by Prof. Baskerville and myself in preliminary experiments of a year ago to be quite small. We then found among 30,000 colonies isolated from 750 plates, exposed in schools with window ventilation, only ten mouth streptococci.

In the present study, in the examination of a total of 174 cubic feet of air, we found fifty-two mouth streptococci, or thirty for every 100 cubic feet of air. The average number of mouth streptococci for the individual schools ranged for the most part between ten and thirty-five per 100 cubic feet. In one crowded school in a poor district, it rose to seventy-five per 100 cubic feet, and in a school in a good semi-suburban district, no streptococci were found in 8 cubic feet of air. The general average of thirty mouth streptococci per 100 cubic feet gives a ratio of about one of these forms to 320 total bacteria.

The trend of epidemiological evidence is strongly against the spread of disease germs by quiet air, as is best illustrated by the practice of some of the most modern hospitals, in which various contagious diseases are successfully treated in open wards with no precaution against air infection, provided only that the spread of disease by direct contact is rigidly excluded. Our bacteriological results seem in harmony with these deductions from practical experience. Since a child breathes less than 100 cubic feet of air during an average school period, our counts mean that each day some twenty-five mouth streptococci may be breathed in. These mouth streptococci must, of course, be far more abundant than pathogenic forms; and at a rate of twenty-five mouth streptococci per day the chance of ingesting pathogenic bacteria from the air is seen to be a very slender one.

There seems to be absolutely no basis at present for the use of ozone or any other disinfectant designed to eliminate bacteria from the general air of school-rooms. When there are crying needs of school hygiene and sanitation to be met it is unjustifiable to spend money in meeting dangers like the danger of air infection, which the evidence at hand strongly suggests to be non-existent.

The most important properties of the atmosphere from a health standpoint are its temperature and humidity. To quote again from Flügge, "Whenever in closed crowded rooms certain impairment of health ensues, such as headache, dizziness, nausea, etc., these symptoms are to be attributed solely to heat retention." Since overheating is the chief practical evil to be avoided in the control of school room air we devoted a great deal of attention to the matter of temperature. The field squad in their visits to the schools obtained temperature and humidity records by the use of the U. S. Weather Bureau Standard Sling Psychrometer and in addition we installed in each school during the period of observation a Tycos thermograph (obtained from the Taylor Instrument Company of Rochester, New York), which gave us a continuous record of temperature during the whole twenty-four hours. We obtained by this method 364 different records of the entire course of the temperature changes in one selected room in a school during the whole school day.

The general results of the 1854 temperature observations made by our field squads with the sling psychrometer are indicated in Table IV and plotted in the central curve of Figure I.

TABLE IV

Distribution of Temperature Records in New York Schools.

Temperature degrees F.	Under 60°	60° to 61°	62° to 63°	64° to 65°	66° to 67°	68° to 69°	70° to 71°	72° to 73°	74° to 75°	Over 75°
Per cent. of observations in each class	1	2	4	11	21	27	20	9	4	1

It is evident that these records as a whole indicate very good conditions. The temperature curve centers closely, as it should, about 68°. The table shows only 14% of all records over 71° and only 5% over 73°. Sixty-eight per cent. of all records fall between 66° and 71°, a reasonable and equable temperature.

On the whole this result must be considered highly creditable and an indication that the children of the New York schools for the most part enjoy good atmospheric conditions, free from objectionable overheating. An examination of particular schools, however, shows that this general curve covers up markedly different conditions in individual cases. In certain schools conditions are uniformly good but in others they are distinctly bad. The curves for three typical schools are plotted for comparison in Figure II.

School 33 is a well managed fan-ventilated school and as the curve indicates conditions are almost perfect. Out of 143 records in this school, 137 were between 64° and 71° and only 3 over 71°. The next curve, for school 49, represents conditions in an old-fashioned school ventilated without fans. Here conditions were much more variable, and overheating more frequent. 129 out of 154 records were between 64° and 71° and 19 over 71°. School 84 is a fan-ventilated school which is carelessly operated. Out of 135 records 86 were within the limits, 64° to 71°, and 41 or about 30 per cent were over 71°. This indicates a condition of gross overheating which must be seriously detrimental to the health and efficiency of the children.

These records obtained by our field squads are confirmed and supplemented in a very conclusive and interesting way by the automatic temperature records obtained by the thermographs. Four of our charts, two for good and two for bad schools, are reproduced herewith in Figures III and VI. Figure III shows the admirable conditions maintained in School 33, to which reference has been made above. It will be noted that for the twenty days our clock was in the school the temperature was maintained with perfect regularity close to 65°, never once in the rooms where the clock was placed rising over 70°. Figure IV shows a record almost equally good. Here the janitor allows the building to cool off rapidly after three o'clock, an economical procedure if not carried to the point of chilling the pupils.

Figure V shows a striking contrast to the last two figures, giving a clear picture of the exaggerated variations in temperature which occur in a carelessly operated school, provided with fans which, however, are often not in operation. Out of 113 sling psychrometer records in this school 32 or twenty-eight per cent. were over 71° and 13 or eleven per cent. over 73°. The thermograph records are the worst obtained anywhere. On the most spectacular day, January 9th, starting in at 63° at 8 o'clock, the temperature was rushed up to 80° at 10:30. Then in a fit of remorse on the part of the janitor, or a spasm of self-defense on the part of the teacher in the particular room where the clock was placed, the temperature was reduced to 53° at 11:15. The relief was short lived, however, for the thermograph registered 81° at 12:30, and stayed over 72° for the rest of the day. On 18 out of 28 days for which we have

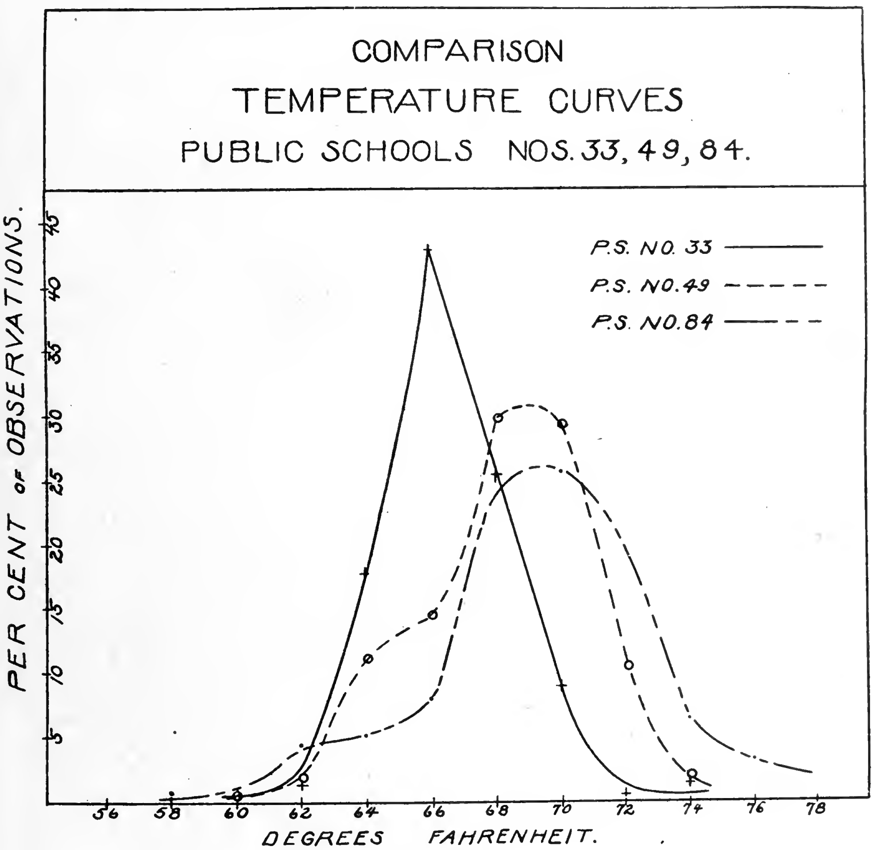


FIGURE 2

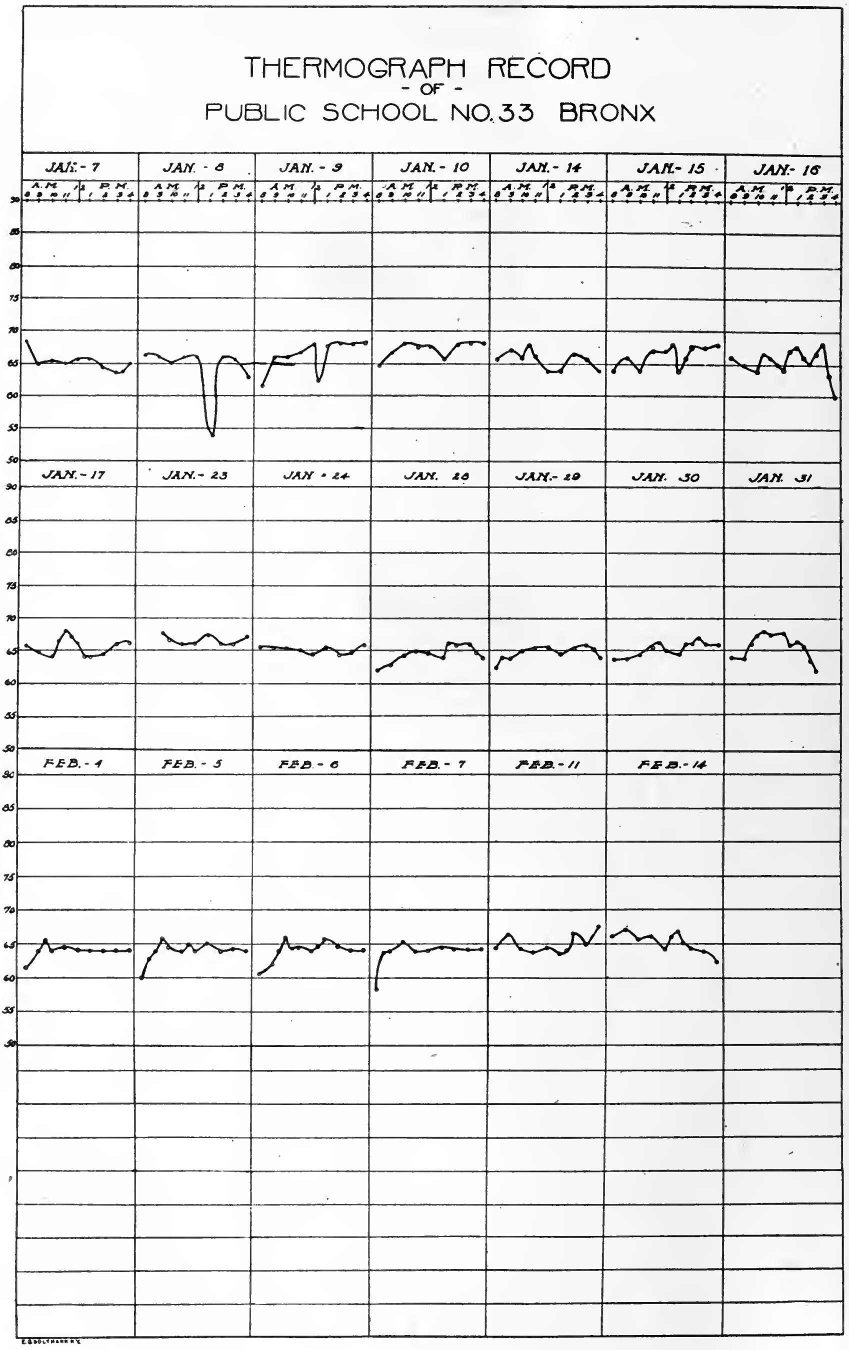

THERMOGRAPH RECORD
- OF -
PUBLIC SCHOOL NO. 33 BRONX
JAN. - 7
JAN. - 8
JAN. - 9
JAN. - 10
JAN. - 14
JAN. - 15
JAN. - 16
A.M.
P.M.
JAN. - 17
JAN. - 23
JAN. - 24
JAN. 28
JAN. - 29
JAN. 30
JAN. 31
FEB. - 4
FEB. - 5
FEB. - 6
FEB. - 7
FEB. - 11
FEB. - 14
DEGREES FAHRENHEIT

FIGURE 3

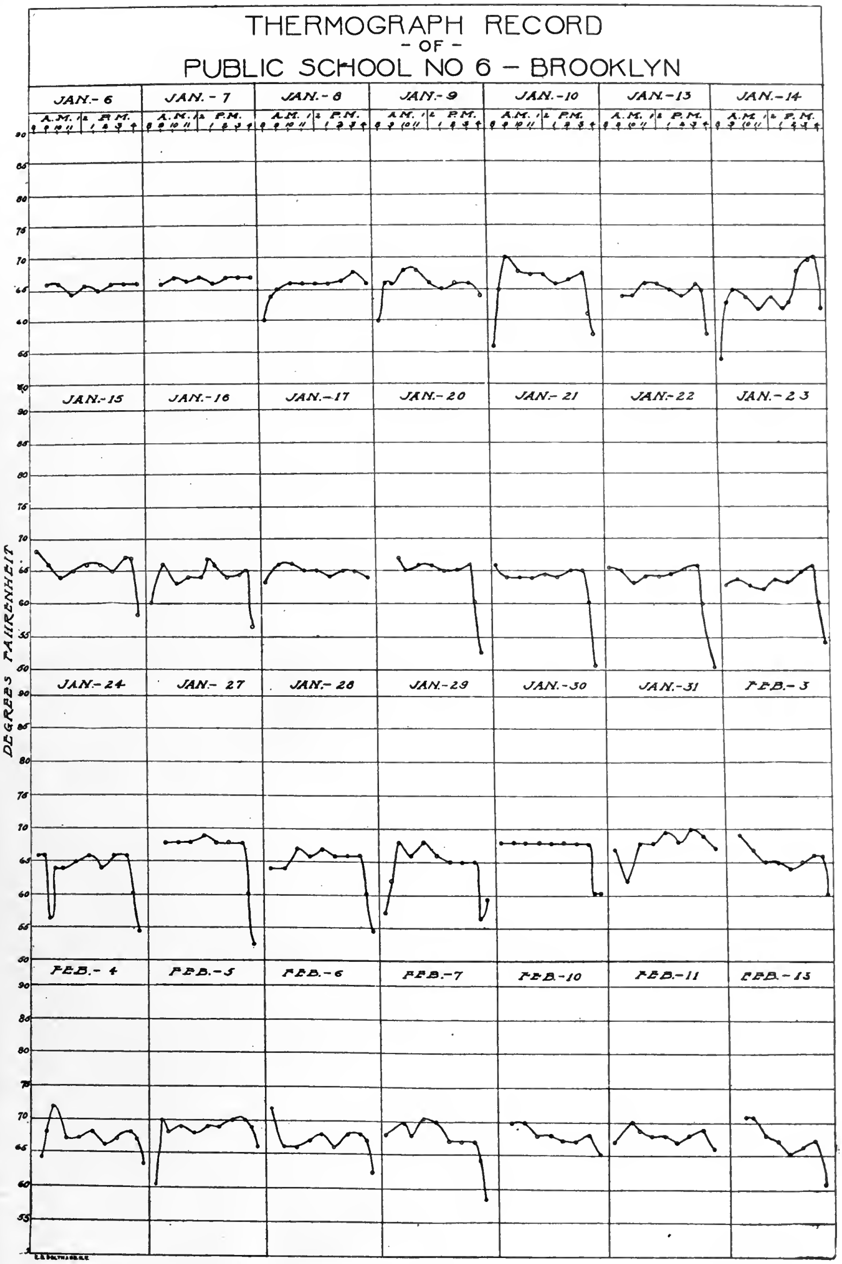

THERMOGRAPH RECORD
- OF -
PUBLIC SCHOOL NO 6 - BROOKLYN
JAN.- 6
JAN.- 7
JAN.- 8
JAN.- 9
JAN.- 10
JAN.- 13
JAN.- 14
A.M. 12 P.M.
JAN.- 15
JAN.- 16
JAN.- 17
JAN.- 20
JAN.- 21
JAN.- 22
JAN.- 23
JAN.- 24
JAN.- 27
JAN.- 28
JAN.- 29
JAN.- 30
JAN.- 31
FEB.- 3
FEB.- 4
FEB.- 5
FEB.- 6
FEB.- 7
FEB.- 10
FEB.- 11
FEB.- 13
DEGREES FAHRENHEIT

FIGURE 4

records in this school the temperature reached 75° and on 6 of them it reached 80°. Figure VI shows very bad conditions as to overheating in a naturally ventilated school. During the six days for which we have records the temperature was almost constantly between 75° and 80° and once reached 87°.

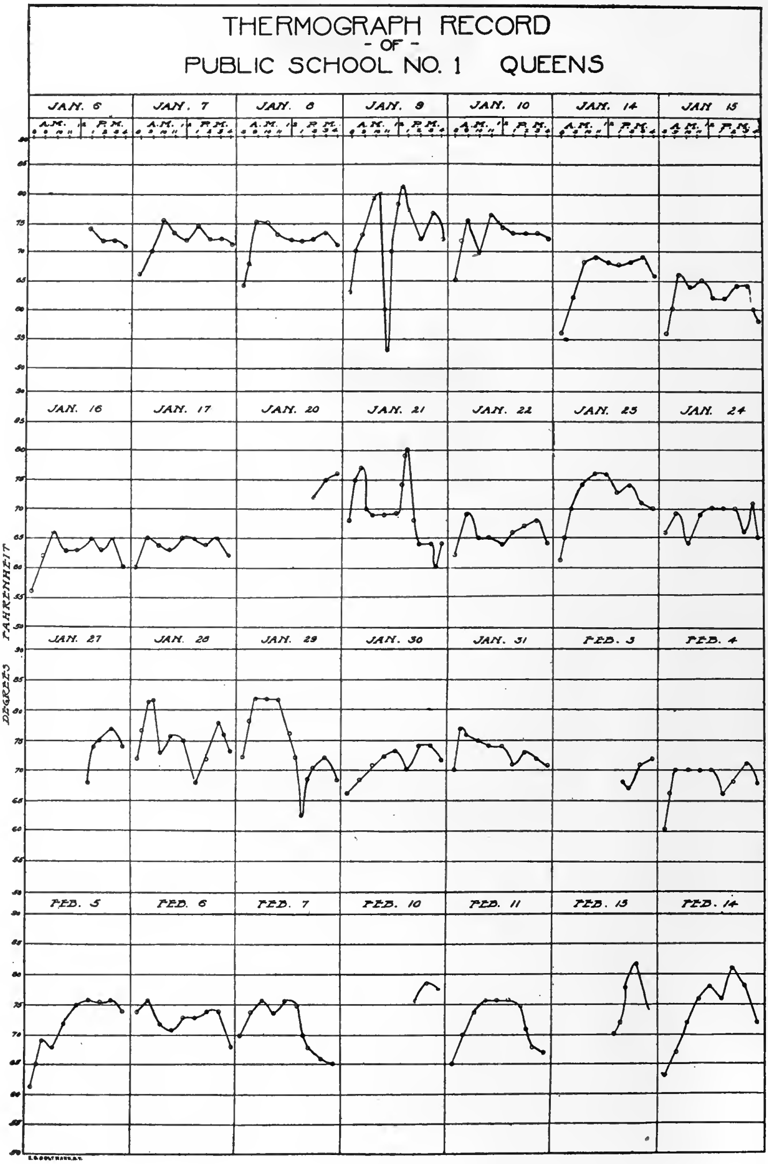


FIGURE 5

In another school, one of our investigators found the temperature as it entered four different rooms from the ventilating ducts to be respectively 64.5°, 83.1°, 98.3° and 125.0°. On the first reading taken at the inlet in the last room a thermometer graduated to 130° was burst by the heat.

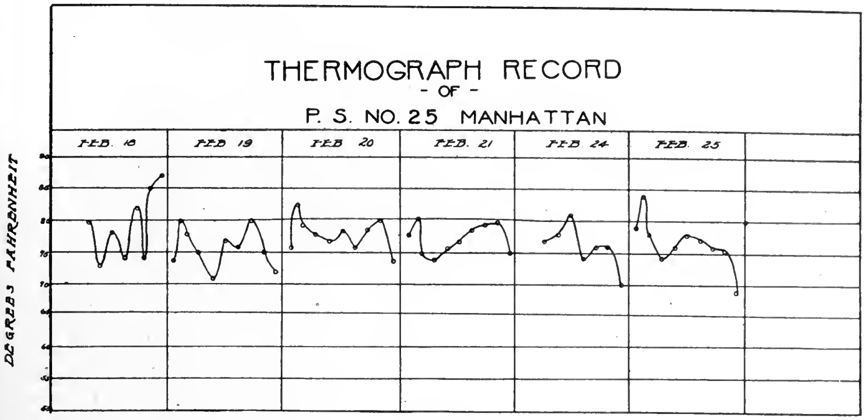


FIGURE 6

Humidity observations were made by our field squads as noted above by the use of the sling psychrometer (1,845 records being obtained). The general distribution of results is shown in Table V and in the fourth curve of Figure I.

TABLE V

Distribution of Relative Humidity Records in New York Schools.

Relative humidity per cent. saturation....	Under 15	16–20	21–25	26–30	31–35	36–40	41–45	46–50	51–55	56–60	Over 60
Per cent. observations in each class.......	6	9	14	17	16	13	10	5	4	3	3

The range of relative humidity is seen to be a wide one. 60% of all observations fall between 20 and 40% of saturation, and the general average for all schools is 35%.

In the case of relative humidity one is somewhat at a loss for a basis on which to found a practical sanitary interpretation of the results. Extravagant denunciations are often heard of the school-room "as dry as the Desert of Sahara" but it must be remembered that many dry climates are sought out on account of their healthfulness and I am not familiar with any serious physiological experiments which indicate whether the relative humidity in a school-room should be 25%, 50% or 75% of saturation.

The main factor in producing the dry air of the school room (for records 90% of which are under 50% saturation must certainly be considered relatively dry) is, of course, the heating of the outside air, without the supply of the additional moisture which air can hold at a higher temperature. The only way to overcome this dryness of the air is by artificial ventilation combined with humidification. We studied two examples of this in school 6, Brooklyn, and in part of School 27, Manhattan. In these cases the effect of humidification was apparent though not very marked. School 6 gave 116 out of 155 records or 75% under 50 per cent. saturation and 31 or 21 per cent. below 35 per cent. saturation and in the humidified half of School 27, sixty-five out of 78 observations were below 50 per cent. saturation and 45 below 35 per cent.

For the purpose of estimating the value of fan ventilation, curves for all the schools, classified on this basis, are brought together in Figure VII. Of course, it must be understood that by natural ventilation it is meant simply that fans were not running. In almost all cases, ducts and often heating coils were there and air was undoubtedly passing through them. So, on the other hand, where fans were in operation, windows were often open and outside air passing in or out through them. The distinction is made solely on the fact that fans were or were not in operation in connection with the particular room in which each test was made.

The general results for the two classes of schools are on the whole remarkably alike. The fan ventilated schools show more dust, more humidity, more carbon dioxide and a somewhat more equable temperature; but none of the differences are very great or very significant.

The high humidity and high carbon dioxide in the fan-ventilated schools can best be accounted for on the assumption that in the window ventilated schools on the whole there is actually more air supplied than is blown in by the fans in the other group. The higher dust counts may perhaps be due to the same thing, less air to dilute dust produced within the school, or to the fact that air entering at a high velocity through a duct brings in more dust from outside, than does air coming in more slowly through window openings. In dust and carbon dioxide, the fan-ventilated schools appear slightly inferior to the others. In humidity they are better (if dry air be a disadvantage). In temperature they are also somewhat better, showing less observations over 72°.

So far as temperature is concerned, however, it should be noted that the curve for the fan-ventilated class conceals wide variations between the individual schools included in it. Of our ten regular schools it is noteworthy that the four really good records (from the standpoint of temperature) were in fan-ventilated schools. The three wholly or partly naturally ventilated schools are mediocre or poor; and two fan-

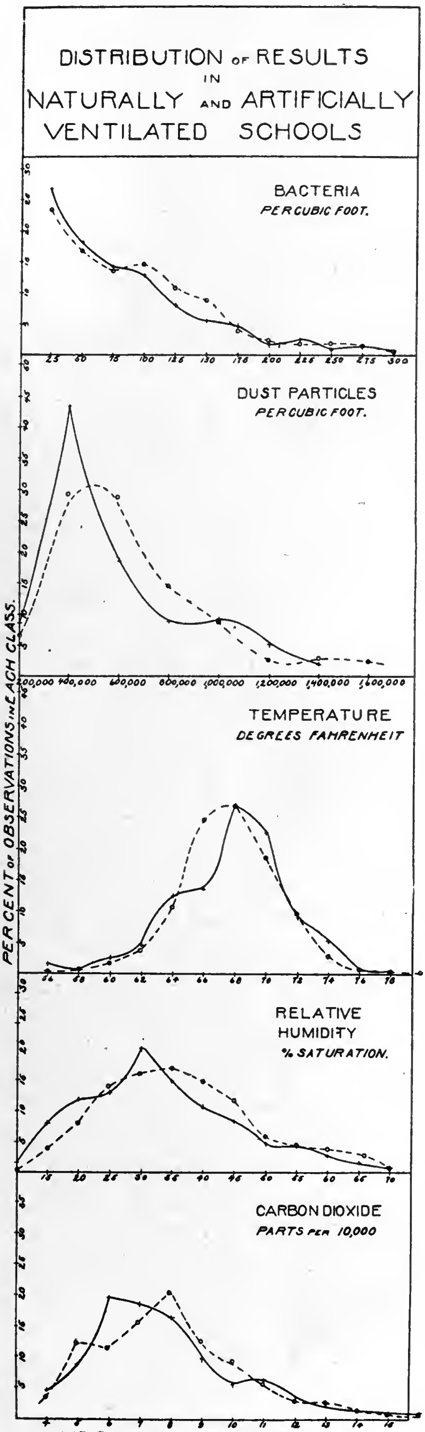


FIGURE 7

ventilated schools are worst of all. Either almost perfect conditions or very poor conditions may be obtained with fan ventilation according to the care and intelligence of the janitor in charge.

The general conclusion from these studies must be that atmospheric conditions in the thirty-two schools investigated are on the whole remarkably good, and that the schools are reasonably free from overheating. The good results obtained in the latter respect may very probably be due to a valuable report made a year ago by a Committee of the Board of Education (Hon. John Martin, Chairman), which was followed by an order of the Board under date of November 27, 1912, providing that the temperature of school-rooms should be maintained between 60° and 68° and that of halls and passageways between 60° and 65°. The same order provided that certain specific schools should be ventilated by opening windows and without fans, except in inclement weather, and that in any other schools the principal might obtain permission to have the same rule in force.

During the winter of 1912-13 there certainly seems to be no basis for serious criticism of the general atmospheric condition of New York school-rooms.

In certain individual schools, however, the air supply was often inadequate as indicated by high carbon dioxide values and, in particular, gross conditions of overheating existed as a result of careless operation. We found schools in which the temperature in one school day ranged from 53° to 81°; schools in which a third of all the records obtained were over 71°; schools in which the temperature for several successive days was almost constantly between 75° and 80°. Such records as these indicate a serious danger to the health and efficiency of the children. We have recommended that the conditions they reveal should be remedied by the employment of visiting engineers to make occasional studies of inlet temperatures and air volumes, and particularly by the installation of an automatic recording thermometer in each school in view of the fact that these instruments appear to offer such a striking check on shortcomings in janitorial service.

The most important general significance of these studies would seem to lie in their possible use as a basis for comparative investigation in schools of other cities, since they appear to offer a fairly good idea of the range of atmospheric conditions which exist in the school-rooms of a large American community where considerable attention has been paid to the quality of school-room air. In regard to carbon dioxide and temperature we have well established standards of interpretation and these New York studies show that with good operation of such ventilating plants as at present exist it is quite practicable to maintain less than 8.5 parts of carbon dioxide and a temperature closely regulated between 66° and 70°. For dust and bacteria we have every reason to believe that such values as we have found (25 to 100 bacteria and 500,000 to 1,000,000 dust particles per cubic foot of air) are normal for ordinary air and have no sanitary significance. Only numbers showing a considerable excess over these would seem to warrant any special measures for air disinfection or air washing on sanitary grounds. Finally, in the case of relative humidity, we have no sound basis for interpretation of the results obtained. The records show that the air of the New York schools is distinctly dry but there are no sound physiological data available to show what degree of humidity is most favorable for human occupancy. This is one of the points in connection with ventilation which most needs experimental elucidation.

AIR WASHING AS A MEANS OF OBTAINING CLEAN AIR IN BUILDINGS

BY

GEORGE C. WHIPPLE AND MELVILLE C. WHIPPLE

Clean air in motion and of proper temperature and humidity is necessary to indoor comfort. This is, perhaps, as succinct a statement as can be made of atmospheric requirements according to modern views. Our concepts of ventilation are undergoing a change. Slight reductions in the amount of oxygen or slight increases in the amount of carbonic acid in the air we breathe are no longer feared. The human body can automatically adapt itself to slight changes in the proportion of these gases. It is more difficult for the body to adapt itself to temperature changes and these may cause more or less discomfort and damage. The heat relations of the body are complicated, involving heat production within the body, affected by food and by physical and mental exercise; heat transference within the body from the interior to the surface; and heat elimination at the surface, for human beings live normally in an atmosphere cooler than the body. Heat elimination is itself a complicated matter: it is lost by conduction, by convection, by radiation; it is affected by the temperature and humidity of the air, by the clothing worn, by the perspiration produced and evaporated. So complicated are these relations that we have not yet solved them. We do not yet know the best combination of indoor temperature and humidity for our greatest bodily comfort and efficiency.

We do know, however, as a matter of universal experience that it is uncomfortable to remain in air that is still, or as we say that is "dead." If the air that we exhale remains so near our faces that we rebreathe a considerable portion of it at each succeeding breath a feeling of oppression and discomfort ensues. Air stagnation also forms an atmospheric cloak about our bodies which affects their heat conditions. Mere stirring of air often changes discomfort to comparative comfort; witness the effect of the introduction of fans in the New York subway cars. The benefits of sleeping in a cold room in which the warm exhaled air quickly rises so that the next breath is new air, and the benefits of outdoor sleeping are due in great measure to the motion of the air. No system of ventilation can be regarded as satisfactory that does not cause a sufficient circulation of the air.

Another thing that we need to appreciate is that the air that we breathe should be clean. So anxious have we been in the past to make sure that the carbonic acid did not exceed some illogical, arbitrary standard that we have overlooked this most patent and obvious need. Of course, the extremes of this quality of cleanliness have been recognized. We know that people who work at dusty trades, in dust-laden air, sicken and die of diseases that gain a foothold in the lungs; and we send our sick to the mountains and the seashore and spend our vacations in the relatively clean air of the woods and fields and upon the waters. Cleanliness is the great thing to be desired in air as it is in water. From time immemorial water that is grossly foul has been regarded as dangerous, but it is only within a generation or so that water which is only moderately contaminated has been regarded as dangerous. A clean water supply is now a watchword of our modern cities. If precedent is followed we shall come to regard as undesirable much of the air that would not by present day standards be called unclean, as well as air that is grossly laden with dust and foul gases.

Modern cities are dust producers. Streets and pavements and even sidewalks are worn by friction of the traffic, especially in this age of the railroad and automobile; car wheels are ground to metallic dust; fabrics turn to lint; fuel burns with products of smoke and ashes. Dust is being continually produced both within and without our factories and houses.

Recent studies made by us in several cities have shown that the number of dust particles in the air just above the sidewalks is very large, even on quiet days. At the air inlets of some of the commercial buildings in Boston the numbers of particles, as determined by microscopical counts, ranged from 100,000 to nearly 1,000,000 per cubic foot of air. With active wind movement the numbers are probably much higher, but even with the lesser number mentioned the number of particles inhaled by a person in an hour would be a million and a half. To be sure the particles making up this vast number are very tiny, ranging from 0.5 to 15 microns in diameter, with an average of about 3 microns (.003 millimeter) and their combined bulk is not large.

Air contains more dust near the street level than at higher elevations. Tests made on May 13, 1913, at the South Terminal Station, Boston, where air is taken in at the roof, showed lower dust counts than air taken at the street level at various office buildings in the business district of Boston. Tests made at the John Hancock Building on June 6, 1913, showed that at the street level the air contained 483,000 dust particles per cubic foot; at the 5th story there were 233,000, and at the 10th story, 140,000 per cubic foot. Tests made on July 2nd, 1913, in New York at the Metropolitan Life Insurance Building and the Woolworth Building, the last named being the highest building in the world, showed similar reductions in the amount of dust in the air in the upper stories. For example, at the Woolworth Building the air at the street level contained 221,000 dust particles per cubic foot; at the 10th story there were 85,000, at the 30th story 70,000, and at the 57th story 27,300. The dust counts at the Metropolitan Building were somewhat lower than at the Woolworth Building, the number at the street level being 173,000, and at the 50th story 21,000 per cubic foot. The lower counts at the Metropolitan Life Building may possibly have been due to the fact that this building is situated near Madison Square and is more isolated than the Woolworth Building which is located down town in a more crowded section. Both sets of observations were made on warm quiet days.

TABLE I.

Table Showing the Number of Dust Particles per Cubic Foot at Different Elevations in Various Well Known High Buildings in New York and Boston.

Floor	Boston, Mass.	New York City		
	John Hancock Building	42d Street Building	Metropolitan Life Building	Woolworth Building
	June 5, 1913 2:50–5:35 P.M.	July 3, 1913 2:25–4:40 P.M.	July 2, 1913 2:35–5:15 P.M.	July 2, 1913 10:10–12:40 A.M.
	Number of Dust Particles per Cubic Foot			
Sidewalk	483,000	......	173,000	221,000
2nd	306,000	122,000	94,000	163,000
3rd	300,000	104,000	71,000	......
5th	233,000	70,000	51,300	111,000
7th	139,000	49,600	50,000	109,000
10th	140,000	......	38,000	85,000
11th		37,600	......	......
14th		34,000	......	......
20th		32,300	36,300	75,000
30th			33,300	70,000
40th			24,000	41,300
50th†			21,000	......
57th*			......	27,300

†662 feet high.
*716 feet high

TABLE II.

Table Showing the Number of Bacteria and Dust Particles in Air Taken at Different Elevations from John Hancock Building, Boston, Mass., June 5, 1913.

Floor	Bacteria per Cu. Ft.		B. Coli	Molds per Cu. Ft.	Dust Particles per Cu. Ft.
	Gel. at 20°	Agar at 38°			
Sidewalk	1330	30	0	20	483,000
2nd	1200	37	0	13	306,000
3rd	417	83	+	8	300,000
5th	720	43	0	15	233,000
7th	310	33	0	10	139,000
10th	330	17	0	3	140,300

Winslow has shown that the air of many of the New York schools contains even larger numbers of dust particles than those above mentioned, ranging from 400,000 to 1,000,000 per cubic foot. Studies by the authors at the gymnasium of the International Y. M. C. A. College at Springfield, Mass., have likewise shown that the indoor air contains dust particles in numbers usually more than 100,000 and sometimes even 400,000 per cubic foot. Such results are naturally to be expected, for indoor air is merely the outdoor air drawn in through the ventilating ducts, the inlets to which are often badly located, while to this outer air is added the dust resulting from friction and air movement of various kinds indoors.

Unclean air contains bacteria and other living organisms as well as lifeless dust particles. The bacteria are usually much less numerous than the dust particles. Our investigations at the John Hancock Building show that at the street level the air contained 1,330 bacteria per cubic foot capable of developing on gelatin at 20° in 96 hours, while at the 10th story the air contained 330 per cubic foot. Speaking broadly it was found that there were from 200 to 300 times as many particles of dust as bacteria. The bacteria capable of growing at the temperature of the human body were still less numerous, there being only 30 such bacteria per cubic foot found at the street level and 17 at the 10th story. The sample from the 3rd story, however, contained 83 per cubic foot, evidently an erratic observation. No attempt was made to determine the particular species of bacteria in these samples, but tests were made for the presence of B. coli and only once was this organism found, namely, in the sample collected at the 3rd story. Molds were also present to the extent of 20 per cubic foot at the street level and 3 at the 10th story.

Winslow's studies of bacteria in the air of rooms, and especially in the air of sewers and drains, showed a conspicuous absence of pathogenic bacteria. Even in the case of sewer air and drain air the numbers of B. coli found were surprisingly small. Our own results corroborate Winslow's findings. Yet in air, just as in water, B. coli may be regarded as an index of undesirable contamination. In this connection it will be remembered that Dr. Chapin, the well known health officer of Providence, R. I., holds that the danger of transmission of disease by the air conveyance of bacteria is extremely small.

Dust and bacteria do not constitute the only undesirable substances found in unclean air. Chemical examinations of the water from air washers in Boston disclosed the presence of ammonia compounds, nitrites, chlorides, sulphates, free sulphuric acid, and iron. The amounts of these substances varied with the locations of the intake ducts. Washers receiving air from the street level showed greater quantities of impurities in the water used for washing than those taking air from a height.

Mention has been made of the dust particles and bacteria in indoor air and of their tendency to outnumber those in outdoor air. The other constituents of indoor air are likewise subject to change. Chief among these are the substances that give rise to odors. Everyone is familiar with the odor of a poorly ventilated room after occupancy by a number of persons. This is due in part to the presence of expired air and to body emanations that accompany physiological processes. The same condition prevails wherever people congregate in restricted quarters, such as halls, churches, theatres, and cars. To some extent the intensity of these disagreeable odors is dependent upon the degree of activity of the occupants: witness the characteristically strong odor of a gymnasium. During the course of the Springfield experiments an increase of the odor of the air after the men began exercising in the gymnasium was very noticeable to one standing in the exhaust air duct.

There is no expression more common than that of "fresh air." Just what is meant by this term? It certainly does not involve the factor of air temperature to any extent, for we use the expression both in winter and in summer, and at times when the outside and indoor temperatures are the same. Neither does it involve humidity. In the opinion of the writers it may be regarded as practically synonymous with clean air in motion, air that is free from dust, from bacteria, and from malodorous or offensive organic emanations and poisonous substances.

Too little attention has been paid in the past to the cleanliness of the air supplied to our buildings. Fresh air inlets are often located with the grossest disregard for the quality of the incoming air. It is not uncommon to see them placed on the sidewalk level, or facing a vacant piece of ground that is swept by clouds of dust, or where smoke or objectionable odors may be taken in. In one of the buildings of Harvard University the air inlet is placed near a main entrance where automobiles stop and start, and the odor of spent gasoline frequently permeates the building.

The effect of forcing unclean air into buildings is to nullify the result aimed at by ventilation, that is to provide a supply of fresh air. The presence of dust, bacteria and odors not only renders the conditions uncomfortable and deleterious to health but it results in attempts at window ventilation, and this means poor ventilation, unequal heat distribution and draughts.

Supplying buildings with unclean air may often be obviated by a judicious choice of location for the inlet duct. A change of location from near the street to some higher point, or from one side of a building to another may greatly improve the quality of the influent air.

Crowded buildings and dusty city streets will often render it impossible to secure clean air from the outdoor atmosphere, without resorting to artificial purification. Fortunately this purification can be accomplished. Just as unclean water may be made wholesome by the employment of Nature's process of filtration, so can unclean air be purified by the application of another efficient process of Nature, namely, air-washing. The purifying effect upon atmospheric air of a heavy fall of rain is well known. A shower is said to freshen the air. Not only are suspended particles removed, such as dust and bacteria, but gaseous impurities, such as acids and ammoniacal vapors, are dissolved and removed, leaving the air sweet and clean. A determination of dust particles in the air after a heavy rain at Harvard University showed only 25,000 particles per cubic foot, whereas in dusty weather the numbers would have been measured by hundreds of thousands. This figure compares favorably with a determination made over the water of Long Island Sound at a point several miles from the shore, when the air contained 18,000 dust particles per cubic foot.

To ascertain the efficiency of air-washing as a means of purification the authors made a study of this method as carried on at several buildings in Boston and Springfield, Mass.

The process of air washing consists of passing the air horizontally through a chamber in which water is falling in drops, as rain, or into which it is sprayed. The sprays are obtained by forcing the water out of perforated pipes or through nozzles placed across the ducts. When the sprays intersect they are said to form a curtain. The object is to bring the air and water into intimate contact. Besides the washing chamber there are heating or tempering coils in the ducts or in a separate chamber, and devices for controlling temperature, a primary object of air washing in the past having been that of conditioning the air with respect to its temperature and humidity. The water used for washing is circulated by means of a pump so that it may be used over and over in the spray chamber for a considerable time. If desired this water may be cooled so as to influence the temperature of the air. Several forms of air washers are on the market, essentially similar in principle but differing in details of construction.

Although it has been known that air washers tended to clean the air, and they have sometimes been introduced for that very purpose, their efficiency as a means of air purification has not been determined. Accordingly the authors undertook a few preliminary studies in order to get data to serve as a guide in planning a more complete investigation. These studies were made at certain installations in Boston and Springfield, where washers made by different companies are in use and included chemical and bacteriological analysis of the air before and after washing, and analyses of the water before its use and after different periods of use. At Springfield the studies formed a part of a more extensive series of ventilation studies made at the gymnasium of the International Y. M. C. A. College during the winter and spring months.

The washers in Boston referred to by the letters A, B, C, D, and E were supplied with air taken from inlets placed as follows. They were all in the business district.

Washer	*Position of Inlet*
A.	8th story, on the roof.
B.	Above street entrance.
C.	Second story, back side of the building.
D.	Street level, just above sidewalk.
E.	Street level, just above sidewalk.

The analyses of air and water were made by the standard methods of the American Public Health Association, supplemented by the use of special apparatus. The results are given in Tables III and IV.

TABLE III.

Table Showing Removal of Bacteria and Dust Particles from Air by Various Air Washers, Boston, Mass.

Source of Sample of Air	Date 1913	Bacteria per Cubic Foot: Gelatine at 20°: Number	Bacteria per Cubic Foot: Gelatine at 20°: Per Cent Removal	Bacteria per Cubic Foot: Litmus Agar at 38°: Number	Bacteria per Cubic Foot: Litmus Agar at 38°: Per Cent Removal	Molds per Cu. ft. (Gelatine)	Dust Particles per Cubic Foot: Number	Dust Particles per Cubic Foot: Per Cent Removal
Washer A								
Outside	Feb. 3	10		0		10	229,600	
Washed	"	5	50%	0	....	0	30,500	87%
Outside	Feb. 10	110		0		8	111,100	
Washed	"	13	88%	0	....	3	58,000	48%
Outside	May 13	1000		7		20	178,300	
Washed	"	300	66%	7	0%	7	124,700	30%
Washer B								
Outside	Feb. 1	27		17		10	158,300	
Washed	"	17	37%	7	55%	3	71,300	55%
Washer C								
Outside	Mch. 13	13		3		0	248,000	
Washed	"	3	77%	0	100%	0	72,000	71%
Washer D								
Outside	Mch. 13	57		3		13	241,000	
Washed	"	7	88%	3	0%	3	104,000	57%
Washer E								
Outside	May 1	187		20		20	729,300	
Washed	"	110	41%	7	65%	13	531,000	27%

TABLE IV.

Table Showing Analysis of Tap Water Before Use, and of Water from Various Air Washers in Boston, Mass., After Use.

	Before Use		After Use						
	Tap Water		Washer A			Washer B	Washer C	Washer D	Washer E
	1	2	1	2	3				
Date of Collection, 1913	Feb. 1	Mch. 13	Feb. 3	Feb. 10	May 13	Feb. 1	Mch. 13	Mch. 13	May 1
Number of Hours Water Had Been Circulated	...	...	192	360	48	75	24	34	9
Temperature F°	...	...	45°	34°	52°	50°	50°	63°	59°
Turbidity	0	1	3	16	6	35	35	145	28
Color	10	16	15	20	15	17	10	20	39
Odor	2v	1v	3v	3a	3a	3a	2v	3a	3d
Total Residue	34.0	40.0	55.0	107.0	96.0	560.0	238.0	765.0	160.0
Loss on Ignition	16.0	17.0	13.0	27.0	21.0	151.0	78.0	240.0	46.0
Fixed Residue	18.0	23.0	42.0	80.0	75.0	409.0	160.0	525.0	114.0
Kjeldahl Nitrogen	.190	.168	.228	.580	.220	2.780	.510	1.740	2.650
Albuminoid Nitrogen	.068	.084	.084	.132	.106	.332	.136	.850	.425
Free Ammonia	.002	.018	.148	.144	.042	1.512	.280	2.350	2.330
Nitrites	.000	.001	.011	.011	.006	.056	.010	.024	.060
Nitrates	.10	.18	.09	.05	.05	2.50	.15	.14	.18
Oxygen Consumed	2.5	3.4	3.5	5.5	4.1	10.0	6.2	26.4	8.2
Chlorine	5.0	5.0	5.0	5.2	5.0	16.0	7.0	19.0	10.0
Total Hardness	11.0	14.5	20.0	28.5	30.0	307.5	130.0	357.5	45.5
Alkalinity	6.0	7.0	0.0	0.5	0.5	−1.5	−4.5	0.0	−0.5
Incrustants	5.0	7.5	20.0	28.0	29.5	309.0	134.5	357.5	50.0
Iron	0.5	0.2	0.4	1.4	0.7	10.0	7.5	32.0	3.5
Copper	...	...	*	*	†	*	*	*	†
Total Bacteria (Numbers Per C. C.)									
Gelatine 4 Days at 20°C.	25	50	25	15	1200	60	0	0	8700
Litmus Agar 2 Days at 38°C.	7	...	2	1	3	10	0	0	12
Molds Per C.C. (Gelatine)	5	...	3	5	...	10	...	...	30

*Signifies that copper was present. †Signifies that copper was absent.

Comparison of the dust counts in the air before and after passing through the water showed that in the case of the five Boston washers the percentage removal ranged from 27% to 87% and averaged 54%, while the removal of bacteria ranged from 37% to 88% and averaged 64%. Generalizing from the data given in Table III, it is fair to say that the air washing process as practised removed about two-thirds of the suspended particles, including dust, bacteria and molds.

The nature of the substances removed by the washers is shown by Table IV. Quantitatively these figures mean little, apart from a knowledge of the volume of water used and the number of times that the same water had passed through the air, and exact data for this could not be obtained. From a comparison of the analyses of the tap water before use with the washer water after use it is evident that many substances were removed from the air besides dust and bacteria.

When street air was passed through a washer it required but a few hours for the water used to resemble sewage in appearance and analysis. A comparison of the analyses of washers B, D, and E, with those of C and A given in Table V, shows how much greater was the amount of dust removed from air near the street level than at higher elevations. The intake ducts of these washers were at the street level, the second story, and the eighth story respectively.

TABLE V.

Average Analysis of Washer Waters

	(Results Expressed in Parts per Million)			
	Water before Use	Intake at Street Level	Intake at 2nd Story	Intake at 8th Story
Turbidity	1	69	35	8
Total Residue	37.0	495.0	238.0	86.0
Loss on Ignition	17.0	148.0	78.0	20.0
Kjedahl Nitrogen	0.179	2.390	0.510	0.343
Free Ammonia	0.010	2.064	0.280	0.111
Oxygen Consumed	3.0	14.9	6.2	4.4
Iron	.35	15.2	7.5	8.0

The presence of sulphurous acids in the air of the business district of Boston was responsible for an interesting phenomenon. These acids resulted from the formation of sulphurous gases during the combustion of coal and, being soluable, were removed from the air and dissolved by the water in the air-washing process. As long as the water contained alkalinity the sulphuric acid was neutralized, but after a certain length of time an excess of acid was present. This condition was found in several washers. Where it occurred in a washer constructed largely of copper the acid dissolved this metal and formed copper sulphate. As a result there was established a sort of automatic process of disinfection, and the numbers of bacteria found in the washer water were very low.

TABLE VI.

Results of a Series of Analyses upon Water from Air Washer, Using Recirculation of Air and Water.

Determination	1 Tap	2 Water	3*	4 Washer	5 Water	6	7
	Jan.13	Jan.15	12 hrs. Jan.13	20 hrs. Jan.15	29 hrs. Jan.20	31 hrs. Jan.20	57 hrs. Jan.29
	(Results Expressed in Parts per Million)						
Temperature	..	43°	52°	56°	51°	54°	54°
Turbidity	0	0	6	10	11	11	15
Color	17	15	37	43	70	73	65
Odor	1v	1v	2a	3a	3a	3a	4s 4m **
Total Solids	35.0	36.0	48.0	67.0	84.0	95.0	106.0
Loss on Ignition	8.0	8.0	16.0	25.0	18.0	22.0	22.0
Fixed Solids	27.0	28.0	32.0	42.0	66.0	73.0	84.0
Total Organic Nitrogen	.032	.046	.220	...	.250	.300	.420
Albuminoid Nitrogen	.058	.044	.110	.150	.174	.164	.244
Free Ammonia	.004	.002	.954	1.304	1.574	1.608	2.228
Nitrates	.000	.000	.040	.055	.155	.145	.144
Nitrites	.05	.05	.07	.09	.11	.12	.15
Oxygen Consumed (5 Mins)	2.6	2.8	4.2	4.5	5.2	5.5	5.9
Chlorine	2.5	2.5	2.7	2.8	3.5	3.5	3.5
Hardness	8.0	6.5	19.5	22.0	30.0	32.5	36.5
Alkalinity	3.5	2.0	14.5	17.5	21.0	22.5	30.5
Incrustants	4.5	4.5	5.0	4.5	9.0	10.0	6.5
Iron	0.15	0.15	1.0	2.2	3.6	4.0	4.4
Free CO2	3.0	3.0	3.0	3.7	3.5	4.0	4.0
Total Bacteria							
Gelatine 4 days at 20°	35	44	37,500	85,000	131,000	155,000	180,000
Litmus Agar, 2 days at 38°	..	..	..	..	50	50	12
Amorphous Matter (Standard Units per c. c.)	0	0	730	684	156	246	1044
Epithelial Scales (Number per c. c.)	0	0	14	24	32	32	40

*The first twelve hours were in the nature of a blank run without occupants in the gymnasiums.

**Odor equals sour and musty.

The gymnasium of the International Y. M. C. A. College at Springfield afforded an opportunity of studying a new phase of the problem of air washing, namely, that of purifying air that had passed through an occupied room. It was supplied with air from a ventilating plant provided with an air washer, operated at such a rate that the air in the room was changed every 9 to 12 minutes. This plant was well adapted for experiment for the reason that air could be taken in from the outside and washed, or the exhaust air from the room could be returned through the washer and again forced into the gymnasium. Comparison could thus be made between the use of outside air and of rewashed air. As in the Boston experiments analyses were made of the air before and after washing and of the water after different periods of service. Frequent tests were made under different conditions of operation. The results appear in Tables VI to X.

TABLE VII.

Comparative Numbers of Bacteria Upon Exposed Plates, Using Recirculation of Air and Water.

Sample	Date	Number Minutes Exposed	Total Bacteria upon Plate				Molds per Plate Gelatine
			Gelatine at 20°		Litmus Agar at 38°		
			Number	Per Cent Removal	Number	Per Cent Removal	
Using Recirculation	1912						
Exhaust Air..........	12/12	45 sec.	130		18		22
Washed "	"	"	12	91%	2	89%	4
	1913						
Exhaust "	1/13	2 min.	62		..		15
Washed "	"	"	7	89%	..	..	2
Exhaust " 3 P.M....	1/20	1 min.	170		..		25
Washed " "	"	"	39	77%	..	..	6
Exhaust " 4 "	"	"	52		21		18
Washed " "	"	"	36	31%	8	62%	6
Exhaust " 3 P.M...	1/29	1 min.	55		49		12
Washed " " ..	"	"	36	35%	3	39%	11
Exhaust " 4:15 " ..	"	"	46		60		7
Washed " " ..	"	"	30	35%	8	87%	2

TABLE VIII

Results of Analyses of Water From Air Washer After Short Time Tests Using Outside Air and Recirculated Air

Determination	1 Tap Water	2 *Washer* Using Outside Air	3 *Washer* Before Using	4 *Washer* Recirculation Without Use	5 *Washer* Recirculation With Use	6 *Washer* Recirculation Without Use
	(Results	Expressed in Parts per Million.)				
Date of Test	Mar. 4	Mar. 4	Mar. 17	Mar. 17	Mar. 17	Mar. 18
Period of Test	..	6 hrs.	..	4 hrs.	4 hrs.*	4 hrs.
Time of Sampling	1 P.M.	3:30P.M	9 A.M.	1 P.M.	6 P.M.	1 P.M.
Temperature	..	38° F.	..	54° F.	50° F.	55° F.
Turbidity	0	10	1	5	5	5
Color	13	42	15	26	21	24
Odor	1v	1v	2v	3a	3a	3a
Total Solids	30.0	66.0	36.0	49.0	46.0	51.0
Loss on Ignition	10.0	32.0	17.0	20.0	17.0	18.0
Fixed Solids	20.0	44.0	19.0	29.0	29.0	33.0
Total Organic Nitrogen	.100	.300	.100	.136	.108	.144
Albuminoid Nitrogen	.048	.140	.068	.108	.092	.114
Free Ammonia	.018	.218	.006	.404	.362	.508
Nitrites	.000	.016	.001	.007	.005	.007
Nitrates	.05	.06	trace	.06	.06	.06
Oxygen Consumed	2.7	4.3	2.6	3.5	3.3	4.0
Chlorine	1.7	1.9	1.3	1.5	1.7	2.5
Hardness	11.0	19.5	10.0	19.5	17.5	20.0
Alkalinity	6.5	12.0	6.5	11.5	10.0	13.5
Incrustants	4.5	7.5	3.5	8.0	7.5	6.5
Iron	0.2	2.5	0.4	0.8	0.7	0.8
Total Bacteria						
Gelatine 4 days at 20°	80	90,000	380	12,000	20,000	2900
Litmus Agar 2 days at 38°	7	9	3	10	75	55
Molds on Gelatine	0	200	6	800	300	200
Amorphous Matter	0	1,000	184	638	574	238

*The number of men hours for this period was 180.

When the exhaust air left the gymnasium it had a noticeably sour and musty odor. After passing through the washer this was almost completely removed and the returned air was fresh and sweet. At the same time the "gymnasium odor" was acquired by the washer water and could be easily detected in the sample bottles. The washer water was also found to contain large numbers of bacteria and many epithelial

TABLE IX.

Quantitative Determinations of Bacteria in Air.

Sample	1 Date 1913	2 Bacteria per Cubic Foot — Gelatine at 20° Number	3 Gelatine at 20° Per Cent Removal	4 Litmus Agar at 38° Number	5 Litmus Agar at 38° Per Cent Removal	6 Molds per cu. ft. (Gelatine)
Using Outside Air						
Outside Air 1:30 P.M.	Mch. 4	27		7		0
Washed Air 2:00 P.M.	"	7	74%	3	57%	0
Exhaust Air 1:10 P.M.	"	27		17		3
Exhaust Air 3:45 P.M.	"	37		23		16
Outside Air 2:10 P.M.	Mch. 11	17		3		0
Washed Air 2:40 P.M.	"	12	29%	0	100%	0
Exhaust Air 1:30 P.M.	"	57		13		23
Exhaust Air 4:00 P.M.	"	130		30		30
(Without Washing)						
Outside Air 4:00 P.M.	Mch. 18	23		6		23
Exhaust Air 4:30 P.M.	"	300		153		40
Recirculation, With Occupants						
Exhaust Air 2:30 P.M.	Feb. 13	193		3		20
Washed Air 2:30 P.M.	"	44	77%	0	100%	17
Exhaust Air 4:15 P.M.	"	100		0		13
Washed Air 4:15 P.M.	"	10	90%	0	..	10
Exhaust Air 2:15 P.M.	Mch. 17	483*		56		83
Exhaust Air 5:15 P.M.	"	93		26		23
Washed Air 5:30 P.M.	"	66	29%	17	35%	17
Recirculation, Without Occupants						
Exhaust Air 10:55 A.M.	Mch. 17	170		3		56
Exhaust Air 1:05 P.M.	"	83		7		53
Washed Air 1:25 P.M.	"	63	24%	7	0%	20
Exhaust Air 12:00 P.M.	Mch. 18	86		17		46
Washed Air 12:35 P.M.	"	60	30%	3	82%	17

*Possibly influenced by taking sample too soon after starting fans.

scales derived from the skin of the men exercising on the floor. Dust, bacteria, molds, nitrogen, and iron were removed from the indoor air by the washer at Springfield to about the same extent as by the washers

TABLE X

Quantitative Determination of Dust.

Sample	Date 1913	Number Dust Particles Per Cu. Ft.	Per Cent Removal	Remarks
Using Outside Air				
Outside Air 1:30 P.M.	Mch. 4	103,000		Mild. Thawing.
Washed Air 2:00 P.M.	"	98,300	5%	Light breeze.
Exhaust Air 1:10 P.M.	"	56,300		
Exhaust Air 3:45 P.M.	"	115,000		
Outside Air 2:10 P.M.	Mch. 11	17,200		Cloudy. Light breeze.
Washed Air 2:40 P.M.	"	13,000	24.5%	Heavy rainfall previous night.
Exhaust Air 1:30 P.M.	"	63,000		
Exhaust Air 4:00 P.M.	"	87,700		
(Without Washing)				
Outside Air 4:10 P.M.	Mch. 18	124,000		Slightly above freezing. Brisk S. W. winds. Washer idle.
Exhaust Air 4:45 P.M.	"	200,000		
Recirculation, With Occupants				
Exhaust Air 2:30 P.M.	Feb. 13	415,000		Temperature below freezing. Light to brisk wind.
Washed Air 2:30 P.M.	"	149,000	64%	
Exhaust Air 4:15 P.M.	"	266,000		
Washed Air 4:15 P.M.	"	122,000	54%	
Exhaust Air 5:10 P.M.	Mch. 17	171,000		Temperature about freezing. Light to brisk W. wind. Fair.
Washed Air 5:40 P.M.	"	91,300	47%	
Recirculation, Without Occupants.				
Exhaust Air 10:45 A.M.	Mch. 17	131,000		Temperature about freezing. Light to brisk W. wind. Fair.
Exhaust Air 1:10 P.M.	"	97,000		
Washed Air 1:20 P.M.	"	59,700	39%	
Exhaust Air 12:10 P.M.	Mch. 18	90,000		Slightly above freezing. Fresh to brisk S. W. wind.
Washed Air 12:25 P.M.	"	57,000	37%	

tested in Boston. The results indicated that under the conditions there existing the exhaust air could be washed and returned to the gymnasium with entire safety and comfort to the occupants of the room and with no apparent sacrifice of wholesome properties. The carbonic acid was not reduced by the air washer—and theoretically it ought not to be reduced—but this fact did not at all affect the acceptability of the washed air to the occupants. The details of these experiments are described in The American Physical Education Review, December 1913. Generalizing from these results, it may be said that the recirculated air after washing was cleaner than unwashed outdoor air, but was slightly less clean than the outdoor air after washing.

The advantage of washing and recirculating the air lies in the great saving of heat in cold weather. Mr. D. D. Kimball, who designed the ventilating plant at Springfield, estimated that when the outdoor temperature was 32° F. the saving in cost of operation effected by recirculating washed air was 40%, while with an outdoor temperature of 0° F. the saving was 50%. The use of less coal at Springfield, when the air was being recirculated instead of being drawn in from outdoors was plainly evident and was commented upon by the engineer in charge of the Springfield plant. In the summer the washer may be operated as a cooling plant to keep down the temperature of the indoor air, or with the windows open it may be shut down to save expense.

The common standard of 30 cubic feet of air per capita per minute, which is now generally applied to schoolhouses, was based upon the idea of keeping the carbonic acid down to a fixed amount. When it became recognized a few years ago that carbonic acid was a negligible factor, some made the inference that a smaller volume of air would suffice. They failed to consider that circulation of the air is of itself one of the essential elements of indoor comfort and a necessary feature of good ventilation.

The cost of heating large volumes of cold air has naturally stood in the way of efficient ventilation of schools and factories during the cold weather. Another difficulty has been the low indoor relative humidity produced by heating outdoor winter air to a comfortable room temperature. If, therefore, both of these objections can be overcome by washing air and using it over and over, so as to furnish an ample supply of clean air in motion the method is one that has much to commend it. Naturally there would be a limit to the continued use of the same air, but ordinary leakage and the possible use of a small percentage of outside air would prevent the concentration of any substances not removed by the washer.

Our study of the subject of air washing has led us to believe that it is one of the vital elements of ventilation in localities where it is difficult to obtain a supply of clean air, and that the recirculation of air thus washed is deserving of serious consideration from the standpoint of economy. It is very evident that the air washers now in operation are not giving as high a degree of efficiency as might be obtained with better designs and more skillful operation and the details of the process should be submitted to careful scientific research.

THE EFFECT OF CONDITIONS OF SCHOOL ROOM HEATING AND VENTILATING ON SCHOOL ATTENDANCE

BY

CHAS. H. KEENE

The following report concerning "The Effect of Conditions of School Room Heating and Ventilating on School Attendance" is based almost entirely on the amount of absence from various class rooms during the past school year. The precentages reported are the percentages of absence, so that a high percentage shows a condition of poor attendance. Other things being equal, the attendance in a class room is a fair index of the health conditions in that room, particularly when the attendance of one room in a building is compared with the attendance in other rooms of the same building or district, of the same or nearly the same grade.

We have in our city about 21 so-called portable buildings, which are really one-room school buildings heated and ventilated by means of a jacketed stove, so arranged that cool air from the outside enters the room about the base of this stove, is heated, rises to the upper part of the room, spreads over the room, settles, and is withdrawn from the room by a gravity foul air duct, the room opening of which is situated at or near the floor level. This is really a gravity system, with the addition that the teachers are at all times allowed to open class room windows if they wish. As a matter of common observance, most of them do wish to frequently. The conditions in these rooms are practically always good. The "school odor" which is so commonly present in schools ventilated by the usual ventilating system, is practically never present. In these portable rooms the teachers are almost universally pleased with the conditions. We have frequent requests from grade school teachers to be transferred to these rooms, but very rarely do we find a teacher in one of these rooms desiring to be transferred to a large building.

The writer of this report does not wish to advance any particular theories, but simply wishes to set forth a series of figures based on the actual attendance. Such a report, covering only one year, must necessarily be in the nature of a preliminary one.

The average absence by grades was figured for the lower three grades separately, as most of the portable buildings contain some one of these grades. The average absence for all third grades in the city was 3.64%, of all the second grades was 3.84%, of all the first grades was 4.73%.

Before going into the body of this report, which is mainly upon these portable buildings, I wish to speak of School No. 1. In one room of this building, a fourth grade room, certain experiments were carried on under the supervision of the engineers, whereby every child was given a supply of air directly in front of his face, which was supposed to be properly humidified and to have the proper amount of oxygen and ozone. The records for the year show that the average absence from this room was 4.29%, whereas the average absence in the ordinary rooms of the fourth and third grades in this building was only 3.09%. So far as I have been able to find out no records were kept of the gain in weight of the children of this room as compared with the gain in weight of the children of other rooms, so that about the only basis of judgment as to the healthfulness of these rooms depends upon the average amount of absence. The artificial conditions thus obtained seem, therefore, to be detrimental.

As regards the main topic:

School No. 2 had six portables located in the school yard—three 5th grade, two 4th grade, one 3d grade. The average absence for these portables was 3.71%; the average absence for the whole building, not including these portables, was 3.82%.

School No. 3 had one portable annex, a 1st grade room, having an average absence of 3.02%, as compared with the average 1st grade absence for the whole city of 4.73%.

School No. 4, a group of four isolated portables, had an average absence of 3.9%. The average absence of the nearest large building, School No. 5, was 5.46%. Taking the comparative figures of these rooms by grades, the third grade portable rooms had an average absence of 3.73%, while the third grade absence in the large building was 5.7%; the 2nd grade absence in the portables was 2.68%, in the large building it was 5.15%; the first grade absence in the portables was 5.55%, in the large building it was 5.72%. These figures are universally in favor of the portable buildings; moreover, many of these children had a long distance to travel over streets lacking sidewalks and proper breaking out in snow-time, so that the large amount of absence in the 1st grade, which is in excess of the average for the city, is to be expected.

School No. 6 was a group of two portables in the same school district, even more inaccessible than the above group. Its 2nd grade absence was 5.26% as compared with 5.15% in the large building, and its 1st grade absence was 5.66% as compared with 5.72% in the large building.

School No. 7 had two portables adjacent to the building, containing 3d and 5th grades. Their average absence was 4.05%, as compared with the average absence for the whole building of 3.75%. These seem to be the only rooms in the whole group of portables, having access to a warmed and proper toilet, which have an absence in excess of that of the nearest large building. The cause for this I have been unable to discover.

School No. 8, a single isolated portable of the 1st grade, shows an average absence of 5.08% as compared with the absence of the nearest large building in the 1st grade of 4.39%. Here the children were obliged to use an unheated, outhouse toilet, which undoubtedly accounts to some extent for its large percentage of absence.

School No. 9, a group of three portables containing from the 1st to the 4th grade, had an average absence for the 1st grade of 4.01%, as contrasted with the 4.73% for all the 1st grades of the city. The average for all three of these portables was 3.12%. The average absence of the nearest big building for the lower three grades was 3.15%.

School No. 10 was a group of four portables in a very isolated region lacking sidewalks and proper snow breaking, containing 1st and 2nd grades. The average absence was 5.53%. This apparently high average is undoubtedly due to conditions outside the class room, as the parents objected very strongly to the outdoor toilets which were necessary here. This undoubtedly forced up the percentage of absence.

School No. 11, a group of two portables in an isolated region, contained 1st and 2nd grades. The average absence for the group was 4.10%. The nearest big building had an average absence in its 1st and 2nd grades of 4.33%, while the absence of the 1st and 2nd grades of the whole city was 4.32%.

School No. 12 had one portable, a 3d grade, in the school yard. This is a Jewish district and the percentage of absence is very high, owing to holidays and other things over which school conditions have little control. The average absence for this particular room, however, was 6.75%; for all the 3d grade rooms in this building it was 7.97%; for all the grades in the building it was 8.64%.

In summarizing, we find that the figures are in favor of portable buildings in every case, except at Schools Nos. 7, 8 and 10. The cause of the poor showing of the latter two has been discussed. It may be said that other conditions have caused this favorable result in attendance. This might be if only one or two of these portables were considered, but when the results are so markedly in their favor throughout the city, it seems fair to assume that there is something in the buildings themselves that makes their conditions more healthful, and the only conditions in these portable buildings that vary from those in the large buildings are the method of heating and ventilating.

Whether this improved condition is due to the jacketed stove or to the benefit of opening the windows at any time, it is hard to say. My personal belief is that it is very largely due to the latter.

In addition to these portable buildings handled on a gravity jacketed stove system, we carried on in our schools three open window classes. In these rooms a whole grade of children is placed in a room whose windows are kept open, there being put in the lower sash a cheese cloth screen to prevent direct draft upon the children, and the temperature of the room being maintained at about 55°. The children are allowed to wear extra wraps if they desire, but they are given no extra nourishment, nor is the routine of the class in any way changed. They are not selected in any way whatsoever, except that we obtain the consent of the parents before putting a child into this room. We simply say to the parents of the children in a certain room in the building, "Are you willing that your child shall enter a room similar to the above?" Practically all of them are, and we then open the windows and put in a cheese cloth screen.

In School No. 13, the absence for this open window class, which was opened about February 1, varied as follows: From November 1 to February 1, when the room was run as an ordinary class room on a supposedly modern, fan, plenum system, the average absence was 5.3%. On February 1, the windows were opened and cheese cloth screens installed. The average absence from February 1 to May 1 dropped to 3%. The teacher of this class in a recent letter states that "the establishment of this room was highly satisfactory and beneficial in many ways. We had throughout the remainder of the winter, the best attendance I have ever had in an entering room. The air was at all times fresh and invigorating and we are hoping to be allowed the privilege of continuing its use next year." During this time, February 1 to May 1, the average absence of the other 1st grade rooms in this same building was 5.3%, which is considerably above the average for the city.

Another of these open window rooms, a 4th grade room, was opened about February 1 in School No. 14. The average absence in this room from September 1 to February 1 was 2.37%. The average absence in the room from February 1 to May 1 was 2.88%, an increase of .5%. In the other 4th grade rooms in this building, the average absence from September 1 to February 1 was 5.11%, and from February 1 to May 1 was 6.21%, an increase of over 1%. All the third grade rooms in this building from February 1 to May 1 had an average absence of 4.28% and the average absence for the whole building during the time was 3.66%.

In School No. 15 one of these open window rooms was opened a year ago last March. Its effect was so pleasing that it was continued during the whole of the school year just passed. Owing to an epidemic of measles, the average absence was high, 4.01%, but even this is considerably below the 4.73% which is the average of all 1st grade rooms in the city. These children were kept in the room throughout the year. Their weights were taken at the 1st of November, January and May. For purposes of comparison, the weights were taken in two other 1st grade rooms in the same building. The children in these latter rooms made an average gain of 1.45 pounds, the children in the open window room made an average gain of 1.85 pounds, which is 27% more gain than was made by the children in the ordinary 1st grade rooms.

We have known for some years that children put in open air class rooms and given extra rest and diet, as has been done for tubercular and sick children, will improve remarkably in their general condition and make marvelous gains in health. During eighteen weeks in our own open air school in Minneapolis, the children made an average gain of 3.3 pounds, two of them gained over 9 pounds; one gained 6.6 pounds and made a double promotion in that time. We have not known, however, whether this increase in weight was due to the type of curriculum, to the rest, to the open air, or to the increased diet, or to all these combined. It seems fair to assume, however, from these comparative weights, that a very large proportion of the gain is due to nothing but unadulterated fresh air, which is neither baked nor stewed. If we can maintain class rooms in the public schools on an open window basis, we are making an immense saving, not only in the installation of costly ventilating apparatus and in the fuel now wasted in producing an excessive temperature, but we are also benefiting very largely the children in our schools, and are acquainting their parents with the fact that fresh air is essential, not only in school, but in the home.

Some things are worthy of further study. Will these conditions of better attendance in class rooms heated by a jacketed stove, where the teachers have the privilege of opening the windows, continue through a series of years? Second, and this we propose to examine into more carefully during the coming school year, does the gain in weight of the children in this type of school room compare favorably with the gain in weight of children of like grade and circumstances, in ordinary school rooms ventilated by the fan system? We have seen remarkable gains in weight in open air schools and our recent work shows very favorable extra gain in open window classes. If the figures on the children cared for by the jacketed stove system are in favor of the combination of jacketed stove and open window, what shall be our attitude towards the costly and apparently inefficient system of forced ventilation?

THE PRIMARY PURPOSE OF VENTILATION, TO FACILITATE THE MAINTENANCE OF THE CONSTANT TEMPERATURE OF THE BODY

BY

THEODORE HOUGH

The study of the subject of ventilation* during the past few years has resulted in drawing a sharply marked line between two different but not mutually exclusive explanations of the mode of action of the air of an inhabited room.

The first of these explanations regards the effects of inadequate ventilation as an intoxication of one kind or another, *i. e.*, a harmful effect upon the organism of some material added to the atmosphere of a room from the bodies of those inhabiting it. It is unimportant, for purposes of this classification, whether this material comes from the lungs, mouth, or nasal cavity, or from the skin; or whether the poisoning is of the kind shown in ordinary pharmacological actions like those of strychnine, or digitalis, or whether it involves an anaphylactic reaction. The essence of the theory is that we are dealing with the poisonous action of some foreign constituent of the air on the human body.

According to the other explanation the air of a badly ventilated room reproduces the atmospheric conditions of a warm, calm day of high humidity, and the effect of poor ventilation is primarily and largely due to the combination of high temperature, high humidity, and deficient movement of the air about the bodies of those in the room. That these physical conditions of the atmosphere are harmful no one will deny, nor can any one doubt that the badly ventilated room does produce effects which closely resemble those of a sultry day. It is, however, as we shall see, a fair question whether the physiological effect of bad ventilation and of a sultry atmosphere are essentially identical.

What, then, are the salient features of experiments bearing upon these two explanations? It does not fall within the scope of this paper to give a summary of the literature; but it will assist us in getting our bearings to describe briefly the most significant points. In the first place it is fair to say that all efforts have failed to demonstrate in the

*In this paper we assume that the initial atmosphere of the inhabited room consists of pure air of normal humidity, and deal with the physiological action of this initial air when changed by the presence of human beings in the room. Such conditions as the lowering of the relative humidity by heating cold air are supposed to be remedied before the air is supplied to the room.

air of a badly ventilated room a foreign constituent *which exerts a poisonous action upon being taken into the lungs with the inspired air.* Carbon dioxide must be definitely acquitted of any such action. As to other constiuents, it may be said that although the odor of the air of a crowded room is sufficient evidence of the presence of foreign matter, the experiments supposed to show that this foreign matter, organic or inorganic, when rebreathed is poisonous have failed of confirmation when repeated under properly controlled conditions. In this connection attention should be called to the fact that harmful results obtained by the subcutaneous injection of material obtained in one way or another from a vitiated atmosphere do not prove that this air is capable of poisoning the body when it is rebreathed, nor is it an ultra-refinement of logic to say that the only acceptible proof that the bad effects of poor ventilation are due to the poisonous action of foreign constituents is to reproduce these effects by *rebreathing the foreign material* in concentrations in which they occur in the room, and with other unfavorable concomitant atmospheric conditions of such rooms excluded. It is not too much to say that no such proof has yet been given.

These considerations apply to the very striking experiments of Rosenau which show that, when the air of a confined space inhabited by one animal is cooled so as to condense certain substances out of it, subcutaneous injection of this condensed material sensitizes another animal so that a second injection of the blood serum of the first animal produces an anaphylactic reaction. These experiments are very important, for at present they constitute the only evidence in our possession of the existence of poisonous material in the air of an inhabited room, but attention must be called to the fact that the anaphylactic reaction has not been produced in a sensitized animal by rebreathing the vitiated air. Until this is done we are not justified in accepting this as the solution of the problem before us. We take this position at the same time that we fully recognize the suggestiveness of the work and express the hope that future experiments along this line will contribute materially to the solution of the physiological problem of ventilation.

The role of the physical conditions which we sum up under the term "sultry" atmosphere in producing the effects of poor ventilation is indicated by numerous observations and experiments. I have already cited in another paper the experience of a friend of mine in ventilating a crowded lecture room. He found that no complaints of bad ventilation came if he kept the temperature of the room at 68° F. by forcing in cold air, but had such complaints if the temperature was much above 70° F., although it often occurred that the actual amount of outdoor air supplied in the latter case was greater than in the former. It is significant, too, that these complaints were not usually of the temperature of the room but of its ventilation. It would be a fair reply to this to say that it is only when the room temperature rises above 70° F. that perspiration begins to be secreted by the sweat glands and that the "crowd poison" may be some material volatilized from the perspiration. Here the cabinet experiments add to our exact knowledge.

When one or more persons are enclosed in a comparatively small air-tight cabinet and thus exposed to the vitiated air which gradually accumulated therein, there is experienced sooner or later and often in very intense form the effects of inadequate ventilation. But these effects can be lessened or delayed, by anyone of three means: (1) by absorbing the excess of water vapor; (2) by the use of an electric fan; or (3) by preventing the rise of temperature of the air of the cabinet. A combination of any two or of all three of these procedures is more effective than is any one taken alone. Flügge and his pupils have, moreover, found that if by the use of a nose or mouth piece provided with suitable valves, the subject within the cabinet breathes the pure air from outside the same results are obtained as when he breathes the air of the cabinet. In this form of experiment the subject is not breathing the "crowd poison," although the surface of his body is exposed to the sultry atmosphere of the cabinet. On the other hand if the subject of experiment remains outside the cabinet but breathes (through the nose or mouth mask) the air of the cabinet vitiated by the presence of a second person no bad effects are felt. While it is fair to urge that these experiments are lacking in any objective test and that the subjects of the experiments may have mistaken their feelings of discomfort for the effects of bad ventilation, yet the fact remains that *they record no ill effects whatever when the physical atmospheric conditions to which the skin is exposed are kept ideal, even though they are breathing into their lungs a highly vitiated air.* If bad ventilation acts solely or chiefly by the poisonous action of a foreign agent in the atmosphere, why were no ill effects experienced when the subjects of these experiments were exposed to this hypothetical "poison"? I see no answer to this except that conscious or unconscious leaning toward a certain theory made the subjects incapable of correct observation. I can only say that on the basis of my personal experience with certain cabinet experiments I am inclined to give little weight to this explanation of the results.

It will assist toward the practical solution of our problem if we consider certain objections which have been raised against the theory we are now considering. We are peculiarly liable to regard the problem of ventilation as a simple problem, involving only a single factor or at most a group of cognate factors, while, as a matter of fact, it may be a problem involving several factors of very diverse character. Hence an objection to a certain solution, although really nothing more than an indication that the problem has been only partially solved, may be mistaken for a conclusive argument against the solution.

The first objection I shall consider is that many persons find the effects of a sultry day qualitatively different from those of bad ventilation. These subjective differences, however, may be partially if not largely due to the well known individual variations in the sensitiveness to odors; for if the odor of "polluted air" produces unfavorable effects, it becomes a real factor in the physiological as well as the practical problem of ventilation. It makes no difference whether the effect is entirely "psychic," for a psychic effect is as real a thing as a toxic effect; and it would be the height of absurdity to say that we should not provide for the person who suffers from these psychic effects of the odor of the air. We will all admit, then, that the air must either be renewed, or purified in the process of recirculation.

But to admit the reality of these effects is by no means to say that the physical conditions of the atmosphere as above outlined are not of primary importance in the problem of ventilation. The writer of this paper is most unfavorably affected by the odor of the air of a badly ventilated room whenever he is conscious of it, indeed the effect in his case can properly be described as a very real physical depression; and yet he has remained without any discomfort whatever for an hour in a closed cabinet, the air of which had an overpowering odor to the attendant upon opening the door. The subject of experiment was unconscious of the odor and it did not influence him. In this same series of experiments, unless the temperature was kept down to 70° F. and excessive humidity prevented, marked discomfort was invariably the result; and this discomfort was essentially the same as that experienced in a poorly ventilated room or on a warm muggy day in summer.

A second objection is that out-of-doors a stagnant, humid atmosphere does not become particularly uncomfortable at a temperature of 73–75° F. whereas the badly ventilated room of this temperature is distinctly oppressive. But there is usually one great difference between the two cases. In the crowded room there is rarely any considerable movement of air about the bodies of those in the room; on the other hand it is distinctly the exception to have no breeze whatever on a sultry day out of doors; and even in the house we usually get some movement of air by opening windows and doors. Now it is precisely the formation of an "aërial blanket" about the skin which is a most important, if indeed it is not the most important source of trouble in the crowded room. This aërial blanket acts, of course, by interfering with the loss of heat from the body, by diminishing both convection of heat and evaporation of perspiration; and I doubt whether anyone sitting still out of doors on a perfectly calm, muggy day of 73° to 75° F.

temperature would fail to note at least the partial correspondence between his discomfort and that which he experiences in a crowded room. It must not be forgotten that it requires only a very slight movement of air to get rid of the aërial blanket; less in fact than would ordinarily be dignified with the name "breeze." This is generally present on the sultry day, especially out of doors; it is usually absent in the crowded room.

I think that in stating this atmospheric aspect of ventilation this factor of air movement has been neglected in our attention to the factors of temperature and humidity. It is not anyone, nor any two of these factors which must be watched. It is all three, and this because all three have the common result of raising the temperature of the skin, thereby introducing into the body the conditions which lead to discomfort, lassitude, headaches, etc.

A third objection which has been urged against the theory is that the vapor chamber of a Turkish bath presents the combination of lack of air movement, high humidity, and high temperature; and yet while exposed to this atmosphere we do not experience the depressing effects of bad ventilation; on the contrary the vapor bath is stimulating. This objection is certainly not well taken. A temperature of 120° F. or more produces very different physiological effects from those produced by a temperature of 75–100° F. It is well known that hot water stimulates both the nerves of heat and those of pain, and that in the stimulus from very hot water that of pain preponderates; and the same thing is true of hot, moist air. Possibly, too, the elevation of body temperature may also contribute to the stimulating result of the Turkish bath. That the physiological effect of high temperature (*e. g.* 120° F.) differs qualitatively, and not simply quantitatively from that of lower (*e. g.* 90° F.) temperature is also shown by the fact that a lukewarm bath generally lowers arterial blood pressure while a hot bath generally raises it. Probably the explanation of the effect of the higher temperature in both cases is the introduction of a new physiological complex through the afferent channel of the nerves of pain. It should also be remembered that, as shown by Head and Rivers, there are two groups of afferent nerves included under the "heat nerves;" the epicritic fibres, whose end organs respond to any elevation of the temperature of the skin, and the protopathic fibres, which respond only to temperatures of 37° C. and higher. The specific reflex connections of these two groups of fibres has not as yet been investigated; but it is quite possible that this also plays some role in the different effects of moderate and strong heat stimulation. At any rate enough has been said to show that the objection in question is not at present logically valid.

Summing up the main points of the foregoing discussion, it would seem fair to say that there is at present no conclusive proof of the presence of a toxic agent in the air of a crowded room but that the possibility of this is not excluded. The effect of inadequate ventilation is probably a complex matter in which several factors contribute to the result. We know and must reckon with some of these factors, while probably others are as yet unknown. Two at least seem to be established namely, the influence upon the organism of conscious sensations of smell, and the unfavorable circulatory and other adjustments forced upon the body in order to maintain its normal temperature under the atmospheric conditions of increased temperature, humidity, and stillness. It is, moreover, probable that the influence of these several factors varies with different individuals, according to their sensitiveness to disagreeable odors, the thickness of their subcutaneous layer of fat, or the intensity of their reaction to the atmospheric conditions in question. It is also modified by a psychic factor; for the man or woman who firmly believes in the existence of "crowd poison" and who consciously or unconsciously identifies this crowd poison with the odoriferous foreign matter will suffer ill effects as soon as he becomes conscious of the odor, even though the physcial condition of the atmospher may be ideal; on the other hand, the man who is not worried by the odor of the air or the man who is unconscious of it may notice no ill effects in the same room. The influence of inadequate ventilation no doubt also differs according to what one is trying to do when exposed to it. It may be negligible in the case of one doing a routine, mechanical task, but very marked in another whose work requires close attention and accurate thinking.

If the writer seems to appear in the role of a partisan of the view that the problem of ventilation is *primarily* a problem of the mechanism of temperature regulation of the body, this is not because he would belittle other possible factors, far less close the door to further investigation; but rather because he believes that everything indicates that this factor is of prime importance; that it is invariably present in a poorly ventilated room; that it inevitably affects unfavorably every inhabitant of such rooms; and that it must be cared for in practice, no matter what else we may try to accomplish. Any practical efforts at ventilation which neglect it are sure to fail and those which provide for it are sure to be at least measurably successful. In other words, it is a real advance in the practical hygiene of our subject to recognize that the primary problem of ventilation is not the removal of poisonous material which would otherwise be breathed into the lungs, but the maintenance of the physical conditions of that portion of the atmosphere in immediate contact with the surface of the body in such form as will place the minimum burden upon the mechanism of temperature regulation.

In the above discussion we have not touched upon the very important question of the physiological action of these unfavorable atmospheric conditions, for it is not possible to treat them within the limits of this paper. Doubtless this physiological action is complex, consisting partly of undesirable changes in the distribution of blood whereby certain organs are deprived of their normal supply in order to rush all the blood possible to the skin; partially to the conscious discomfort of an overheated and moist skin, and partially to some as yet imperfectly understood effect upon the oxygen-carrying function of the blood. Especially suggestive are the observations of Barcroft and his co-workers on the effect of moist heat upon the dissociation curve of blood. (Journal of Physiology, 1913, XLV, p. xlvii.)

In conclusion let us consider some practical application of the theory that the physiological problem of ventilation is primarily a matter of the mechanism of temperature regulation in the body:

1. When the temperature of the atmosphere about the surface of the body is kept at about 68°-70° F. the problem of ventilation is largely solved. "Foul air," *i. e.* air having a distinctly disagreeable odor must of course be removed; but at this temperature the unpleasant odors seem to be less intense, probably because of the smaller secretion and evaporation of the perspiration.

We may call this the critical room temperature, for it is the dividing line between those temperatures at which the body becomes chilly and those at which it must take active measures to get rid of the heat necessarily produced in its life processes. The correction of too low a room temperature is the problem of heating; the correction of the conditions above this critical temperature is the primary problem of ventilation. So long as the room temperature is kept at the critical point, humidity and air movement are negligible factors, so far as the regulation of the temperature of the body is concerned. Renewal of the air is necessary, but the less draft produced in accomplishing this the better. This statement, however, holds true only for this critical temperature.

2. If it is not possible to keep the temperature of the air immediately about the body at 68°-70° F., the first recourse must be to those measures which favor the prompt evaporation of the perspiration. To be strictly accurate, it is not the temperature of the air immediately about the skin, but the temperature (and perhaps the water content) of the skin which determines the comfort or discomfort of the subject. Air at 85° F., if fairly dry and in motion, may through the effective evaporation of the perspiration keep the skin at the same temperature as comparatively still air at 70° F. In other words the two cases present identical physiological conditions, although this physiological condition

results from very different physical properties of the air immediately about the body. Consequently in practical ventilation there are two rules to follow at room temperature above 70° F. The first is to keep down the humidity of the air as much as possible; the second and more important is to keep the air about the body in motion; if in doing this it is renewed, so much the better. The first requisite on hot days is a breeze; and the most important practical problem in the ventilation of a crowded room is to secure this breeze, *so as to maintain the temperature of the skin at the optimum point*, *i. e.*, the point which it has in a comparatively dry atmosphere of 68°-70° F. when the subject is at rest. Sometimes this is best secured in one way, sometimes in another. Thus if cool air can be admitted from outside it is better to open windows wide or in other ways to admit this air. If, on the other hand, the outside air is very hot, it is better to admit it only sparingly and depend upon electric fans to produce the essential movement of air.

To put the same thing in another way: On a hot (*e. g.*, 90° F.) day a room may be better ventilated when its temperature is kept down by opening the windows only enough to secure moderate renewal of the air and keeping the cooler air within in movement by the use of fans, even though the renewal of the air be very imperfect, than it would be when the air is thoroughly renewed by sending in large quantities of hot and perhaps humid air from outside. In this and all similar cases, the first thing to make sure of in meeting the problem of ventilation is not the renewal of the air breathed but the maintenance of the temperature of the skin as nearly as possible at what we have called the optimum point. At 68° F. no great amount of movement of air is needed; indeed it is not desirable; at 80° F. it is necessary; and for precisely the same purpose in the two cases, in order to maintain the proper skin temperature.

Finally, to avoid misunderstanding, it must be distinctly understood that we only assert that the regulation of these atmospheric conditions which come into relation with the mechanism of temperature regulation in the body, are of first importance; we do not assert that this alone is important. We simply insist on this as something which must not be neglected, indeed must be first attended to in practical ventilation, and we insist upon this without in the least denying that other factors may and do need attention.

DISCUSSION OF

Papers of Drs. McCurdy, Keene and Hough

BY

A. H. MacKay

I recognize that the small degree of exhaustion of oxygen and increase of carbon dioxide in school room air are not of themselves the most serious defects under ordinary conditions. The more indeterminate gaseous excreta from the lungs and skin have always appeared to me to be the more serious, notwithstanding the assurance from some quarters of their non-toxic character. It may be but a fancy, but the air of a badly ventilated crowded public meeting seems to have the physiological effect, among others, of acceleration of the pulse, while depressing the power of attention and inducing sleepiness. The stale odor of the vacant unventilated school has always a powerfully unpleasant psychological effect. I fancy that any system of ventilation saving the expenditure of heat by washing and returning the air, should wash out very thoroughly these offensive organic substances and odors. The elimination of carbon dioxide may be assumed to be approximately proportional to these more subtle and indefinite excreta. Its measurement, therefore, will indicate very nearly the general degree of the defilement of the air. What I should like to know is the character and effects of this air defilement, and the character and efficiency of the washing of the air which is being returned for rebreathing?

SESSION FOUR

Room A. Wednesday, August 27th, 2:00 P.M.

THE VENTILATING, HEATING AND CLEANING OF SCHOOL BUILDINGS (Part Two)

FREDERIC BASS, *Chairman*

DR. ARTHUR SCHAEFER, Buffalo, N. Y., *Vice-Chairman*

Program of Session Four

FREDERIC BASS, B.S., Director, Engineering Division, Minnesota State Board of Health. "An Experiment in School Room Ventilation."

JOHN W. SHEPHERD, A.M., Head of Department of Science, Chicago Normal College. "Some Experiments on the Ventilation of a School Room."

GEORGE W. FITZ, M.D., Formerly Assistant Professor of Physiology and Hygiene and Medical Visitor, Harvard University. "Physiologic Cost of Insufficient Protective Clothing."

JOHN C. OLSEN, Ph.D., Professor of Analytical Chemistry, Polytechnic Institute, College of Engineering, Brooklyn, N. Y. "The Purification of Air and Water by Means of Ozone."

Professor Dr. SELTER, Dozent für Hygiene, University, Bonn. "Ventilation und Heizung der Schulräume."

Papers Presented in Absentia in Session Four (Read by Title)

JULIUS BRANDAU, M.D., Kassel, Germany. "Der Einfluss der kalten Füsse auf die Geistestätigkeit der Schulkinder."

LEONARD NICE, Ph.D., Professor of Hygiene, University of Oklahoma. "Book Disinfection—A Neglected Factor in School Sanitation."

MELVIN G. OVERLOCK, M.D., State Inspector of Health, Worcester, Mass. "Proper Ventilation of School Buildings."

MILTON W. FRANKLIN, A.M., M.D., Manager Ozone Department, General Electric Company, New York City. "Ozone in Ventilation."

Dr. SCHOENFELDER, Stadtbaurat und Kgl. Baurat, Elberfeld, Germany. "Die Reinhaltung der Schulräume."

AN EXPERIMENT IN SCHOOL ROOM VENTILATION

BY

Frederic Bass

The standards of ventilating practice as applied to closed rooms of human occupancy have in the past been almost universally quite crude. It has been determined that when the carbon dioxide content rises above 10 parts per 10,000 in an occupied room odors will be noticeable. With the ordinary system of ventilation in use in school rooms, 30 cubic feet of air per minute per person is necessary to secure immunity from odor.

Many laboratory experiments have been conducted upon single individuals which show that no deleterious physiological results are apparent when the carbon dioxide rises to 200 parts per 10,000, whether as a metabolic product or artificially introduced. Such experiments have also shown that the oxygen content of the air is sufficient when it is above 19%. Further, it has been found that air must be kept in motion under these conditions in order to maintain comfort.

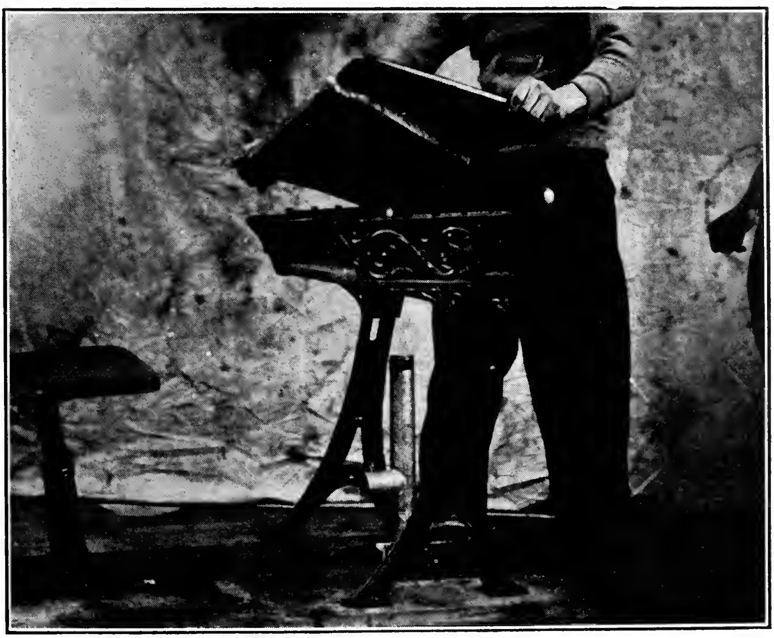


FIGURE 1

If these conclusions are sound as applied to the practical conditions of a school room, it should be unnecessary to take air from the outside of a building, raise the temperature from 30 degrees to 130 degrees F. and after passing it through the room, exhaust it at the higher temperature into the outer air. The ordinary leakage through walls, crevices and past occasionally opened doors is sufficient to provide more than enough oxygen for respiration and to carry away the excess humidity and bodily heat. In such a room, the air would have to be sensibly in motion.

FIGURE 2

The writer believed it would be desirable to apply these principles under normal school conditions, and having obtained a grant from the research fund of the University of Minnesota, fitted out a school room as described below.

A room was selected on the first floor of the Jackson School in Minneapolis. The air to be delivered to the pupils in the room was taken in through a window in the basement and passed over two Vento radiators to a Webster air washer and humidifier, thence to a heating coil, from which the air was blown to the outlets in the room by means of a Sirocco blower. This apparatus was loaned through the courtesy of the Morgan-Gerrish Company of Minneapolis. The main duct from the blower was carried along the ceiling at one end of the basement room immediately below the room in which the pupils to be the subjects of the experiment were located and from it three ducts were extended parallel to the rows of desks. From these ducts, the air was carried through two-inch risers extending through the floor to each desk in the room above, at which points it entered the room through funnel-shaped orifices.

Previous experiment with a single desk and funnel ventilator had

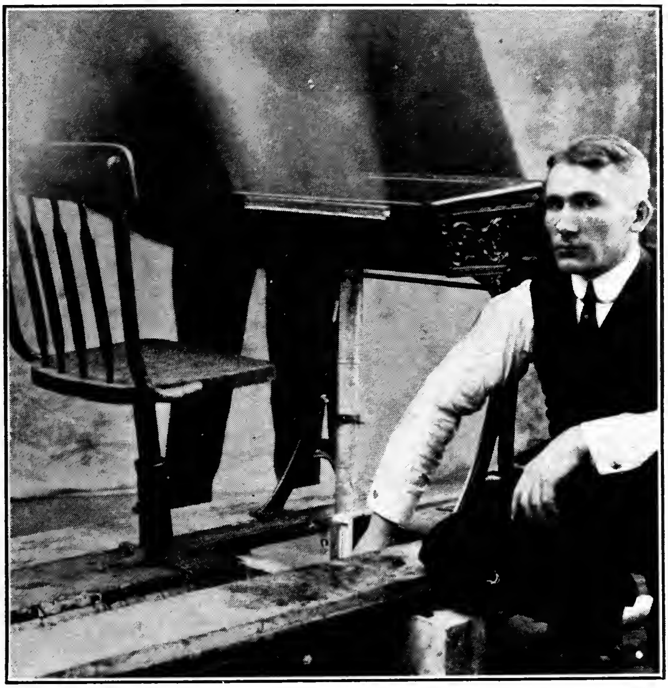


FIGURE 3

shown that with seven cubic feet of air per minute, the head and shoulders of the pupil could be surrounded by air moving at a velocity sufficient to carry away the breath, but still not great enough to be objectionable. In this way it was made certain that each pupil would actually receive the air both in quantity and quality that was desirable, and by means of a number of openings in the ceiling, through which the air was drawn by an exhaust fan, it was made equally certain that the exhaled air would be immediately removed from the room.

In the preliminary experiments to determine the best type and location of orifice for admission of air to the room, the first form experimented upon was an elongated orifice or slit in the front edge of the desk. Figures 1, 2 and 3 show views of this orifice. The funnel type shown in Figure 4 gave a much better distribution of air and for other reasons was much better adapted for use in a school room and it was accordingly adopted. Figure 5 shows the school desks themselves with a number of these orifices in position. Figure 6 is a view in the basement room below the room fitted out, and shows the heating coils, washer, blower, regulating devices, as well as the system of pipes used to distribute the air to the desks. In addition to the inlets at the desks, two lines of six inch pipes, with 1 inch by 2 inch rectangular orifices one foot apart

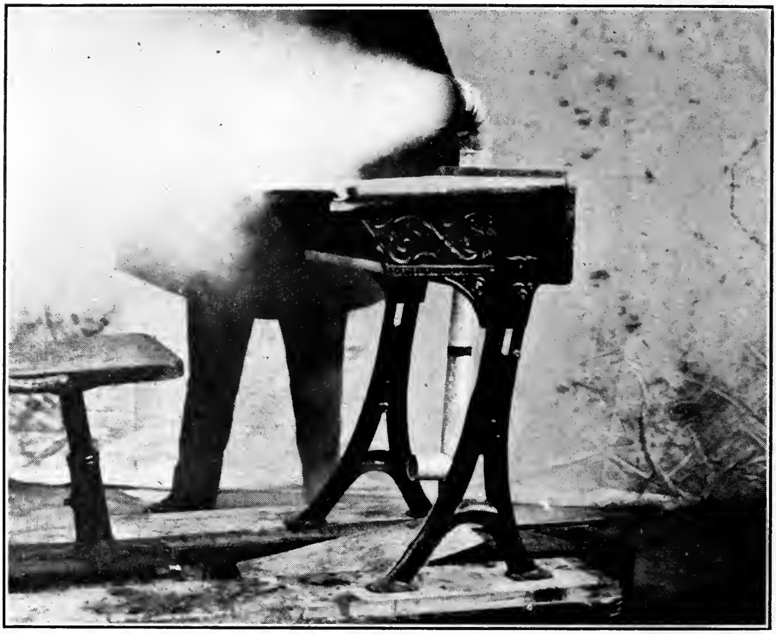


FIGURE 4

were placed along the two sides of the room at a height of six feet from the floor; approximately 50 cubic feet of air per minute was blown into the room through these openings.

The cumbersome appearance of this apparatus is due to the fact that the washer, blower and heating coils were loaned and it was necessary to use the particular apparatus available, although it was larger than necessary. The direct radiation in the room, the temperature of the entering air and the temperature of the water in the air washer were automatically regulated by thermostatic control put in by the Johnson Service Company. The piping and sheet metal work was done by the Waterman-Waterbury Company of Minneapolis. In addition to the above described apparatus, an ozone generator was installed by A. R. Willford of Minneapolis. The ozone was generated by an electrical current at 9,000 volts. It was forced into the pipe system by a small Sirocco fan. The ozonizer was calibrated by the potassium iodide method. The ozone was introduced into the room in the proportion of one part to 1,000,000 parts of air. The heating of the room was performed by direct radiation controlled by Johnson thermostats.

Operation. The room was supplied with about 8½ cubic feet of air per minute per capita and the velocity of the air as it reached the

FIGURE 5

faces of the pupils was at the center of the current about 1½ foot per second. During the period the characteristic odor of ozone was perceptible in the room and apparently kept the air in an acceptable and pleasant condition, for on one occasion the Sirocco motor-blower set which forced the ozone into the air current was temporarily disconnected and the teacher, now knowing what had happened, within half an hour felt it necessary to open the windows and to call attention to the marked change in the air.

A group of pupils in the room described was selected for physiological and psychological tests. A control group of children of the same grade and general characteristics of race and living conditions was selected in a nearby school where an ordinary fan ventilating system delivering about 30 cubic feet of air per minute was installed.

The description of the experimental work may be divided into three divisions, as follows: (*a*) Physical records, including measurements of air velocities and volumes, temperature records and humidity observations; (*b*) Physiological observations, including bodily temperatures

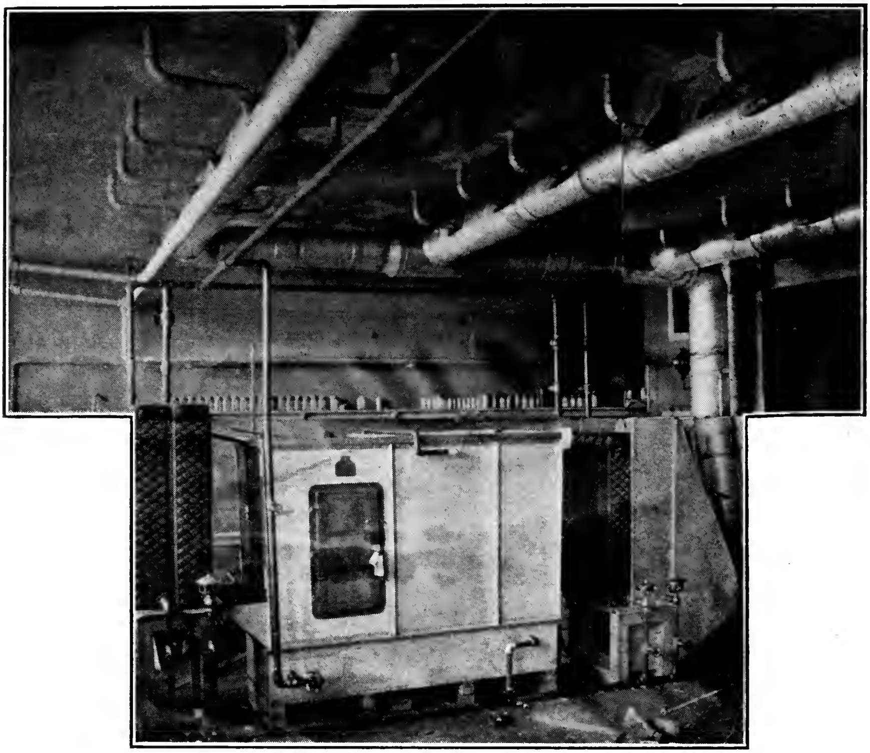


FIGURE 6

and blood pressures, and (*c*) Psychological tests, including division, substitution and motor tests. The physical records and the manipulation of the plant was performed by W. J. Bingen, a post-graduate student in the College of Engineering; the physiological observations were made by Dr. E. J. Heunnekens, and the psychological work and computation was performed by Mr. H. D. Kitson, a post-graduate student in the College of Science, Literature and the Arts.

The detail of the tests is given in an Appendix.

The results of this study show that the change in ventilation made at the Jackson School produced no appreciable effect upon the work of the children in the tests with the possible exception of a slight difference in substitution work, which may be explained on other grounds. This conclusion is substantiated by the work of the children in the following forms of psycho-physical activity; (1) solving problems in short division, a task involving a high type of selective thinking and memory processes; (2) learning to make substitutions, a task partly mental and partly motor; (3) movement of the index finger, a strictly motor act. In neither the division or motor tests is there indication of any effect of change in ventilation, and the slight difference observable in the second week's substitution work is not outside the range of chance error. The work was examined with reference to total amount, rate of improvement, and rate of fatigue, and in all these respects, except that cited above, the work of the test group showed practically no variation from that of the control group where the ventilation was unchanged.

Generally speaking, the results of the tests in the two groups showed parallelism. The work in division, however, showed a very marked divergence. The test group showed an average gain of 64% in this test while the control group showed but 25%. This difference aroused suspicion and an investigation showed that the test group had been coached by the teacher. This unfortunate occurrence made it impossible to compare the total work done in division of the two groups.

Conclusion. From the standpoint of the engineer, it is interesting to know that it is possible to renew the air of a fully occupied school room for a period of three hours (with recess period as usual) without the use of outside air other than that which leaked through crevices and occasionally opened doors and other minor openings, and during this period to keep the air sweet and comfortable. It is further interesting to know that the continuation of this form of air renewal day after day, five hours each day (three hours and two hours) for three weeks had no perceptible effect upon a group of school children under careful observation by expert observers making physiological and psychological determinations. The conditions in the room were such that the teacher and pupils were perfectly content and satisfied at all times and unaware of the fact that they were not being treated to the air of the street instead of the renewed air of their own room. At one time during the test, a small fan supplying ozone failed and the effect was noticed within a few minutes by the teacher, who felt that the air was "stuffy," although she had no way of knowing of the accident. Apparently in this case the ozone alone kept the air of the room in a comfortable condition. Ozone has an affinity for water-vapor, and if there were enough of it, humidity might be reduced by it, but in this experiment there was not enough ozone to materially affect the humidity. The humidity due to evaporation from the pupils may have been partially removed by condensation on the cold surfaces of the distribution pipes in the basement and by the air leakage from the room.

The psychological tests were carefully planned and executed; their value for such work cannot be doubted, for the delicacy is admirably fitted to detect and measure the elusive effects which have been usually described as "sense of oppression," "dullness," "restlessness," "sleepiness," and others due to poor ventilation. The work done by Mr. Kitson in analysing and arranging and correlating his observations indicates a standard of completeness not often reached in tests of ventilation conducted outside of laboratory conditions, but it is the work of a character worthy of consideration in the preparation of standard phychological or physiological field tests.

The physiological tests made by Dr. Huennekens were quite complete so far as they went, but circumstances made it impossible to make blood counts or haemoglobin tests as would have been desirable. There is undoubtedly a large, undetermined personal equation in the blood pressure determinations. The temperature observations lead to no valuable conclusions.

The apparatus for the experiment delivered to each child, whether at his seat or at the blackboard, a refreshing current of cool air, with a small quantity of ozone. The humidity was moderate, averaging 32.6%, as was the temperature, averaging 68.8° F. The velocity of the center of air current two feet away from the desk funnel, or at the usual position of the face, was one and one-half feet per second. The oxygen content might have been low and the carbon dioxide content might have been high, but since so many investigators have conclusively proven that under such conditions as obtained in this experiment these were negligible factors, these determinations were not made. There are further desirable data that might have been taken had it been possible; the temperature and humidity of the air in the control group would have been recorded, variations in humidity each day in both groups, actual measurements of leakage among the physical factors, blood counts, hæmoglobin tests, conditions and environment of pupils outside of school, histories among the physiological data, and more extended physiological tests. A longer period of observation would have been desirable but was impossible under local limitations.

The results show conclusively that in rooms and auditoriums only occasionally used, such as lecture rooms, theatres, churches not subjected to repeated occupancy by the same persons, the revolving and renewing of air by proper treatment is as desirable as the use of outside air. Outside air ducts and indirect heating coils are entirely unnecessary. It seems probable, too, that persons may intermittently occupy rooms ventilated by renewed air for a great length of time, certainly for periods as long as three weeks, without suffering or even exhibiting any effect either consciously or unconsciously.

It would seem to me that the time has come when old standards of ventilation and methods of ventilating practice should be radically altered. More extensive, comprehensive, complete experiments along the lines of this limited work need to be performed, and as a result of such experiments, a new science and a new practice of ventilation of buildings should be established.

The psychological work of this investigation was done by Mr. H. D. Kitson, M.A., and a large part of the work done and description herein are his. Any success attained has been due to his work.

APPENDIX

Physical Records. The performance of the fans and other apparatus had been determined previously to the beginning of these experiments by Mr. E. J. Lewis, a mechanical engineer of Minneapolis. The distributors on the desks were controlled by means of individual dampers so that approximately seven cubic feet of air per minute was supplied through each. This rate was continued throughout the experiment as well as for two weeks before. The temperature was recorded by a Draper's self-recording thermometer and the humidity of the room was observed each day at 10 A. M. by the use of a "Hygrodeik" hygrometer which had been calibrated. It was found that this instrument is easily accurate to 1% provided the wick is kept clean. Both instruments were located on a shelf on an inside wall about six feet from the floor.

It will be seen from the table below that the average temperature of the test room in the Jackson School was 68.8 degrees F. and that the average relative humidity was 32.6% during the test. During the first week in which psychological observations were made, the average temperature was 68.4 degrees F., and during the latter week, 68.8° F. The relative humidities were 35.6% and 29.8% respectively. The highest average daily temperature recorded was 71.9° and the lowest 65.1°. The highest humidity observation was 50% and the lowest 25%.

The temperature at the Adams School was kept at 70°. No humidity records were kept, but in all probability these were not materially different from those in the Jackson School since during the three week previous to the first test week the humidity in the Jackson School averaged 33.3% when outside air was supplied, as against 32.6% during the three weeks when the renewed air was supplied, which would seem to indicate that the revolving of the air did not greatly affect the humidity in this experiment.

Date	Av. Temperature Inside	Av. Temperature Outside	Av. Rel. Humidity Inside	Av. Rel. Humidity Outside	Inside Av. for Wk. T.	Inside Av. for Wk. H.	Inside Av. 3 Wks. T.	Inside Av. 3 Wks. H.
Feb. 18	70.7		35					
19	67.7		37					
20	68.4		41					
21	68.5							
24	69.1		35					
25	7.9		32					
26	8.8						68.4	33.3
27			37					
28	7.7							
Mar. 3	66.8		36					
4	7.5		29					
5	8.6		27					
6	8.5		25		68.5	29.8		
7	9.3		32					
10	70.		38					
11	70.4		32					
12	71.9		38					
13	0.8		35					
14	69.3		36					
17	67.3		40					
18	68.2		37					
19	8.5		50					
20	8.4		35				68.8	32.6
21	5.1		31					
24	67.9		35					
25	69.2		40					
26	68.8		42		68.6	35.6		
27	9.4		33					
28	7.6		28					

Physiological Observations. These included observation of temperature and blood pressure during two weeks, one immediately preceding and the other during the last week when the air of the test room was rotated. They were made upon ten children in the morning and ten in the afternoon, the children being tested twice on the first test week and three times during the second test week. Each child was tested at the same hour throughout the five tests, the morning measurements being made from 9:45 to 10:30, the afternoon measurements from 1:45 to 2:30. This brought them before recess and was done in order that the measurements might not be affected by the excitement resulting from play at recess. The average temperature of the average child for the first week was 98.67, m. v. .32; for the last week, 98.46, m. v. .28. The corresponding blood pressure measurements were 110.13 m. v.

FIGURE 15
Ergometer in Use

5.47 and 106.25, m. v. 5.48. The temperature tests showed no appreciable difference. The blood pressure readings showed a difference, however, of 3.8 and is to be regarded as probably significant when considered in relation to the error of difference which is 1.7. If these blood pressure tests may be regarded as a fair sample, the chances are only about four in 10,000 that this difference is not significant. It is to be said, however, that the blood pressure tests have a low coefficient of correlation, that for the first and second days being .54, for the last two days, .56 using the method of unlike signs. This low correlation casts doubt upon the reliability of these results as it indicates a pronounced individual variation under the same conditions. On the other hand, the difference is somewhat more significant in view of the fact that the decrease in blood pressure for the three days of the last week took place in 16 out of the 19 cases, and is in the direction opposite to and in spite of the fact that there may have been considerable emotional excitement due to the strangeness of the proceedings during the first week. In spite of this, which might have tended to reduce the blood pressure more in the first week than in the second, there is a decrease of blood pressure in the second week, after the ventilation had been changed.

Psychological Observations. The pupils in the room above described were tested to determine their mental progress at the same time that they were tested physically. It was important in the latter tests to eliminate the effect of increased facility which would be acquired by repetition, also to allow for fatigue which would have a tendency to reduce the amount of work the longer it continued. In order to isolate the effects of ventilation, the control group of pupils was chosen in an adjoining school so that the average of the tests in the control group would be practically the same as that in the test group. The control group was tested in the same manner and for the same periods as was the test group, only a week later.

It was assumed that the two groups were equally efficient in the activities required, this assumption being based on the similarity of their averages in the first series of tests. Both groups averaged the same within one per cent. The work of the control group was a trifle higher in all the tests of the first series, so the assumption was made that this difference would remain constant, and in comparing the work of the two groups for the second week, it was allowed for by deducting the amount of difference. This placed the two groups on the same level at the beginning of the second test week, and it was assumed that any deviation which then appeared in the work of the test group could be ascribed to effects of ventilation change. The tests were given on the last hour of the morning of each day in order to have the effect of the indoor ventilation at its maximum.

Division, substitution and motor tests were used in forms to be described shortly. Promptly at eleven o'clock A. M. the tests were started, ten minutes being devoted to each activity in the above order. For the division test, each child was given a paper upon which were printed 140 problems in short division. The divisors were 6, 7, 8, and 9 used in rotation, and the dividends contained three digits. The numbers were so arranged that each problem came out even with two figures in the quotient. Owing to the impossibility of combining the nine digits in such a manner as to furnish new problems each day, the same problems were given every day. Careful instructions were given before each of the three tests and two minute practice allowed in each one the first day so as to permit of slight familiarity and prevent misunderstanding of the instructions. After instructions and preliminary practice the papers were laid face downward upon the desks and the children were told to write in the upper left hand corner date, name, age and birthday. When all had finished, the children turned over their papers and the signal was given to start, timing always being done with a stopwatch. At the expiration of five minutes, signal was given and each pupil drew a line underneath the problem he was then working. This was done in order to furnish a means of comparing the work of the first five minutes with that of the last five minutes.

For the substitution test a sheet of paper was given each child containing the letters of the alphabet arranged in two horizontal rows across the top. Underneath each letter was placed some number which lay between 11 and 36 inclusive. These numbers were arranged in chance order. The rest of the paper was covered with seventeen rows of squares, ten in a row, each square containing a number and a space underneath in which to insert the letter which accompanied that number in the key above. The arrangement of the numbers in the key was varied from day to day. The procedure of this test was the same as that for division. A sample of each test sheet is attached.

The motor test consisted of the sidewise movement of the index finger described by Bergstrom, with a modification in the manner of holding the rest of the hand in position. It was manifestly impossible to obtain kymographic records of the work of each child, so a simple ergometer was devised which would be adapted to group tests and obtain fairly accurate measures of movement against a slight pressure (the wire agitator described below). In this ergometer, the finger is inserted into a circular hole in a lever, which, when raised up and down, moves a slide back and forth. This slide runs horizontally in a standard which contains a hollow tube 5-32 inches in diameter. On top of this standard, which is three inches high, is a round wooden bowl serving as a hopper. When this is filled with steel balls ⅛ inch in diameter, they drop down one by one into the tube and rest upon the slide to which the lever is attached. This slide, which is exactly ⅛ inch thick, contains a small hole just large enough to accommodate one of the steel balls. As the slide is moved outward by the raising of the finger-lever, it carries out the steel ball from the standard and drops it into a receptacle at the side. Then as the lever is pulled down, the slide moves back into position and another ball drops into the ⅛ inch hole. The standard is mounted on a thin base and clamped to the right side of the desk, with about two inches projecting beyond the edge of the desk. On the under side of the base is a small ledge upon which the middle finger rests. The forearm rests upon the desk. At the conclusion of the test period the receptacles which catch the balls were collected and their contents weighed, from which it could be determined how many times the child raised his finger the required height.

Since the balls tend to clog at the mouth of the tube, a wire extending through the bottom of the hopper into the top of the finger-lever agitates the balls with every movement of the finger. Where a short test is made, however, a vertical brass tube two feet in length replaces the hopper and the wire may be dispensed with. This arrangement affords a movement that is practically without friction.

It is to be noted that the structure of the apparatus compels the child to raise his finger to a certain height in order to have the movement counted. Every upward stroke of the lever must be high enough to carry the slide beyond the edge of the standard or the ball will not drop. On the other hand, every downward stroke must bring the lever clear down to the base or the hole in the slide will not lie underneath the hole leading from the hopper. This regulating of the lift insures a movement of the finger throughout a wide amplitude, and brings about a fatigue effect which cannot be secured by only a moderately high lift.

This instrument, though not possessing the refinements of the Bergstrom ergograph, nevertheless lent itself very satisfactorily to the present experiment. It is easy to adjust and easy to operate; can be adapted to any size hand by using an aperature in the lever farther from or nearer to the axis of the lever. Furthermore, the element of interest is always present—an important desideratum in dealing with children. It is made of hard maple and can be manufactured for fifty cents.

Various modifications of method can be employed; the time can be divided into several periods by the use of different receptacles. In the present experiment the record of each test was divided into two parts by the use of two differently colored boxes which were shifted at the end of five minutes, thus securing a measure of the first five minutes' work to be compared with that of the last five minutes.

The method of scoring was as follows: In division, every correct solution was given a value of three. For an error in the first figure of the quotient, two was deducted, and for an error in the second figure one was deducted. For every example omitted, one and one-half was deducted. Under this system of scoring the highest score attained by any individual during a ten-minute period was 335, the lowest 10.

In substitution, every square correctly filled counted one; for each substitution omitted, one was deducted. The highest score attained by any individual during a ten-minute period was 144; the lowest, 24.

In the motor test, scores were obtained by weighing the total number of balls dropped by each individual and dividing by the weight of the ball. The highest score made in ten minutes was 1093; the lowest, 123.

The tests were chosen with a view to selecting activities of as varied nature as possible, so that there might be several chances of detecting ventilation effects, and if they were discernible, that they might be observed from several angles. That this end was attained is evident from the comparatively low correlation of the tests with each other. The work of the control group in division correlates with their work in the motor test by .06; substitution with motor, by .49; division with substitution, by .36 (using the method of rank differences). These low correlations show that the functions exercised by the three tests are quite diverse. Division work requires a high type of selective thinking and good memory for multiplication tables. The motor test measures voluntary ability to move the finger rapidly and continuously. Success in the substitution test requires quickness of perception and the ability to adjust oneself rapidly to new conditions. Inasmuch as the arrangement of the numbers in the key was varied every day, the child was obliged in addition to adjusting himself to the new arrangement, to also work against the habit he had formed the day before. All three tests require close attention, and in the substitution and motor tests there is opportunity for considerable economizing of effort by the gradual elimination of useless movements.

The value of the tests as constant measures of the work of one child relative to the work of another is indicated by the following table of reliability coefficients, computed by the method or rank differences.

Correlations in Work of the Control Group

		No. of Cases
First and second days' work in division	.91	25
Fourth and fifth " " "	.90	
First and second " motor work	.87	19
Third and fourth " " "	.89	
First and second " work in substitution	.83	28
Fourth and fifth " " "	.75	

Inasmuch as the substitution test seemed least reliable of the three, the first day's work in this test was compared with that of the tenth day, and a correlation of .77 was found. These high reliability coefficients indicate that the tests are good tests.

A feature that commends them for use with children is the high interest-value they possess. The children welcomed the test-hour with demonstrations of joy, and maintained, on the whole, a considerable amount of zeal. A few words of encouragement and commendation were given each day, and positive suggestion made that they do even better than they did the previous day. At the conclusion of the first day's work in division and substitution in each school, the children were asked to write down which of the tests they liked better. The preferences were as follows:

	Test Group	Control Group
Division	7	6
Substitution	32	32
Absent	2	3

Individual differences in performance were great, but the extremes were similar in each group as shown by the following table:

	First Week		Second Week	
	Test Group	Control Group	Test Group	Control Group
Division				
Lowest score	10	11	29	26
Average score	98.1	99.9	160.2	125.4
Highest score	215	242	335	309
Substitution				
Lowest score	35	32	24	24
Average score	65.3	64.3	70.1	73.3
Highest score	119	107	144	129
Motor				
Lowest score	164	123	154	194
Average score	423.3	440.4	519.9	549.2
Highest score	708	784	850	1090

From this examination of the tests it appears that they are admirably suited for measurements of work in ventilation effects. Their value in use with groups is evident from the tendency of each child to retain the same rank in the group in successive tests. Their value as group tests is further shown by the similarity with which the two groups worked as will appear in the results. In addition to the extreme similarity of the averages in all three tests, there was a corresponding similarity in extremes. The same test was preferred by an equal number in each group, and the effects of practice and fatigue were almost exactly the same upon both groups.

The tests measure functions that are quite diverse, as the low correlations indicate. This makes them especially valuable in measuring effects whose exact nature is not known. It is further evident that the different tests also check each other as to effects of subjective disturbances. It is to be regretted that the division results were injured by interference, still the clearness with which this interference is shown, is excellent evidence of the delicacy of the test.

After eliminating the records of all children who were absent on any of the test days and who were thus deprived of practice, together with one who was pronouncedly feeble-minded, and thus unable to do some of the work, the number of records finally used out of the test group was reduced to 28 for each division and substitution. The number of motor records used out of the test group was further reduced to 17 owing to the fact that some of the children experienced difficulty with their machines while others broke them. Although these were furnished new machines, each child working steadily, still it seemed advisable to use only the records of children who retained the same machines throughout the tests. The control group was reduced in the same manner to 25 for division, 28 for substitution and 19 for motor. The total amount of work done each day by the average child is as follows:

Test Group (Ventilation Changed)

	Mon.	Tues.	Wed.	Thur.	Fri.	Total	P. E.
Division (Mar. 3–7)	67.3	86.8	105.5	109.6	120.8	490.	154.
Mar. 24–28	133.7	163.7	161.5	161.4	180.7	801.	220.
Sub., 1st week	54.	63.7	68.	65.6	75.2	326.5	54.4
2nd week	69.1	70.	70.	71.	70.8	351.	64.9
Motor, 1st week	Omitted	354.4	420.	459.3	468.5	1693.2	295.3
2nd week	"	501.0	473.3	530.6	574.6	2079.5	304.5

Control Group (Ventilation Unchanged)

	Mon.	Tues.	Wed.	Thur.	Fri.	Total	P. E.
Division (Mar. 10–17)	69.5	86.0	100.6	112.9	130.9	500.	147.4
Mar. 31–Apr. 4	107.3	111.7	129.1	139.4	139.5	627.1	186.4
Sub., 1st week	52.5	61.2	68.8	66.0	73.2	321.7	46.2
2nd week	69.8	74.7	73.9	75.9	72.3	366.6	69.9
Motor, 1st week	Omitted	362.1	433.0	470.7	495.8	1761.6	334.3
2nd week	"	518.6	554.0	556.7	567.4	2196.7	98.8

For graphic representation of results see Plates 1, 2, and 3.

The curves show at a glance extreme similarity in the work of the two groups. In view of the similarity of performance during the first week, it is to be expected that the work of the second week will be equally similar unless some new element is introduced. It is then in the second week's results that one is to look for possible effects of the change made in ventilation.

The work of the test group differs most noticeably from that of the control group in division. The total score made by the average child for the first week is 490, and for the second week, 801. This represents a gain of 64%, while the corresponding gain made by the average child in the control group is only 25%. This enormous difference aroused the experimenter's suspicions, and upon investigation it was found that during the two weeks elapsing between the first and second test weeks, the teacher had been coaching the children in short division, using as divisors 6, 7, 8, and 9. The curve shows the results. The control group began the second week's work in division at some distance below the mark of efficiency attained at the end of the first week, showing a loss in efficiency due to practice. The test group, however, began the second week's work far in advance of the point attained at the end of the first week, showing clearly the effect of the intervening two weeks' practice. The occurrence of this phenomenon, while extremely interesting from a psychological and pedagogical point of view, is most unfortunate for the purpose of this experiment, as it thus becomes impossible to compare the total work done in division of each group.

Inasmuch as the work of each day was divided into two five-minute periods, it is possible to compare the two groups with respect to their rate of fatigue. Although practice would tend to increase the amount of work, fatigue would act in the opposite direction and the combined effect of these two factors may be measured by a "fatigue-index" found as follows: The total score for the week made by each child during the second five minutes of the tests was divided by his total score for the first five-minute periods. This was done in the case of twelve children in each group (only that number marking the time periods according to directions). For the first week both groups had the same fatigue-index, .8125 m. v., .11. For the second week the fatigue-index for the test group was .7709 m. v., .08, and for the control group, .7591 m. v., .11. The difference is only .0018, and as its probable error is .037 it will be seen that the slight difference is not at all significant. Thus the division results, though not comparable *en gros*, nevertheless, as treated above, show no effect of change in ventilation.

The second week's record for substitution shows a difference of 15.6 in the work done by the average child of the two groups. This difference is in favor of the control group. It is to be noted that the difference existing between the two groups at the end of the first week is that between 326.5 and 321.7, or 4.8. Assuming that this difference continued in the second week, the net difference becomes 10.8. The probable error of this difference computed by the formula P. E. of Differences = P. E. P. E. is 17.7. The chances are even, that a difference of about 3% would occur in fifty minutes, or the chances are two out of three that there will be some difference in favor of the first form of ventilation. Since four days out of the last five tested show against the test group under the second condition of ventilation, the chance that it had a slight effect is somewhat increased. Subtracting the daily average difference between the two groups of .96, (obtained by dividing 4.8 by 5) the daily record of the last week stands as follows:

	Mon.	Tues.	Wed.	Thur.	Fri.
Control Group..	69.8	74.7	73.9	75.9	72.3
Test Group......	69.1	70.	70.	71.	70.8
Difference.......	.7	4.70	3.90	4.90	1.50
Subtract........		96	96	96	96
Net Difference...		3.74	2.94	3.94	.54

As the difference is only two-thirds of its probable error, however, it is not to be regarded as outside of the range of a chance error due to the single week's sampling of the conditions.

A further comparison is made possible by computing the gain or loss made by each individual. This is done by subtracting the total score made by each child during the first week, from his total score of the second week, or in case of a loss, *vice versa*. This shows that out of 28 children in the control group, only three actually lost, while out of the 28 children in the test group, loss occurred in eight cases. The average gain made by those who gained is also greater in the case of the control group, being 16%, while that of the test group was 13%. This method of comparison is hardly justifiable, however, as it fails to take into account the fact that the control group was slightly superior to the other group at the start and would be expected to gain faster than the test group.

The fatigue-index for the first week, computed for 17 children in each group, was the same in both groups, .896 with a m. v. of .099 in the test group average, and of .072 in the control group average. Second week, test group .933, m. v. .15, control .883, m. v. .10. The difference in the fatigue-index of the second week is .065. It is possible that this difference may be significant, being a third larger than its probable error which is .037. The fact that this difference, slight as it is, favors the test group is hard to explain, in view of the fact that the total work done by the control group slightly exceeds that done by the test group. It is hardly probable that the difference in fatigue-index was not affected in either of the other tests. The only hypothesis that offers any clue is in connection with the peculiar habit-making process involved in this test. It is possible that the control group, being naturally a trifle superior to the Jackson group, were able to completely adjust themselves to this feature during the first week, while the other group might still be showing the effects of this adjustment in the second week. The true significance of this difference can be determined only by further experimentation.

The motor records for the second week's work of the test group shows a decided drop on the second day. As this drop is entirely out of proportion to the rest of the curve, it is probable that some constant error entered in—possibly a mistake in weighing the balls which record the finger movements. Omitting the second day's work from both records, the curves follow each other fairly regularly. The following table gives a comparison of the motor work for the three days of each week—Tuesday, Thursday and Friday:

Number of Movements Made by Average Child

Control Group....	Av. 1329	M. V. 291	Av. 1643	M. V. 505
Test Group.......	1273	257	1606	230
	56		37	

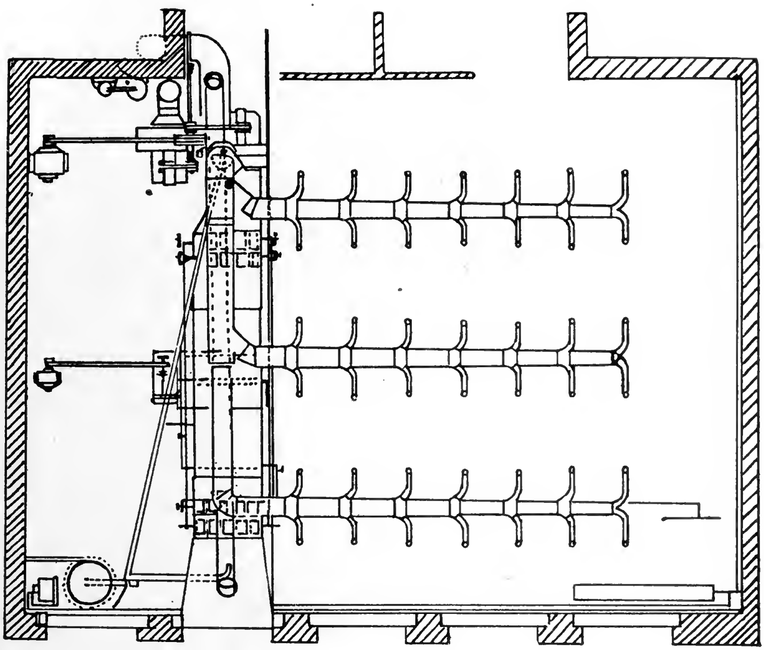
The difference in favor of the control group at the end of the first week was 56. Assuming that this difference remained constant in the second week, the net difference between the work of the two groups for the second week is 56–37 or 19, in favor of the test group. This difference is less than 2-10ths of its probable error (108); therefore, it can only be attributed to chance.

The greatest difference occurring in any one day is that on Thursday —26. The probable error of this difference is 42. Since the difference is only 6-10ths of the probable error, the chances are only two out of three that there would be any difference.

A comparison of gains distributed among individuals shows a slight average gain in favor of the test group, the difference being 24.2, but the number of cases is so small and the mean variations are so high that the difference can hardly be regarded as significant. The objections to this method of comparison were discussed in connection with individual gains in substitution.

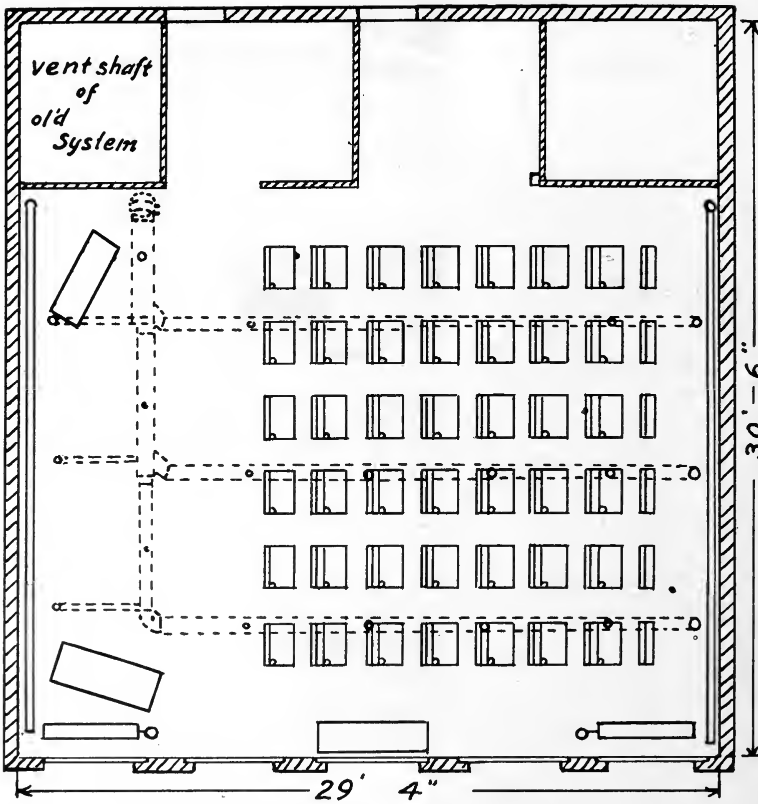
The average fatigue-index for the first week, computed for sixteen children in each group, is 1.016 in each group, with a m. v. of .077 for the test group and .12 for the control group. For the second week, the test group fatigue-index is 1.056, m. v. .15, control group, 1.060, m. v. .13. The difference is only .004 and is only 1-10th of its probable error, which is .045.

Thus the motor results, compared with respect to average amount distributed gains and rate of fatigue, show no more than a chance difference between the two groups.



BASEMENT FLOOR PLAN
showing
Ventilating apparatus and
fresh air supply ducts on
ceiling.

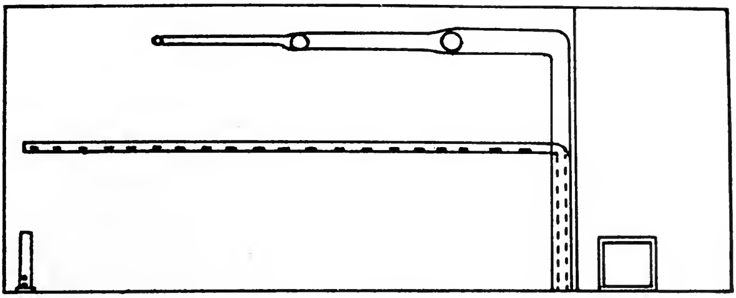
FIGURE 7



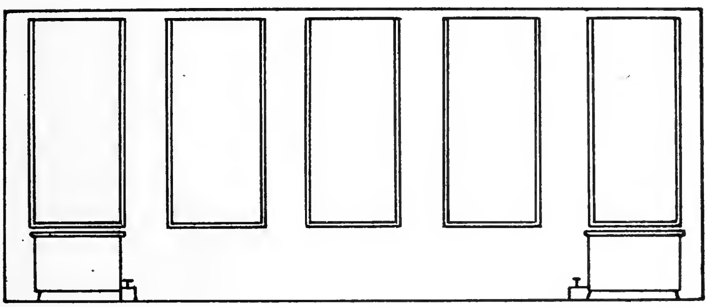
FLOOR PLAN
1/8" = 1'

SOUTH SIDE
1/8" = 1'

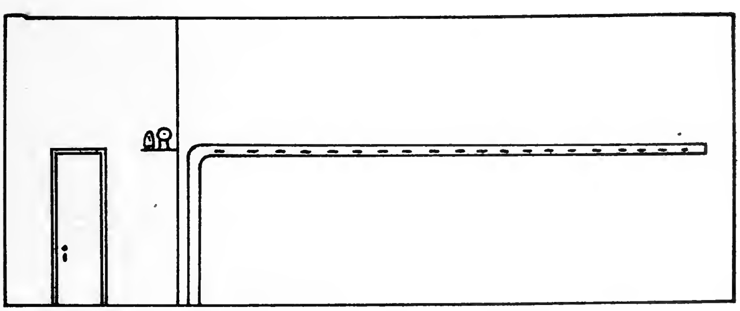
FIGURE 8



EAST END



NORTH SIDE



WEST END

FIGURE 9

SUBSTITUTION TEST

A	B	C	D	E	F	G	H	I	J	K	L	M
17	34	23	16	32	35	21	30	19	20	29	13	24
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
31	11	25	12	26	33	15	28	36	18	27	22	14

28	19	17	24	31	18	16	30	21	14
29	12	25	33	35	15	22	26	20	27
34	11	23	13	36	32	20	11	28	30
16	22	12	19	23	18	17	29	34	32
15	31	13	26	25	27	24	14	21	36
35	33	20	32	30	19	26	23	33	18
16	14	12	21	17	25	31	11	22	34
35	29	15	36	24	28	27	13	30	33
15	13	27	36	11	12	34	14	17	32
22	35	18	16	19	25	29	20	24	28
31	26	23	21	28	34	18	30	20	29
36	21	14	16	23	22	11	31	24	33
25	17	27	32	12	13	15	35	19	26
23	25	32	14	34	31	36	24	13	11
22	27	21	17	33	35	30	20	28	15
29	19	16	12	26	18	28	19	17	24
31	18	16	30	21	14	29	12	25	33

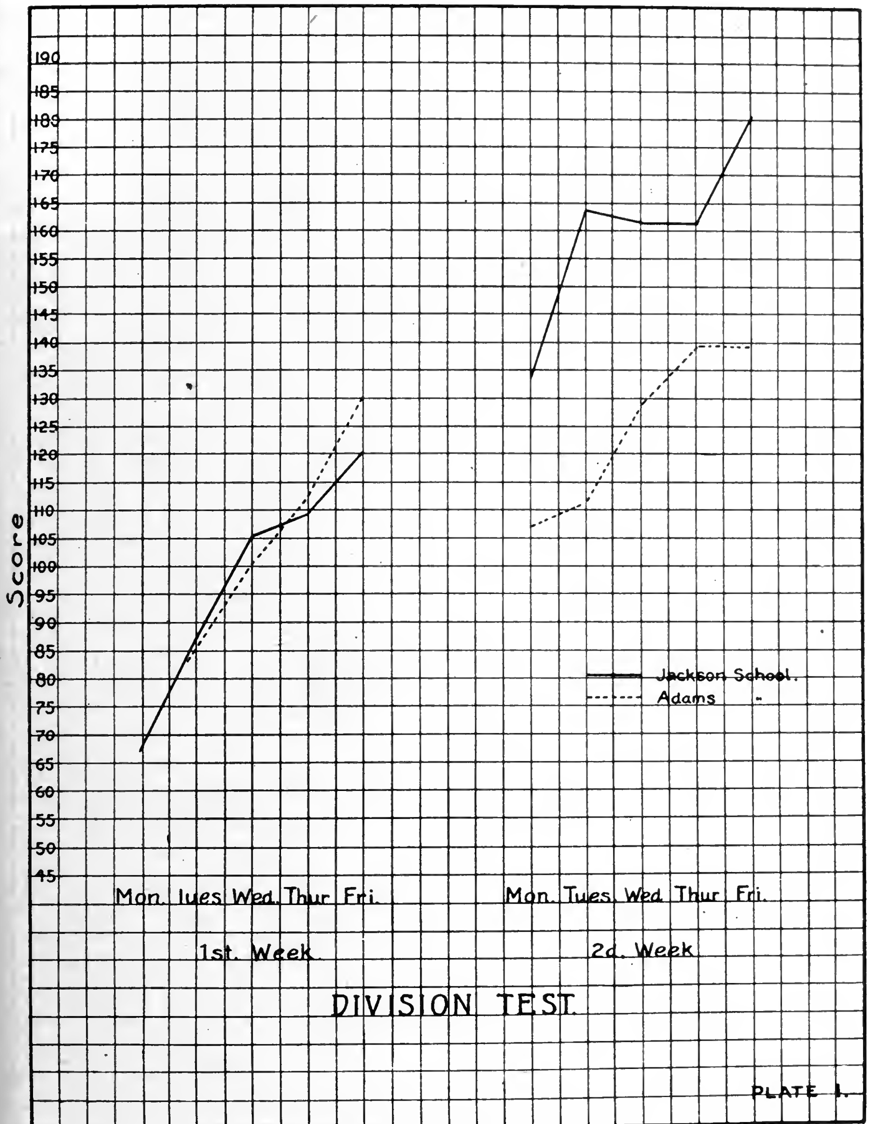

Score
190
185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
Jackson School.
Adams
Mon. Tues. Wed. Thur. Fri.
1st. Week.
Mon. Tues. Wed. Thur. Fri.
2d. Week
DIVISION TEST.
PLATE 1.

FIGURE 10

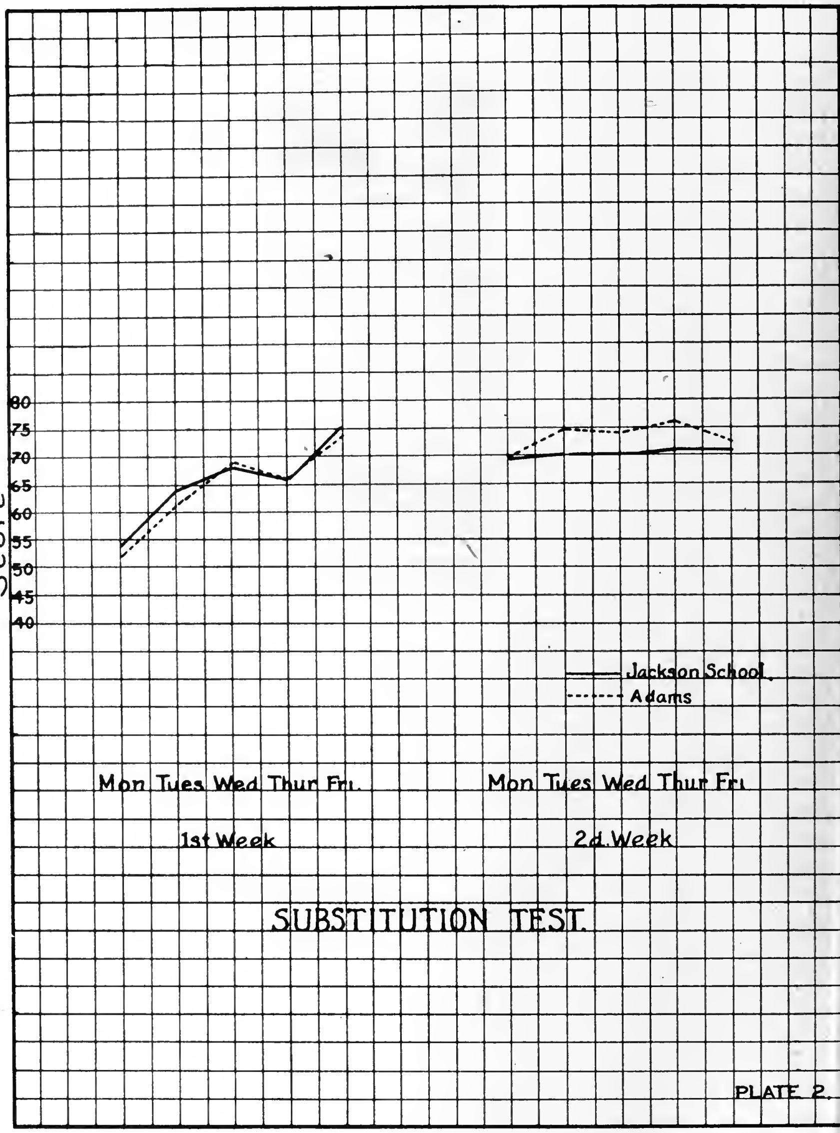

80
75
70
65
60
55
50
45
40
Score
Jackson School
Adams
Mon Tues Wed Thur Fri.
Mon Tues Wed Thur Fri
1st Week
2d. Week
SUBSTITUTION TEST.
PLATE 2.

FIGURE 11

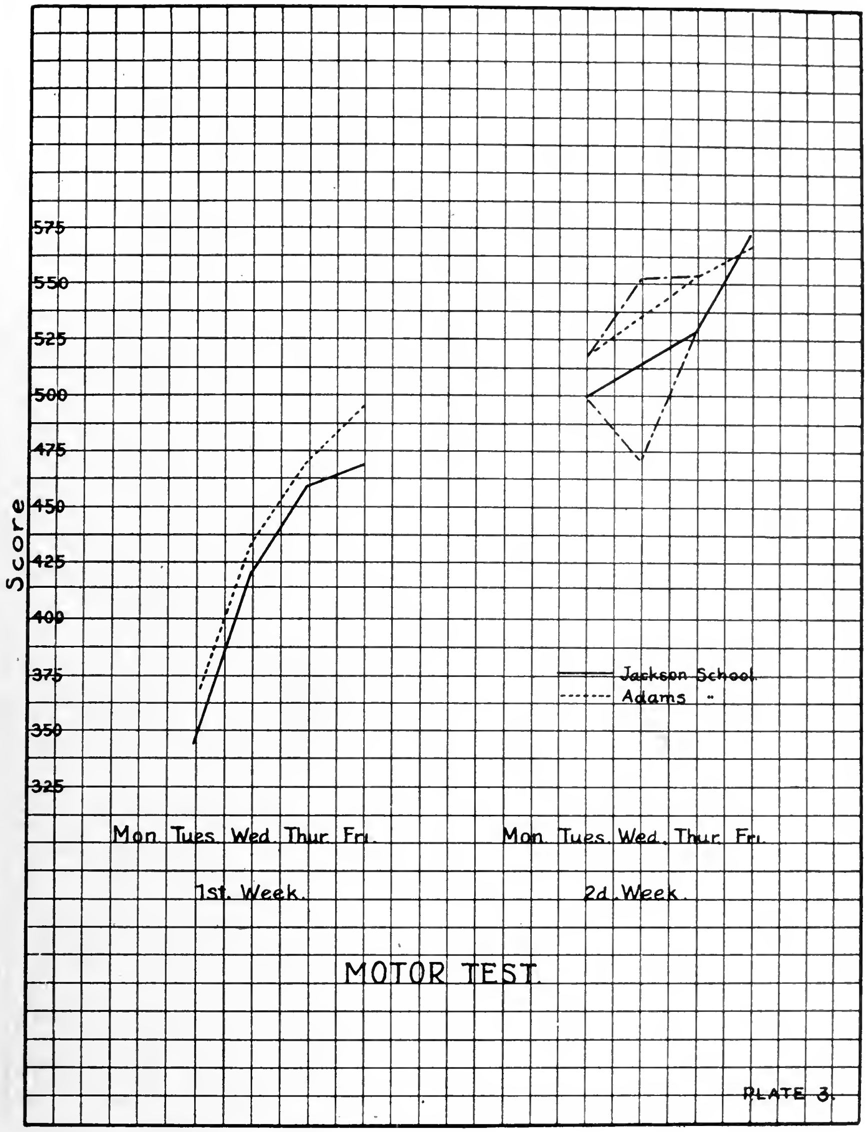

Score
575
550
525
500
475
450
425
400
375
350
325
Jackson School
Adams "
Mon Tues Wed Thur Fri.
1st. Week.
Mon. Tues. Wed. Thur. Fri.
2d. Week.
MOTOR TEST.
PLATE 3.

FIGURE 12

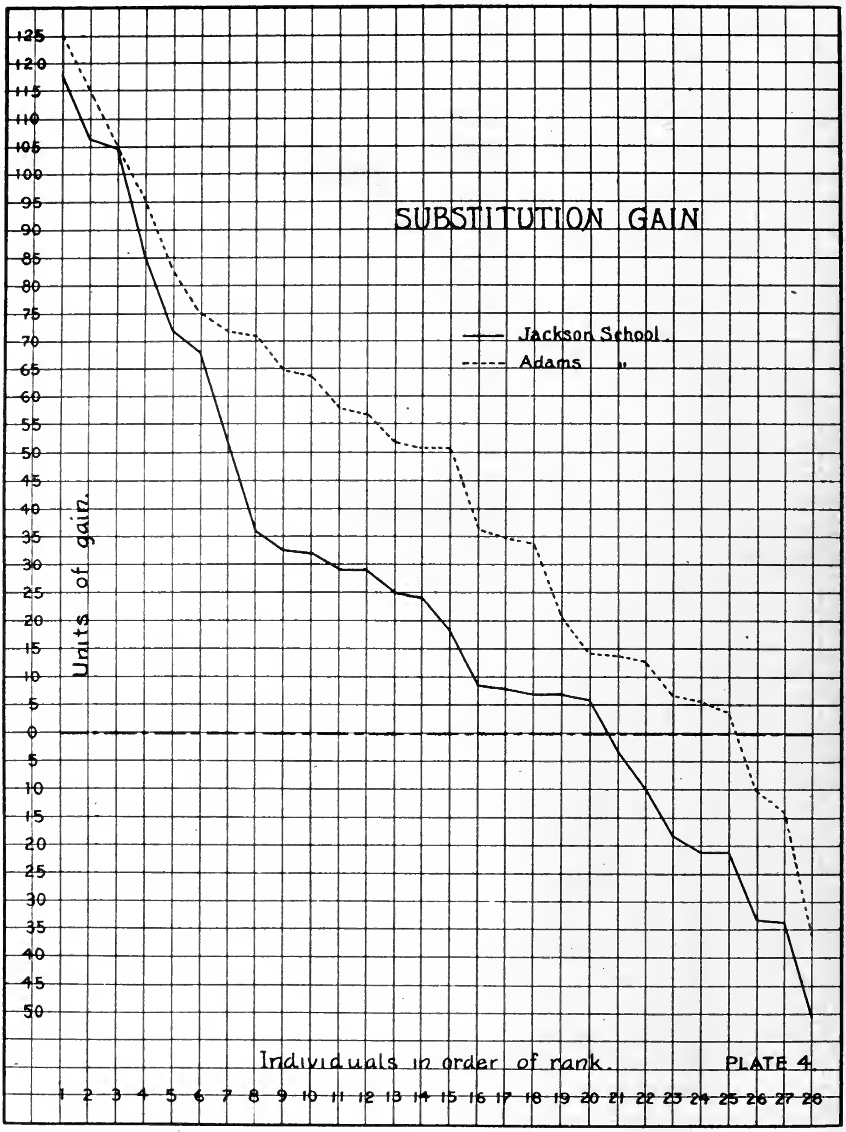

SUBSTITUTION GAIN
Jackson School.
Adams "
Units of gain.
Individuals in order of rank.
PLATE 4.
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
5
10
15
20
25
30
35
40
45
50
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

FIGURE 13

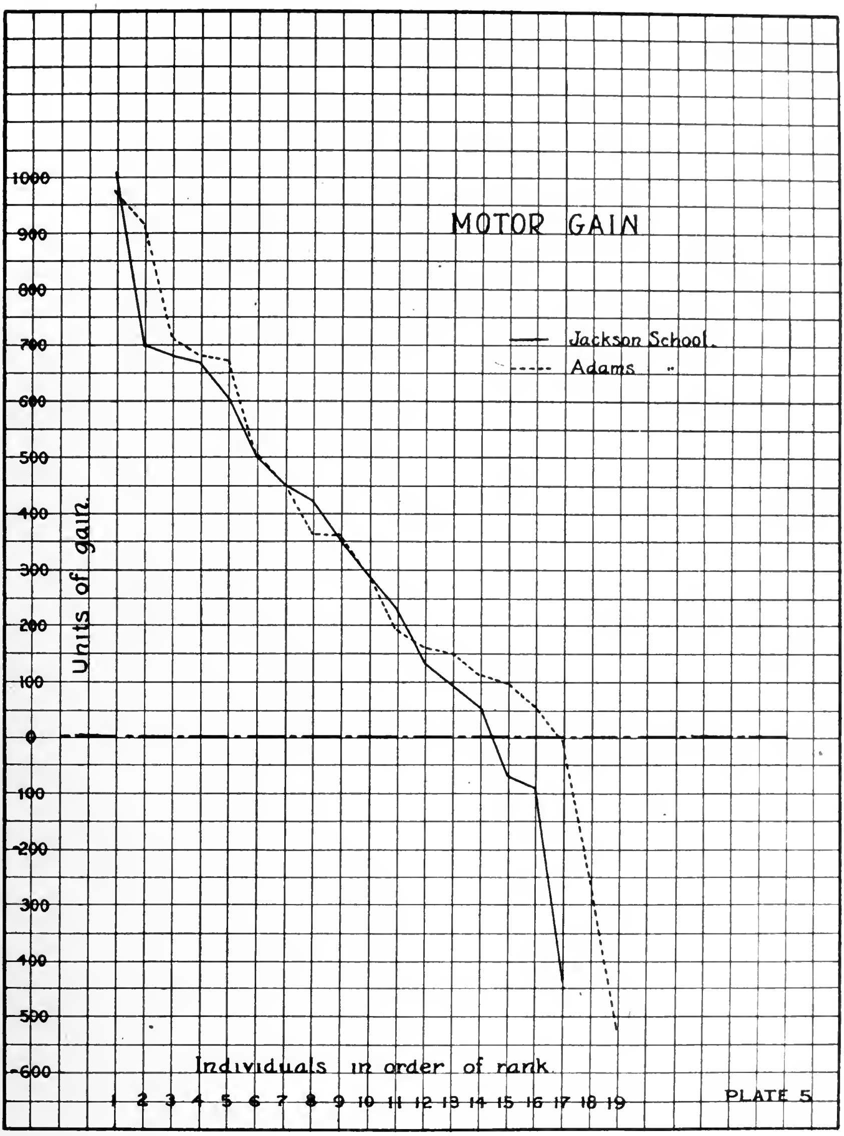

MOTOR GAIN
Jackson School.
Adams "
Units of gain.
1000
900
800
700
600
500
400
300
200
100
0
100
200
300
400
500
-600
Individuals in order of rank
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
PLATE 5

FIGURE 14

SOME EXPERIMENTS ON THE VENTILATION OF A SCHOOL ROOM

BY

J. W. Shepherd

The best ventilation for a school building is that which most nearly duplicates outdoor ventilation. Our own experiences, together with the experiences of past centuries, warrant our approval of outdoor air for breathing purposes.

It is much easier to commend outdoor ventilation than to point out the factors and conditions that produce it. Does the mere movement of air outdoors, over an area in which one is at work or in repose, suffice for ventilation? Or does the rate of movement, or the change of rate, or the change in direction of the movement, affect the result? Does the fact that most air movement is parallel with the earth's surface instead of vertical to it, make for better health conditions? How far is our opinion of outdoor ventilation influenced by the fact that one is usually in greater muscular activity outdoors than indoors? Finally, how can we discriminate between those outdoor agencies that produce good ventilation, and other outdoor agencies that also make for good health, for example, sunshine? These questions and other kindred ones become significant if we attempt to make indoor ventilation as good as outdoor ventilation.

Beyond doubt, our belief in outdoor ventilation dominates the practice in what, at present, we are calling open-air schools. Moreover, almost all are agreed that wherever feasible this type of schoolroom should come into general use. Personally I am thoroughly in sympathy with the open-air-school movement; however, I am convinced that in cold climates we must provide for closed schoolrooms. Instead of going outdoors in order to circumvent our difficulties in procuring proper ventilation, we must meet the issue squarely to the end that in cold weather we shall provide our closed schoolrooms with outdoor conditions of ventilation. The establishment of these conditions seems to me to be a problem for our generation.

Not longer ago than a generation or two, the ventilation of a schoolroom or building was of little concern. In those days we were unable to build as well as at present. In cold winter weather the windows rattled and cold air swept under and above the doors, and sifted in around the windows. Through imperfections in construction, winds helped freely to ventilate all kinds of buildings. The methods of heating school buildings also were different from those in use at present. Stoves and open hearths were used in the earlier days. The combustion of fuel within the stoves or open hearths necessitated a change of air within a room or building. Moreover, this change of air was supplied from all parts of the room, which fact within itself meant also the ventilation of the room. In the days when heating was done entirely by fireplaces or stoves, a supply of fresh air was necessary for the burning of the fuel, and there was abundant leakage of air around the poorly fitted windows and doors. To-day, as a rule, the fuel is not consumed within the schoolroom, and therefore there is not the constant demand for fresh air to enter the rooms for heating purposes; moreover, we now have devices to prevent leakage around windows and doors. In the ventilation of a school building to-day, therefore, we must purposely provide openings through which air enters the room and also openings through which it leaves. And in addition to these openings, we must provide a means for forcing air *into*, *through*, and *out* of the room.

Mechanical systems of ventilation have necessarily come into being because of the improvement in the construction of buildings and the heating of rooms with other means than stoves and fireplaces. There are two general systems of mechanical ventilation, and all others are but modifications of one or both of these. The two systems are known by contrast as the Plenum system and the Vacuum system. In the operation of the Plenum system, the air in the rooms is kept under a pressure somewhat greater than the atmospheric pressure outdoors, and therefore is more dense. In the operation of the Vacuum system, the air within the rooms is somewhat less dense than that outdoors. Large fans are generally used in producing the increased pressure of the Plenum system or the reduced pressure of the Vacuum system. In both systems of ventilation it is necessary to have a circuit through which air from outdoors is compelled to travel.

I shall briefly describe the Plenum system because it is the one with which I began my experimental work. To begin with, it should be understood that the Plenum system is both a ventilating system and a heating system, the idea being that a room is heated with air which subsequently is breathed by its occupants. The equipment for this system is substantially as follows: There is a central room at least as large as a schoolroom, which is known as the Plenum chamber or distributing chamber, and from which air for ventilation and heating is distributed throughout the building. From this distributing chamber, inlet ducts lead to all the rooms in the building, and deliver the air into the rooms near the ceilings. All these rooms are also provided with outlet ducts near the floor line, and these ducts lead to air shafts connected with outdoors. Air is brought into the large central distributing room from outdoors, being drawn in and forced in by means of a large fan. The fan is installed between a large outdoor intake or screened opening and the distributing chamber. Between the fan and the distributing chamber are banks of steam coils for the purpose of heating the air before it is delivered into the distributing chamber. In the latest improved Plenum system, this central air chamber is divided into an upper and a lower portion, or compartments. The upper one of these compartments receives hot air, and the lower one temperate or cool air. The ducts that lead to the various rooms are all connected both with the hot and cool air compartments of the distributing chamber. All ducts leading from the distributing chamber are provided with dampers by means of which the relative air supply for the various rooms is controlled. The temperature of the mixed air is delivered into the rooms from the two compartments, is under the automatic control of thermostats in the rooms.

The quantity of air delivered into the various rooms by the Plenum system depends, most largely, on the area of the ducts and the speed of the fan. Roughly speaking, the idea in the Plenum system of ventilation within a room, is that heated air distributed to the rooms at the ceiling gradually cools, and in so doing settles down into the breathing zone, and is then forced down to the floor and out by the fresh heated air that is constantly being forced in at the top of the room. This view seems satisfactory to most heating and ventilating engineers, and therefore the emphasis, in the ventilation of a building, is placed by them on the quantity of air delivered by this system. In other words, ventilation, until very recently, had come to mean the delivery to and the removal from a room of a certain volume of air per unit of time.

The public school buildings of Chicago are equipped with the Plenum system, and during the last three years I have made something of a study of, and with, this system. My study has been made within a building of rather recent construction, and, therefore, equipped with the latest ventilation devices. Just here may I say that I know of no better system of mechanical ventilation than that with which I began my study.

Quantity of Air. My first tests were made on the quantity of air delivered in unit time per pupil in a number of rooms in the main building of the Chicago Normal College. Anemometer readings showed a linear velocity of from 600 to 650 feet per minute, which meant at least thirty cubic feet of air per minute per pupil, counting forty as the number of pupils per room. From the tests made, it seems that a sufficient volume of air is delivered to and removed from our schoolrooms for adequate ventilation. There remains, however, a closely related question, namely, whether or not the air within the rooms acts as a unit or whether, perhaps, there may be currents of air within the rooms.

Distribution of Air. I made a study for air currents in two rooms. One of these rooms is about 25 feet square with a 13-foot ceiling, and contains one inlet duct and a single outlet duct. The other room is 26 by 45 feet with a 13-foot ceiling, and contains two inlet ducts and two outlet ducts. All four of these ducts are installed in the same wall, the inlet ducts above, and the outlet ducts near the floor. In all installations it is the practice to locate the inlet and outlet ducts on the same wall, so as most nearly to insure a circulation of air throughout the room. The tests on air currents were made under my supervision by a class of manual-training students (boys) who were graduates of technical high schools, and the work was done as part of a required course.

Two devices were used in making the tests. Toy balloons were inflated with hydrogen gas and counterpoised in the rooms by means of improvised weights. Small turbine wheels, also were used. These were made from aluminum, cork and steel needles, and were especially constructed for these tests. The blades of the turbines were made from aluminum and set into hubs of cork. Across one end of a cork hub and parallel with the plane of the blades, was fastened a strip of aluminum containing a slight indentation in which the pivot of the device turned. The fine point of a steel needle served as a pivot, and when ready for use the turbine revolved in a horizontal plane. These turbines were very sensitive to vertical currents of air; in fact, they respond to convection currents from the heat of one's hand. The counterpoised balloons were useful in tracing all air currents, irrespective of their direction, whereas the turbine wheels could be used only in testing for vertical currents.

I shall now speak of the tests within the two rooms heretofore mentioned. The smaller room, 25 by 25 feet, has an east exposure. The other walls of the room have no immediate contact with the outdoors. The inlet and outlet ducts in this room are installed in the north wall, and the air enters the room with a velocity of about 650 feet per minute. When balloons were pushed into the entering current, they were hurried across the room near the ceiling to the south wall. From the ceiling at the south wall the balloons usually took one of two general courses, depending largely upon the outdoor weather conditions. If the outdoor temperature was low and the wind was blowing directly against the windows, then the balloons moved over to the outside wall, down the wall or windows, and over to the outlet duct. If the outdoor temperature was moderate, then instead of the balloons crossing over to the outside wall, they were likely to poise in the southeast corner of the room, or possibly move vertically down along the wall opposite the inlet duct to within a foot or two of the floor, and then over to the outlet duct. It was very noticeable that air currents established themselves in aisles and other open spaces along the floor. During the winter season the turbine wheels, when placed on the window ledges, revolved almost all the time. Their direction of rotation indicated the downward movement of a sheet of cold air; moreover, this sheet of cold air was very perceptible to anyone seated near the outside wall or windows. It might be said just here that in planning an installation, it is desirable to have the hot air delivered across the room to the outside wall, in order partially to overcome the influence of wall and window chill. This plan of installation could not be carried out in the room just mentioned.

The larger of the two rooms, 26 by 45 feet, is a northwest corner room. It has about twice as much exposure on the north as on the west side. As already stated, there are two inlets and two outlets in this room, and they are located in the long inside wall. The velocity of the incoming current of air was practically the same as in the smaller room. Anemometer readings showed an adequate supply of air for good ventilation. Balloons placed in the incoming current were hurried across the room to the opposite wall, the outside wall with the north exposure. After reaching the outside wall, they almost always went vertically downward to within a couple of feet of the floor; then they moved over to the outlets near the floor and almost directly under the inlets. The hot incoming air driven against the cold outside north wall and windows, reduced the influence of wall and window chill. But in cold weather, especially with a north or northwest wind, a downward moving sheet of cold air was very noticeable. The small turbine wheels revolved constantly in cold weather when placed upon the window ledges or near the exposed walls. In the central part of the room, that is, between the two sets of inlet and outlet ducts, the balloons did not show perceptible air currents. Furthermore, there seemed to be eddies in close proximity to the currents at either end of the room. From the evidence obtained in the use of the balloons and turbine wheels, I concluded that air within our schoolrooms did not act as anticipated in the Plenum system. My experiences throughout my experiments have convinced me of a rather paradoxical view, namely, that the thing which makes mechanical ventilation possible is also the thing which makes it difficult to obtain. I refer to the fact that currents are very easily established in atmospheric air, and it is the control of these currents that makes ventilation difficult.

Individual Supply of Air for Ventilation. My first constructive effort in the ventilation of a schoolroom in which the Plenum system had been installed, was an attempt to supply each pupil with his portion of the fresh air admitted to the room. I wanted first to deliver the air into the room near the pupils and secondly to take advantage of convection currents produced by the pupils.

One of the regular schoolrooms in the Normal College was set apart as an experimental room. This room is 24 by 32 feet, on the basement floor, and has a west exposure. The room had a 13-foot ceiling. In the original installation for ventilation, air entered the room near the ceiling at the center of the east wall. The main air current was across the room from the east wall to the west (outside) wall, then down the cold outside wall, and back to the outlet duct near the floor in the east wall. The changes made in the room were as follows: First, the outlet, near the floor, was closed; then an air-tight false floor was built about eighteen inches above the regular floor of the room, and a false ceiling was hung about eight inches below the room ceiling; then an air shaft was constructed to connect the inlet duct of the original installation with the air reservoir between the floors. The outlet duct was tapped near the ceiling connecting it with the compartment between the ceiling and the false ceiling. Three-inch circular holes were cut through the false floor, and galvanized iron pipes, fitted into these openings, led up under each desk to within an inch of the desk bottom. Openings also were made through the false ceiling so that air delivered into the room might move on through it. It will be noted that these changes turned the operation of the Plenum system upside down. Instead of the air entering at the ceiling and leaving near the floor line, this new scheme delivered the air below the floor, and outgoing air currents left the room at the ceiling. As already intimated, the idea in this scheme was to furnish a positive distribution of air to all the pupils within the room and also to take advantage of the heat liberated by them in the production of upward moving currents. The new installation was tested in two ways: (1) Simple tests were made with anemometers placed at the edges of the desks. Every test showed an up current. (2) A more striking test than the one with the anemometer, and one as fully convincing, or even more so, was a chemical test made with ammonia and an indicator known as phenolphthalein. This chemical test was made as follows: Linen strings were stretched over the rows of desks at the height of the breathing zone for children seated at the desks. Upon these strings, at intervals of ten or twelve inches, were hung pieces of unsized paper made wet with an alcoholic solution of phenolphthalein. When the room was thus dotted over with these wet papers, it looked much like a laundry drying-room flecked with white. Before the wet papers had time to dry, a handkerchief, made thoroughly wet with concentrated ammonia water, was hung in the air duct leading from the Plenum chamber, or distributing room, to the experimental room. Within two minutes after hanging the handkerchief in the duct, every paper on the linen threads in the experimental room became red in color. When ammonia is added to a colorless solution of phenolphthalein, the solution becomes red; therefore, the change in the color of the papers was conclusive evidence that ammonia from the handkerchief had been distributed to every piece of paper wet with the alcoholic solution. The test was repeated at another time with the same result. Still another test was made which contained an added feature. In addition to the papers suspended in the breathing zone over the desks and seats, others were hung on strings stretched parallel with those over the rows of desks about seven feet from the floor, but directly over the aisles. In this test all the lower paper reddened in approximately the same time as before, and the upper ones reddened soon thereafter. These tests are conclusive evidence that the air in the experimental room is delivered to each desk, and that the movement of the air in the room is upward, and quite uniformly so. Moreover, anemometer tests made at the outlets of the galvanized iron tubes before the desks were placed, showed that each tube delivered approximately the same volume of air in unit time.

The Experimental Room Becomes a High School Room. As soon as the before-mentioned changes in the experimental room had been made and tested, the room became a regular high school room, in use throughout the day. In our high school it is customary for classes to change rooms for different recitations and, therefore, the experimental room was occupied by different classes each hour. This arrangement added somewhat to the difficulty of our experiments.

Source of Contamination in Respired Air. As soon as the pupils became accustomed to the room, tests were made to determine the degree of contamination of the air within the room. The amount of contamination due to expired air was determined by chemical tests for carbon dioxide as an indicator. A large number of such tests were made. The director of the Municipal Laboratory of Chicago and one of his chemists helped to make the tests. Samples of air were taken from the breathing zone of the different classes, and the amount of contamination indicated was always well within the limit of safety. This limit is generally considered as one-tenth of 1%.

It is generally considered that the percentage of carbon dioxide in an occupied room is only an index of the harmful agencies present, and that the carbon dioxide itself is comparatively harmless. I am of the opinion that the injury resulting to an individual from breathing expired air, is due in the largest degree to inhaling air expired by others, and not from that expired by himself. The reason for this opinion is that exhaled air comes from an organism in which healthy tissues function normally in their own more or less toxic surroundings. Except for the impurities already in the air supplied for breathing purposes, exhaled air can contain only those things which were present in the exhaling organism, and also in greater dilution than in the organism itself. Experiments have shown that under certain conditions one may live comfortably in an atmosphere highly contaminated with expired air when the contamination is due only to the respiration of the individual himself.

If my belief is well founded that the greatest injury from breathing respired air comes from cross-contamination, then it is highly significant to note that the installation in the experimental room is such as to minimize the possibility of pupils breathing air that has been breathed by others. This is due to the fact that the air is delivered under each desk and then is moved upward to the ceiling instead of being blown across the room or of depending on diffusion or convection.

A Requirement for Ventilation. However satisfactory the quantity of air furnished for the ventilation of a room, and however satisfactory may be the means employed for properly distributing it, both of which in the long run are very important, nevertheless the human body makes an immediate demand which may overshadow either or both. *Immediate physical comfort is the standard of the human body*, whatever the consequences, as exemplified either in the drowsy stupor that descends on one immersed in a hot, stifling atmosphere on a cold, wintry night, or in the quiet repose that comes from a balmy summer breeze outdoors. I want to insist that good ventilation shall produce immediate comfort.

One of the most prominent as well as immediate factors in the production of comfort, is temperature, and therefore a study was made to determine the best temperature for a schoolroom. The comfort of the human body is largely influenced by the temperature of the surrounding air, and also, at the same time, by the rate at which perspiration may evaporate into the air from the body. Relative humidity influences the rate at which such evaporation occurs, but it is only in recent years that much consideration has been given to atmospheric humidity in relation to temperature and comfort.

Temperature and Humidity in Relation to Comfort. It has become traditional in this country that the best temperature to maintain in a room is 68 to 70 degrees. There are, however, some who urge that these temperatures are too high, and they cite the English practice of

59 to 62 degrees as evidence of their claim. The difficulty with both these positions is that in deciding on the best temperature, proper consideration is not given to relative humidity. Any adult knows that sultry days are much less comfortable than days of even higher temperature when the atmosphere is comparatively dry. This well-known fact of outdoor experience must be taken into account indoors, especially since it is now recognized that in cold weather we need to humidify air indoors. On this point of humidity may I say that the human organism seems to be adapted to a large range of relative humidity, but it is not accustomed to abrupt changes such as one might experience on a cold day in passing from the outdoors into a heated room. In a word, it seems important from a standpoint of health and comfort to maintain a fair degree of correspondence between the relative humidity outdoors and indoors.

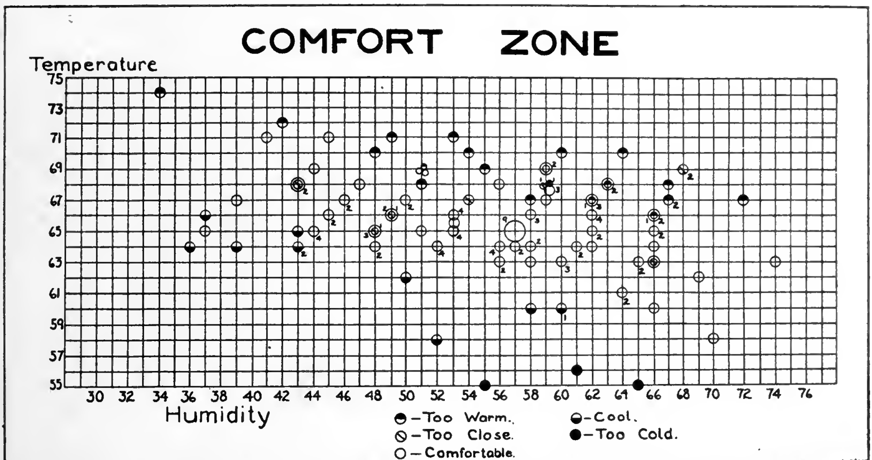
I want again to insist that any system of ventilation, to be practicable, must produce a feeling of comfort, and therefore both the temperature and the relative humidity of the air are important in ventilation. Temperature and relative humidity jointly help determine comfort.

It has generally been considered that a temperature of from 68 to 70 degrees with a relative humidity of 70%, is a most desirable condition to obtain (the 70% relative humidity also is largely traditional). In our tests it was assumed that the best temperature may or may not be 68 to 70 degrees; and also the most satisfactory relative humidity may or may not be 70%.

Our experimental room was equipped with an automatic temperature control, and also an automatic humidity control. Moreover, the temperature in the different parts of the room was determined by standard thermometers, and the relative humidity in the different parts of the room was determined by means of a sling psychrometer. For the most part, the tests on relative humidity and temperature in relation to comfort, were made by myself and a graduate student from the University of Chicago. Frequently individual high school pupils in the room were asked whether or not they felt comfortable, and in each case the pupil answering did not know that any other pupil had been asked. The teachers in charge of the room also were asked for opinions. All these opinions, together with our own, served as a basis for record.

Before working very long, it became evident that there was a temperature and humidity range within which the occupants of the room were comfortable, and this range gave rise to what I have called the Comfort Zone. This term, comfort zone, means that there is a maximum temperature with a minimum relative humidity, and a minimum temperature with a corresponding relative maximum humidity between which limits the occupants of a room are comfortable. In other words there seems to be no best temperature and also no best relative humidity; but the maximum temperature at which one is comfortable will be associated with a minimum relative humidity, and the minimum temperature for comfort will have associated with it a maximum relative humidity. Under the conditions with which we were working, we found that a temperature of 64 to 70 degrees with a corresponding relative humidity of 55 to 30%, seems to be the limits; that is, the comfort zone for us lies between 64 degrees and 55% and 70 degrees and 30%.

It is worthy of note that with a temperature below 67 or 68 with a proper relative humidity, the pupils were better able to give attention to their work than if the conditions were otherwise.



This chart represents 154 tests made between Jan. 1 and April 1, 1912. The small numbers indicate duplicate results.

Clean Air for Ventilation. In the ventilation of a schoolroom, one should give careful consideration to the source of air supply and also to dust from the floor. The reason for this is obvious. Late in the autumn of 1911, some experiments were undertaken to determine what extent the air for ventilation in the experimental room was contaminated with dust from the floor. It was thought that air blown close up under the desks probably would baffle the dust stirred up from the floor. The experiments done at that time were too few in number to warrant a conclusion, but it is the intention during the coming autumn and winter to complete the tests. The tests will be made, as were the earlier ones, by bacterial counts on exposed culture plates.

Outside Wall and Window Chill. The problem of how to prevent outside wall and window chill from seriously interfering with ventilation, has never been satisfactorily solved.

With the change in installation in the experimental room, it was necessary to make some provision for preventing a sheet of cold air from falling down the exposed wall and windows. We tried to do this by installing steam pipes along the window casings just in front of the windows. The idea in this installation was to induce convection currents around the windows, and in this way prevent the downward currents of cold air. Tests were made of the scheme in two ways: (1) By the use of small turbines it was found that down currents of air were established from a few inches to a foot or more above the horizontal steam pipes. A second method was that of getting temperature readings at different heights from the floor in the aisle between the desks and the outside wall. These temperature readings showed a variation from almost nothing to eight or ten degrees, between the floor and the top of the desks. During the very severe weather of January and February, 1912, it became evident that this installation was only partially satisfactory. When the outside temperature was ten or more degrees below zero, there was a cold current of air that spilled out from the window over the top of the heating pipes above the window sills. This fact led to a proposed installation to overcome the window chill in another way—by means of a sheet of hot air. This new installation will be tried during the coming winter.

The Humidity Factor is a Serious One for the Plenum System. As already stated, the Plenum system combines the heating and the ventilating of a building. The heating is accomplished by means of heated air which subsequently is used for ventilation.

My experimental work has determined that the amount of air necessary for heating a building in cold weather, is greater in quantity than that necessary for ventilating. This fact becomes significant when relative humidity is taken into account. In order to increase the relative humidity within a room, it is necessary to evaporate water into the air. Whatever the source of this moisture, it entails expenditure of energy which, of course, costs money; and since it is best in our climate to have a fairly humid atmosphere in which to live, it becomes a question of considerable importance from the standpoint of economy as to whether or not it is best to allow the heating and the ventilating of a building to remain combined. Air need not be humidified for heating purposes.

Aside from the standpoint of cost, there is also involved the debatable question of whether or not one should breathe air soon after it has been heated as hot as it is necessary when used in the Plenum system. Physicians are not agreed upon the point, and therefore it seems desirable to avoid it, especially when it may be avoided without additional cost—probably at less cost.

Air Washing and Relative Humidity. Wherever foul air only is available for ventilation, the very important and vital matter of air washing may readily take care of adding humidity to the air. I have done nothing on the problem of air washing.

Our Next Move. We now propose to separate the heating of our experimental room from the ventilating insofar as they seem to impair the efficiency of each other. The scheme in brief is this: We propose to heat the room by means of hot air circulated under the floor, some of which will be allowed to escape through proper openings under control along the outside wall and windows, and thus force a thin sheet of hot air vertically upward. This thin sheet of hot air is for the purpose of destroying outside wall and window chill.

The ducts for ventilating the room will remain substantially as they now are except that the supply of air for breathing will be independent of that for heating; undoubtedly this will mean a lower temperature of the air for breathing purposes, and also will necessitate a minimum of moisture for properly humidifying the air for breathing.

The experimental room is now being fitted out in order to make tests along the line just indicated, during the coming winter.

Acknowledgment. I wish now to acknowledge my indebtedness to the Board of Education of the City of Chicago; the Department of Health, City of Chicago; also to the other members of the Chicago Commission on Ventilation. Without assistance from these various sources, I could not have carried out my experiments.

Finally the idea toward which all my experimental work is directed is that of keeping the schoolroom sufficiently warm to be comfortable to its occupants, and at the same time furnish them, for breathing purposes, with an individual and adequate supply of fresh, clean, cool, humid, moving air from outdoors.

THE PHYSIOLOGIC COST OF INSUFFICIENT PROTECTIVE CLOTHING

BY

G. W. Fitz

There is perhaps no subject of such constant and vital interest, on which there are so many opinions vigorously supported, as that of clothing. As what we wear is a matter of daily choice, that we may adapt ourselves to the vagaries of weather and climate, and as each individual considers himself the ultimate judge of what constitutes comfort for himself under these varying conditions, the subject is of necessity clouded by a mass of personal, unscientific, more or less haphazard opinion. The chief popular attempt to mould this opinion has been made, not by hygienists nor by physicians, who are as rarely consulted upon this subject as upon the family diet, but by the manufacturers of special fabrics, who have bombarded the public with cleverly constructed statements of the vital superiority of their particular products. As a result of this, there are to-day a number of clothing cults, supported by this quasi-scientific commercial literature, advocating the exclusive use of wool, silk, cotton, or linen, in knit, mesh, or other form of weave, and in varying weights.

In an attempt to analyze and explain the various features of personal comfort involved in these different materials and weaves, and to establish the functions of clothing, certain physiologists, notably Rubner, have made elaborate experiments. They conclude that the essential features of ideal underclothing lie in its ability to remove moisture rapidly from the surface of the body and, at the same time, to delay its evaporation at the outer surface of the clothing, in order to avoid chill. The ideal underclothing must further be sufficiently porous to give adequate ventilation to the surface of the body and must contain fibres sufficiently elastic to give a large air and moisture capacity, which they must retain even when wet, thereby avoiding clinging to the skin and loss of ventilation.

The material which in cool weather best meets these requirements in underclothing, they found to be that which Nature has developed in various forms, in her vast experimental laboratory, expressly for the protection of animal life, namely hair or wool; and its mode of manufacture to be the so-called tricot, or knit, weave. The objection to the practical use of wool which they recognize, is its first cost and its liability to be quickly ruined by shrinking when washed.

Next in value to wool, they found silk, which, although somewhat inferior to wool in certain characteristics, has the advantage of being an extremely agreeable and smooth fabric, which is not at all irritating to sensitive skins. The insurmountable objection to its general use is its very high initial cost and its lack of durability in the knit weave.

Cotton proved to be next in value to wool and silk. Cotton fabric, however, is somewhat deficient in the essential characteristic of elasticity of fibre. Therefore, when used as underclothing, it has an inferior air and moisture capacity, and fails, even when dry, to conserve the body heat to the same degree as wool. When moist, its inferiority is considerably increased by the softening of its fibres and the consequent reduction of its air and moisture capacity; the ventilation of the skin, to which it tends to cling, is reduced, at the same time that the rapidity of evaporation from its outer surface is decidedly increased. The heat of the body is thereby dissipated so rapidly that chill often results.

Linen was found to be still less desirable than cotton, since it favors an even more rapid evaporation of the body's moisture and thereby greatly predisposes to chill.

The desirable weave for all of these materials, when used as underclothing, was proved to be the tricot or knit, because of the added elasticity and porosity it imparts to the fabrics. In the case of cotton, this weave contributes a firmness which somewhat lessens its tendency to cling to the skin and to lose its porosity when moist.

The open mesh weave Rubner found objectionable in direct proportion to the size of its holes, since it reduces the fabric's ability to absorb and remove from the skin its excess moisture.

We naturally turn from the conflicting and confused opinions of the laity with their vagaries of habit and standards of immediate personal comfort, and the conclusions of the physiologists, which are based largely upon the physical characteristics of clothing in their relation to the heat regulation of the animal body, to the experience of physicians, based upon the observation of the influence of clothing upon health. In this, we naturally expect greater unanimity of opinion through the generalization and elimination of individual peculiarities and the formulation of a consistent standard of clothing use from the standpoint of health.

Being unable to find any satisfactory expression of such medical opinion, I sent a questionnaire to several hundred of the most prominent medical practitioners of America, selected chiefly from Cattell's American Men of Science. Rather more than a hundred replies were received. Of these, forty odd, while expressing great interest in the subject, frankly acknowledged total ignorance of it, and admitted an attitude based wholly upon personal predilection, since they had paid no attention to the clothing habits of their patients. More or less complete replies were received from about sixty, and have been tabulated on the basis of positive statement only. Of these, thirty-six agreed that personal comfort was a guide to the kind and amount of clothing required. Thirty-four stated positively that cold hands, feet, nose and ears were reliable signs of insufficient clothing, barring the presence of chronic cardiac or other causative disease. Only eight considered cold extremities consistent with adequate clothing and normal health. Other criteria suggested by a few were general health, resistance to disease, weight, and reaction to cold.

In the selection of materials for clothing, although there was not complete unanimity of opinion on the part of those who committed themselves, wool led by more than five to one in its favor. Twenty-seven claimed that at all ages in cool climates wool was a necessary protection. Only five claimed that it was totally unnecessary. Twenty-five considered it essential as underclothing, especially in childhood; twenty-eight considered it also essential as underclothing for old age. Twenty-seven made it essential as outer clothing for all ages. As a more or less complete substitute for wool in underclothing, sixteen favored cotton, three specifying cotton mesh; seven favored linen, four specifying linen mesh; nine favored silk; eight favored mixed wool and cotton.

In reply to the question as to the hygienic safety of the present light weight winter clothing for women and children, thirty-seven condemned it as unsafe; four were in doubt; eleven approved of it. Among the deleterious effects stated to have been observed were an increased tendency to colds and minor illnesses, poor sleep, lowered intellectual efficiency, decreased growth and development. Twenty-two expected from it decreased, while two expected increased, resistance to disease.

In choice of room temperature, greater unanimity of opinion was apparent, in that only one called for a temperature above 73° F., whereas forty-one chose a range of 65° to 70°, with a marked tendency in favor of 67° to 68°. The remaining eighteen were non-committal, with the exception of four who thought higher temperatures at times necessary, unless the great dryness of indoor winter air was neutralized by additional moisture.

The following diseases were recognized as having, in their experience, been associated with inadequate protective clothing: Bronchitis, by 30; nasal catarrh, by 27; pneumonia, by 26; pleurisy, gastro-enteritis and rheumatism, by 22; nephritis and tonsilitis, by 19; tuberculosis, by 18; middle ear and antrum inflammation, by 16; catarrhal jaundice, gastritis, rheumatoid arthritis and imperfect nutrition, by 14; retarded growth, by 13; dyspepsia and neurasthenia, by 10; osteo-arthritis and villous arthritis, by 8. Thus many physicians are seen to recognize as results of underprotection by clothing, not only acute catarrhal troubles, but also remote and essentially chronic, organic, joint and nervous ailments, which, in their inception, may in no wise affect the individual's immediate sense of comfort and against which he may not therefore guard himself.

A large proportion of the prominent physicians who replied to my questionnaire would thus seem to be in agreement with the findings of the physiologists, that wool is the superior material for clothing and that it is a necessary safeguard of health.

Their conclusion would appear to be borne out by the practical experiences of men in the more trying branches of labor, where disability is quickly shown, as firemen on steamships and workers in foundries and other places in which perspiring men are exposed to cold drafts of air. I remember, for example, a foundryman coming to my clinic with a markedly painful spinal osteo-arthritis, who, when questioned as to his habits of clothing, replied that, when he went into the foundry the workmen all advised him to wear wool underclothes and warned him that otherwise his back was sure to become crippled. Because of poverty and a large family, he wore heavy cotton instead, with the result of being permanently incapacitated for heavy work at the end of a few years. This is only one of many instances which have come under my observation and have convinced me of the casual relation between inadequate protection by clothing and remote ailments of rheumatoid or arthritic type, which are not generally recognized as being thus associated.

The deleterious effects of inadequate clothing are not confined to adults. There is a type of child, poorly nourished and generally underdeveloped in strength and endurance, with poor appetite and constantly subject to minor ailments, who is popularly diagnosed as having poor circulation because of habitually cold extremities. We often see in this class marvelous improvement as a result of changing to wool underclothing, sufficient in amount to keep the hands and feet warm. Unfortunately, the change is often attributed entirely to the tonic medicine which the doctor usually gives at the same time.

Many persons, especially women, are content to go through life with cold extremities, accepting the popular verdict of poor circulation, because they experience no particular discomfort, on account of the essential exhaustion of the terminal sense organs of cold in the extremities. In this class, we frequently find developed, usually after the years 30 to 35, many cases of painful joints, especially of foot, ankle, knee and hand. The joints, on examination, frequently show distinct enlargement, that is, are osteo-arthritic in nature. In some, the enlargement is very slight and its sensitiveness greatly in excess of that seemingly warranted by the physical condition. We find further many cases of nervous irritability, ranging from the "nervous stomach" to distinct and painful neuritis of persistent type.

This multitude of cases, such as painful joints in women and children, colic, especially in young children, nervous states seemingly obscure in their origin, malnutrition, sleeplessness, general irritability, and neuritis, which are ameliorated or even cured by a change to warmer clothing, constitute a mass of positive evidence which no amount of personal prejudice or negative experience would seem competent to overthrow. Negatively to argue that dozens of people are seemingly able to maintain their normal equilibrium for years in spite of inadequate clothing is far from proving either that they may not later pay with years of suffering, or that dozens of others do not pay earlier in life. It is the argument used to prove alcohol incapable of harm, because some drunkards live to be eighty.

That notwithstanding this positive evidence, there yet exists to-day so much ignorance and conflicting opinion on the subject of underprotection by clothing and its physiological cost (it will be remembered that out of over one hundred prominent physicians, nearly half expressed their ignorance of the subject) is undoubtedly due to our failure carefully to study the etiology of chronic diseases, and, especially, to get adequate histories of the clothing habits of our patients. The situation is now further complicated by the great emphasis being laid upon the stimulating effect of cold and the miracles it performs, with the result that we are in danger of being swept off our feet in our indiscriminate use of this powerful agent. We are in danger of forgetting that, like most so-called stimulants, it has another and antagonistic side. Brief applications of cold, especially when alternated with heat, are marvelously stimulating to the nutritive processes and nerve control of the body. They train its heat-regulating apparatus to broaden the range of safe exposure to variations of temperature, and under such training, the body unquestionably becomes better able automatically to protect itself.

This use of cold as a stimulant and trainer of the automatic processes of the body is, however, a very different matter from the keeping of any part of the body constantly at a temperature below the normal of 98.5° F. Under these conditions, the delicately controlled heat-regulating mechanism at once acts in defense of the vital organs by partially excluding the blood from the extremities where it is being overcooled. The result is that the tissues of the extremities are kept in a state of anæmia and chill. This means in a certain percentage of cases, but apparently not of necessity in all, that the nutritive conditions in bone, nerve, muscle, tendon and other tissue, are so changed that wholesome development and maintenance may be impossible. In this depressed condition, cellular activity is often so seriously impaired that the weak spot in the individual is made manifest, as in the form of overgrowth of tender bone around the joints, or of an abnormally irritable state of the nerve terminals and trunks. The cold, instead of being a stimulant, has now become a depressant of serious menace to comfort and health.

The normal warmth of the entire body, on the contrary, means the maintenance of cell activity at its maximum efficiency through the presence of a rich blood supply and renders the body most resistant to disease.

It thus appears that each individual has to consider whether or not, through adequate clothing, he will insure himself against the risk of illness or of prolonged discomfort and inefficiency during the later years of his life. It would seem that the safest form of insurance had been shown by physiologists and physicians and by the practical experience of men under trying temperature conditions, to be wool clothing for cool weather, since by its use the body has been found to be fully protected. The expense of this insurance has by many been considered prohibitive, not because of its first cost, but because the life of the porous wool undergarment is so shortened by shrinkage in washing. This objection I have proved to be easily obviated. For the past ten years my family and I have worn in winter pure wool unions, of varying weights—a form of garment which cannot be worn when even slightly shrunk. By using ammonia in wash water of blood temperature and a so-called wool soap and by avoiding rubbing except lightly with the hands, we have not been able to discover any shrinkage or loss of original softness and pliability. Garments originally bought large, of heavy weight and pure wool, have remained too large even after several years of use and garments of exact fit have remained so. From the standpoint of economy, therefore, judged by its yearly cost as an insurance against financial loss through illness and inefficiency, knit wool underclothing must be considered remarkably cheap.

From the standpoint of the possible physiological cost of inadequate clothing in lowered vitality, illness, and inefficiency, as well as discomfort, we must consider it extremely fortunate that nature, by its ages of experimentation to develop for animal life the best protection against wet and cold, has thereby provided the human animal with so adequate a protective material.

In view of the fact, however, that there is so much confusion in the popular mind on the subject of the proper protection by clothing and so much neglect and divergence of opinion on the part of physicians, and that the positive evidence of disability through underprotection, now at our disposal, is too isolated and fragmentary to be considered fully authoritative, it would seem that the great practical importance of the subject demands that it be more adequately studied in the future.

PURIFICATION OF AIR AND WATER BY MEANS OF OZONE

BY

J. C. OLSEN

Water has long been known as a carrier of germs of disease. In the purification of water great advances have been made in recent years so that city supplies are now filtered and purified by the addition of chemical substances and we now consider it criminal negligence to use contaminated water. We still consider it a dispensation of Providence if we contract colds, influenza, pneumonia, measles or other contagious diseases and take only indirect means to protect ourselves from these air-born diseases. Only in the rooms of the convalescent do we sterilize the air, clothing and room generally, but we breathe the germ-laden air of our crowded school rooms, theatres and public assemblies, trusting to our strong constitutions to resist the millions of disease germs which we inhale or acquire by contact just as our forefathers drank polluted as well as pure water with no thought that there could be found any means of destroying the death-dealing bacteria.

Undoubtedly, the death rate from contagious diseases could be greatly reduced if we had at hand means for sterilizing or purifying the air as it passes from one individual to others as well as the clothing and furniture in our living rooms. Our places of public assembly, such as theatres, churches, public halls and schools are, undoubtedly, great clearing houses where the germs of contagious diseases are distributed to be carried by susceptible individuals into our homes. An interesting study could, no doubt, be made of the number of cases of diseases of a contagious nature occurring in a group of school children meeting in school rooms in which the air is ozonized and compared with the number occurring in school rooms in which the air is not ozonized.

Mr. George C. Whipple has made a very interesting study of the value of pure water to a community. From the reduction in the death rate from typhoid fever and other water-born diseases on changing from a somewhat polluted to a pure water supply, he concludes that the pure water is worth to the community from $66.71 to $121.77 per million gallons consumed, depending upon the consumption per capita.

The value of ozonized air could be computed in a similar manner from the aggregate doctors' and nurses' bills as well as the value of the lives of those whose deaths are due to impure air. According to the table used by Mr. Whipple an average child of 5–10 years is worth $2,300, while a child of 10-15 years is worth $2,500. The aggregate would, undoubtedly, be very considerable and many times greater than the cost of ozonizing the air which is quite small. Of course this is considering the question from the financial point of view only. Other considerations will suggest themselves to everyone. Observation in offices where the air is ozonized has shown a marked reduction of the time lost by the clerical force on account of sickness.

Modern scientific research has brought to light many means of destroying bacteria and we may stop to ask what properties the *ideal* disinfectant should possess. While effectually destroying bacteria it should also be entirely harmless to human beings and should not injure clothing, books, furniture or growing plants in our living rooms. Such a bactericide could be continually present in the air of our living rooms protecting us from the germs of contagious diseases just as at present most of us live in modern civilized communities around which our Health Authorities have erected walls shutting out impure water, milk and other foods dangerous to health.

We find that the bactericides which have been used, such as chlorine, sulphur dioxide, formaldehyde are all poisons which we cannot inhale without serious injury and which seriously injure clothing, furniture and plant life.

Chemically we find that chlorine is a strong oxidizing agent while sulphur dioxide is a strong reducing agent. This is also true of formaldehyde. The natural disinfectant which continually operates is the oxygen of the air. This is particularly efficient in the presence of strong sunlight, the actinic or chemical rays of which greatly accelerate the action of the oxygen of the air. Natural waters are purified in this manner. The amount of dissolved free oxygen is now considered the best criterion of the purity of water as pathogenic bacteria cannot long survive in its presence.

Ozone is a modified form of oxygen produced by passing the silent electric discharge through oxygen or the air. The oxygen absorbs energy from the electric current and passes into an allotropic modification which is more active than ordinary oxygen. This increased activity of ozone is due to the energy which it contains. Chemically it is given the formula O_3 while ordinary oxygen has the formula O_2. When ozone comes into contact with dead organic matter or living organic matter, such as bacteria, oxidation immediately takes place with destruction of the organic matter or bacteria. Ozone is more efficient in this respect than oxygen so that while some pathogenic bacteria can resist the action of oxygen, it has been conclusively demonstrated that pathogenic bacteria are quickly destroyed by means of ozone. When present in suitable concentration ozone has long been recognized as beneficial to human beings whose vigor and very life depend upon oxidizing processes. There is always present in the mouth and nasal passages a great deal of effete organic matter and bacteria which can be ozonized with great benefit to the organism. Ozone is not in any way destructive of clothing or furniture, but on the contrary very quickly and effectively removes any disagreeable odors which may be present. Plant life is not injured by ozone. When breathed in too great concentration, irritation of the throat and nasal passages result but no permanent ill effect results. For breathing purposes not more than 0.3 parts of ozone per 1,000,000 parts air should be present.

Ozone as a disinfectant has therefore a number of very marked superiorities over the commonly used disinfectants, the greatest of which is probably the fact that it can be introduced into rooms occupied by human beings who thrive in its presence while the bacteria alone are destroyed. The question immediately rises why it has not been used more than it has. The answer is that methods have not, until recently, been available for its production where needed. Like so many other of our modern conveniences and necessities it has passed its childhood as a scientific toy awaiting the time when it can take its place as a serviceable member of our adult scientific community, the telephone, wireless, aëroplane, etc. It has also been necessary to demonstrate its usefulness and to educate the public to its necessity in ordinary life.

On June 23rd a test was made in New York City of the air in school rooms before and after ozone had been introduced. The test was carried out together with a representative of the Board of Health by the Board of Education, having been arranged for by the American Museum of Safety of New York. The first test was made in a room 20½ x 22½ feet with 12-foot ceiling. It was situated on the ground floor with three windows opening directly upon the street. The temperature of the room was 25° C. The pupils were of grade 1A and numbered 44.

All determinations were made by drawing 3 cubic feet of air through a sterilized tube containing sterilized sand. The sand was afterwards washed with 10 c.c. of sterile water which was plated on agar, incubated at 37½° C. and counted after three days, and on gelatine, incubated at 20° C. and counted after 4 days. Moulds were also counted. Tests for B. Coli were also made by means of ox bile.

The following tests were made without ozone:

Sample of air taken at 11:45 A.M. School in session—teacher and six adults present. Windows open.

Total Bacteria per cu. ft.	167
Moulds, per cu. ft.	23
B. Coli	absent

Test made at 12:00 M.—School marching out.

Total Bacteria per cu. ft.	533
Moulds per cu. ft.	30
B. Coli	absent

These tests show the condition of the air in the room with the school in session and marching out.

A further test was made when only the adults who were taking the samples were present. The fan of the ozonizing machine was going but no ozone was generated.

Windows closed, fan going, six adults in the room. Sample taken at 12:30 P.M.

Total Bacteria per cu. ft.	133
Moulds per cu. ft.	67
B. Coli	absent

Finally the ozonizer was operated for 15 minutes and a strong smell of ozone was noticeable throughout the room.

Sample taken at 1:00 P.M.

Total Bacteria per cu. ft.	7
Moulds per cu. ft.	10
B. Coli	absent

The reduction in the number of bacteria is so great that all disease bacteria were probably killed and the air rendered entirely safe if experience with water-born bacteria can be used as a guide.

Experiments were also conducted in another school building in the same crowded section of Manhattan. The room selected was in the old portion of the building and measured 15 x 19 with a 14-foot ceiling. The grade was 2-A with 31 pupils. There were two windows on one side of the room which were open from the top. The samples were taken and counts made in the same manner as already described.

School in session. Fan going for 15 minutes. Sample taken at 2:42 P.M.

Total Bacteria per cu. ft.	133
Moulds per cu. ft.	17
B. Coli	absent

The fan only of the ozonizer was operated during this test. After the ozonizer had been operated for 15 minutes, another test was made.

School in session. Ozonizer operated for 15 minutes. Sample taken at 3:10 P.M.

Total Bacteria per cu. ft.	33
Moulds per cu. ft.	7
B. Coli	absent

The reduction in the number of bacteria was not as great as in the tests in the first school, probably because the windows were open from the top, allowing constant entrance of bacteria laden air. The number of moulds is also not so great as the room was on the second floor and on the south side of the building.

The ozonizer was continued in operation during the dismissal of the school and after 15 minutes another test was made with the following result:

Total Bacteria per cu. ft.	7
Moulds per cu. ft.	7
B. Coli	absent

While the movement of the pupils would tend to increase the number of bacteria in the air, the continued action of the ozone reduced the number of bacteria so that the air was finally as nearly sterile as in the first room tested. Undoubtedly, the ozone tends to sterilize the clothing and the dust on the floor and furniture so that while movements of the pupils may increase the amount of dust in the air, the bacterial content of the air is decreased.

The result of these tests are sufficiently favorable to lead to the belief that it is possible to obtain as high a bacterial purity in the air which we breathe as in the water which we drink and that a very marked reduction in the number of cases of disease from air-born bacteria is possible if the air is ozonized.

The ozonater used was a Vohr Machine, manufactured by the Hudson Ozone Machine Co. of 120 Liberty Street, New York City.

The ozonizer proper consists of two sets of flattened aluminum tubes fixed in wooden frames and separated by air spaces and glass plates. The silent discharge of electricity of 9,500 volts passes from one tube to the next and the air is forced by means of a fan through the blue zone of electricity. The direct current of 110 volts which was available was converted to alternating current. About .85 amperes of current is consumed. The somewhat larger machine used for ozonizing water, style B, consumes about 1 ampere of current. On account of the small amount of current used the cost of ozonizing air or water is very low.

The ozonization of water was carried out by means of the same ozonizing machine inclosed in an air-tight box having an opening on the rear for the admission of air and another opening in front. To the latter a tube is attached which conveys the ozone to a T tube where it is sucked into the water by means of a suction pump operated by the water pressure. The mixture of ozone, air and water is forced into a specially constructed chamber where a thorough mixing of the ozone and water is secured.

The Croton water before treatment with ozone had the following composition:

Unfiltered Unozonized Croton Water.

Bacteriological Examination:

Total Bacteria—80
B. Coli—absent

Physical Examination:

Turbidity—3
Color—5

Chemical Analysis:

	Parts per Million
Nitrites	absent
Oxygen Consumed	.9
Free Ammonia	.026
Albuminoid Ammonia	.12

The water was ozonized at the rate of 128 gallons per hour. The ozonized water was analyzed with the following result:

Sample of Water Ozonized by Two Small Generators.
Bacteriological Examination.

Total Bacteria	none
B. Coli	absent

Sample of Water Ozonized by Single Generator—Style B.
Bacteriological Examination.

Total Bacteria	none
B. Coli	absent

Physical Examination.

Turbidity	3
Color	1

Chemical Examination.

	Parts per Million
Nitrites	.0025
Oxygen Consumed	.5
Free Ammonia	.04
Albuminoid Ammonia	.113

The physical examination showed that the turbidity was unaffected while the color was almost entirely removed. Ozonizers should, therefore, be used with filters if the water is very turbid.

The chemical examination showed marked oxidation of organic matter.

It is evident from these tests that the drinking water of schools can very readily be purified by means of ozone so as to render it absolutely safe.

VENTILATION UND HEIZUNG DER SCHULRÄUME

VON

HUGO SELTER

Die Luft der Schulräume erleidet während des Unterrichts sehr bald eine Verschlechterung, die bedingt ist durch die Zunahme der Ausatem-Kohlensäure, der sogenannten Riechstoffe, Erhöhung der Temperatur und Feuchtigkeit. Die Giftigkeit der Ausatemluft hat sich bisher nicht beweisen lassen. Auch die neusten Mitteilungen *Weichardt's* über das Vorkommen von Ermüdungsgift in der Ausatemluft konnten von anderer Seite nicht bestätigt werden. Die Konstitution der Riechstoffe kennen wir nicht, wir wissen nur, dass sie von der Schweiss-sekretion der Haut, aus kariösen Zähnen, Ausdünstungen des Magen-Darmkanals und den Kleidern der Schulkinder stammen. Die Riechstoffe vermögen bei Menschen, die von aussen in einen schlecht ventilierten, überfüllten Raum treten, Ekelgefühl hervorzurufen. Die Insassen merken weniger von den Riechstoffen, da die Riechnerven durch das allmähliche Auftreten der Riechstoffe abgestumpft werden. Es ist aber doch anzunehmen, dass eine Schädigung der Schulkinder, die gezwungen sind, monatelang in schlechter, mit Riechstoffen angereicherter Luft zu verbringen, eintreten kann. Die Beseitigung der Riechstoffe durch die Ventilation ist deshalb unbedingt zu verlangen.

Die durch schlechte Luft beim Menschen auftretenden Symptome, Müdigkeit, Unbehagen, Schwindel, Neigung zu Erbrechen, Ohnmacht, usw. sind nach Untersuchungen *Flugge's* und seiner Schüler jedoch weniger auf eine chemische Veränderung der Raumluft zu beziehen, als auf eine mangelhafte Entwärmung des Körpers durch zu hohe Temperatur und Feuchtigkeit des Raumes. Wurde in einem Kasten die Temperatur auf über 20° C. und die Feuchtigkeit über 60% erhöht, so traten bei Versuchspersonen die genannten Symptome auf; sie blieben aus bei Steigerung des Kohlensäuregehaltes durch die Ausatemluft bis auf 15%, wenn Temperatur und Feuchtigkeit niedrige Grade zeigten. Es ist daraus zu schliessen, dass Temperatur und Feuchtigkeit vor allem bei der Beurteilung der Schulzimmerluft zu berücksichtigen sind.

Während früher zur Berechnung der Ventilationsgrösse allein der Kohlensäuremassstab herangezogen wurde, und auf Grund dessen in Schulzimmern eine mindestens dreimalige Lufterneuerung verlangt wurde, sucht man jetzt an Stelle desselben den Wärmemassstab (Berechnung der Ventilationsgrösse nach Wärme und eines nicht zu überschreitenden Feuchtigkeitsgehaltes) zu setzen. Die Temperatur des Schulzimmers soll nicht über 20° C. und die Feuchtigkeit nicht über 60%

hinauskommen. Die Ventilation hätte also die Aufgabe, diese Grenzen einzuhalten. Eine bestimmte Temperatur liesse sich durch Regulierung der Heizung unter Berücksichtigung der von den Schülern abgegebenen Wärme leicht erreichen, auch ohne Ventilation. Schwieriger ist die Einhaltung eines gewissen Feuchtigkeitsgrades, da von 50 Schulkindern während einer Unterrichtsstunde ca 1000 g Wasser durch die Ausatemluft und Verdunstung von der Haut aus als Wasserdampf an die Raumluft abgegeben werden, was bei 18° C. einer Erhöhung des Feuchtigkeitsgehaltes um etwa 30% entsprechen würde. Um dieser Feuchtigkeitsanreicherung durch die Ventilation zu begegnen, würde man bei einer Aussentemperatur von + 5° C. und 80% relativer Feuchtigkeit einen etwa einmaligen Luftwechsel benötigen, bei + 12° einen zweimaligen; bei + 14° und derselben Feuchtigkeit würden aber schon nicht genügende Mengen Luft zugeführt werden können, um die Feuchtigkeit der Zimmerluft unter 60% zu halten. Als alleinigen Massstab für die Ventilationsgrösse die Bestimmung der Temperatur und Feuchtigkeit heranzuziehen, scheint demnach für Schulen nicht angebracht. Dem Heizer müsste denn eine Tabelle gegeben werden, aus welcher er bei jeder Temperatur und Feuchtigkeit der Aussenluft das erforderliche Ventilationsquantum ablesen könnte. Neben der Beurteilung der Raumluft nach Temperatur und Feuchtigkeit ist auch die Berechnung nach der Zunahme der Kohlensäure durch die Ausatemluft erwünscht. Als Grundforderung ist aufzustellen eine mindestens dreimalige Lufterneuerung während des Unterrichtes und Vermeidung einer Erhöhung der Temperatur über 19–20°. Das Auftreten von Riechstoffen kann durch fleissige Benutzung der Schulbrausebäder, Beseitigung der kariösen Zähne, Aufhängen der Ueberkleider ausserhalb des Schulzimmers vermindert werden.

Ein dreimaliger Wechsel der Schulluft wird nur durch künstliche Ventilationseinrichtungen zu erreichen sein. In den Pausen kann durch Öffnen der Fenster und Türen eine schnelle Durchlüftung und Entwärmung der Klassen herbeigeführt werden. Eine Lüftung durch klappbare Oberfenster ist nur ausreichend, wenn zwischen Aussen und Innentemperatur mindestens 5° Differenz bestehen. Bei kalten Aussentemperaturen kann diese Lüftung aber zu Schädigungen der am Fenster sitzenden Kinder führen. Im Sommer ist dagegen eine Durchlüftung des Raumes durch Öffnen der ganzen Fenster zu erreichen, auch wenn Aussen- und Innen-Temperatur geringe Temperaturdifferenzen aufweisen. Wie Untersuchungen im Hygienischen Institut in Bonn zeigten, tritt selbst bei geringer oder mangelnder Windbewegung schnell ein Ausgleich der Feuchtigkeit der Raumluft mit der atmosphärischen ein, was nur durch Diffusion bedingt sein kann.

Jedes Schulzimmer muss mit einem Zuluft- und Abluftkanal versehen sein. Für Aborte, Schulbäder und Schulküchen sind nur Abluftkanäle vorzusehen in die für bessere Aspiration der Luft ein Heizkörper gestellt wird. Die Zuluft ist in Verbindung mit der Heizung zu bringen, um sie vorzuwärmen und dadurch Zugbelästigungen der Kinder zu vermeiden. Bei Ofenheizung verbindet man den Zuluftkanal mit dem Raum zwischen Ofen und Mantel. Bei Zentralheizung erwärmt man die Luft entweder in einer Zentralheizkammer, oder lässt sie an Heizkörpern, die in den zu den Klassenzimmern vertikal aufwärts führenden Kanälen aufgestellt sind, vorbeistreichen. Hierdurch ist aber nicht zu allen Zeiten, vor allem nicht in den Uebergangszeiten und bei Ausserbetriebsetzung der Heizung eine dreimalige Lufterneuerung der Schulzimmer gesichert. Diese ist nur zu errreichen, wenn durch einen Motor die Luft in die Schulzimmer hineingetrieben wird. Die Pulsionslüftung ist deshalb für Schulen in 1. Linie zu empfehlen. Nimmt man den Querschnitt des Abluftkanales kleiner wie den des Zuluftkanales, so erreicht man in den Klassenzimmern einen gewissen Ueberdruck, der eine Zugbelästigung der Kinder durch die sonst von den Fenstern einfallende kalte Luft ausschliesst. Bei dieser Ueberdrucklüftung wurde bisher von den Heizungsingenieuren verlangt, dass die Fenster während der ganzen Schulzeit geschlossen gehalten werden sollten, da durch Öffnen der Fenster eine Störung der Luftzufuhr befürchtet wurde. Aus erzieherischen Grundsätzen und um eine schnelle Entwärmung der Klassenzimmer herbeizuführen, ist aber in den Pausen das Öffnen der Fenster und Türen vorzuziehen. Diese Verbindung der Fensterlüftung mit der Ueberdrucklüftung lässt sich technisch ermöglichen, indem der Heizer während der Pausen den Motor abstellt. Vielleicht würde sich dies auch auf automatischem Wege erreichen lassen. Die Ueberdrucklüftung soll jedoch nicht an Stelle einer Luftheizung treten, indem sie die Aufgabe hätte bei völligem Abstellen der Heizkörper die Innehaltung der Temperatur von 19° C. durch die zugeführte Luft zu bewirken. Hierzu würde eine Temperatur von 19-21° erforderlich sein, was aber leicht zu einer Ueberwärmung der Klassenzimmer führen muss. Die zugeführte Frischluft soll nur auf 15-16° erwärmt werden, nur so weit, dass eine Zugbelästigung der Kinder vermieden wird. Eine Zugbelästigung ist bei dieser Temperatur selbst bei mehr wie fünfmaligem Luftwechsel und bei einer Geschwindigkeit der zugeführten Luft bis zu 5 m in der Sekunde nicht zu befürchten, wenn die Zuluft in der Nähe der Decke eintritt und durch ein vorgestelltes Gitter in kleinere Luftströme zerlegt wird. Die Ueberdrucklüftung kann auch zur Kühlung der Schulräume im Sommer dienen, was in sehr heissen Sommern nützlich sein wird. So wurden z. B. im Sommer 1911 in Strassburg bei den Schulkindern Hitzestauungserscheinungen beobachtet, die sich durch Abnahme des Körpergewichtes und Zunahme der Blutarmut bemerkbar machten und zum Teil nicht einmal durch die langen Herbstferien ausgeglichen wurden, sondern erst im Laufe der Wintermonate verschwanden. Eine Kühlung der Luft könnte dadurch erreicht werden, dass man die Luft in den Kellerräumen entweder durch Brausen durchführt, oder an den durch kaltes Leitungswasser gekühlten Radiatoren der Heizungskammer vorbeistreichen lässt. Auch durch Inbetriebhaltung der Lüftung während der Nacht wäre eine Kühlung der Räume möglich; nach Untersuchungen Hottinger's kann dadurch während der Unterrichtsstunden von 8-11 Uhr die Raumtemperatur um etwa 4° niedriger als die Aussentemperatur gehalten werden. Am einfachsten ist die Kühlung durch Brausen zu erreichen, wodurch zugleich eine Reinigung der Luft von Staub bewirkt wird. Eine Befeuchtung der Luft hierbei ist nur in ganz geringem Masse möglich. In heissen Sommertagen sollte den Knaben gestattet werden während des Unterrichts die Oberkleider abzulegen.

Die Zuluftkanäle werden am besten aus glasiertem Tonrohr oder verbleitem Eisenblech hergestellt und müssen leicht zu reinigen sein.

In letzter Zeit ist auch versucht worden, durch Ozonisierung der Luft eine Verbesserung herbeizuführen. Durch die reinigende, oxydierende Wirkung des Ozons glaubte man verdorbene Zimmerluft wieder auffrischen und ihr den Charakter reiner Aussenluft geben zu können. Die experimentelle Prüfung von hygienischer Seite hat jedoch ergeben, dass diese Voraussetzungen nicht zutreffen und dass eine Oxydation der Riechstoffe und eine Vernichtung der in der Raumluft enthaltenen Bakterien nicht nachzuweisen ist. Die Riechstoffe werden zwar verdeckt, aber nicht zerstört und treten nach Verschwinden des Ozongeruches wieder auf. Das Ozon ist auch kein indifferentes, sondern ein ausgesprochen giftiges Gas, das schon in Mengen, die unter der quantitativen Bestimmbarkeit liegen, Belästigungen der Insassen hervorruft. Bei Konzentrationen von 0,0001% treten schon Reizungen der Atmungsorgane beim Menschen auf. Bei Versuchstieren hatte die Einatmung der Ozonluft eine Vermehrung der Kohlensäureausscheidung und Verminderung der Sauerstoffaufnahme, also eine Herabsetzung des Atmungsumsatzes zur Folge. Die Anwendung des Ozons in Schulräumen muss deshalb nicht nur als überflüssig, sondern als direkt gefährlich bezeichnet werden. Seine Anwendung würde auch andere Ventilationsanlagen nicht entbehrlich machen.

Die Heizung soll eine Innehaltung der Raumtemperatur selbst an den kältesten Wintertagen auf 19-20° C. ermöglichen. Von den Heizungsanlagen ist zu verlangen, dass die Wärme gleichmässig über den ganzen Raum verteilt wird, dass sie schnell und gut zu regulieren sind, und dass durch Bedienung derselben Staub oder gasförmige Verunreinigungen nicht in die Zimmerluft gebracht werden. Bei Ofenheizung kann dies durch Anwendung geeigneter Dauerbrandöfen erreicht werden. Zweckmässiger erfolgt die Heizung in Schulen jedoch durch Zentralheizung, deren Betrieb infolge des geringern Brennstoffverbrauches auch weit billiger ist, wie die Ofenheizung Selbst unter Berücksichtigung der höheren Anlagekosten stellt sich vom wirtschaftlichen Standpunkt aus eine Zentralheizung nicht teuerer, als Ofenheizung. Die in Schulen gebräuchlichen Systeme sind Niederdruckdampf- und Warmwasserheizung. Die Niederdruckdampfheizung hat den Nachteil, dass sich die Heizkörper sehr stark erwärmen und dass es dadurch zu einer Verbrennung des auf ihnen liegenden Staubes kommt. Nach den Untersuchungen von *Esmarch* und *Nussbaum* tritt eine Verbrennung des Staubes ein, wenn die Oberflächen der Heizkörper Temperaturen über 70° erreichen, es entstehen dann brenzliche Stoffe, die die Atmungsorgane reizen, was früher fälschlicherweise einer Trockonheit der Luft zugeschrieben wurde. Bei der Warmwasserheizung bleibt die Oberflächentemperatur der Heizkörper meist unter 70°, da es bei nicht zu kalten Aussentemperaturen möglich ist, mit einer Wasserwärme von 50-60° die Zimmer genügend zu heizen. Die Warmwasserheizung hat auch den Vorteil, dass sie generell besser reguliert werden kann. Ihre Anlagekosten sind zwar etwas höher als die der Niederdruckdampfheizung, der Brennstoffverbrauch aber geringer. Die Warmwasserheizung muss deshalb als die beste Heizung für Schulräume betrachtet werden. Auf die Einfrierungsgefahr in den Ferien ist Rücksicht zu nehmen. Zweckmässig ist in grösseren Schulgebäuden neben der Warmwasserheizung noch die Anlage einer Niederdruckdampfheizung, an welche die Aula, Turnhallen und Korridore anzuschliessen sind. Die Heizkörper sollen als glatte, auf Konsolen gestellte Radiatoren mit weiten Gliederabständen unter den Fensternischen angebracht sein, oder als lange, mehrfach übereinander geordnete Rohre an der Fensterseite verlaufen. Bei der Ueberdrucklüftung wird auch die Stellung der Heizkörper an der Innenseite möglich sein Die Regulierung der Heizung soll nicht dem Lehrer überlassen sein, sondern in die Hand eines ausgebildeten Heizers gelegt werden. Das Anbringen der in die Wand eingelassenen Schauthermometer, wodurch sich der Heizer über die Temperaturen der Schulzimmer unterrichten soll, hat nicht viel Zweck; es wird dem Heizer nur selten mölich sein, danach die Heizung zu stellen. Eine sichere Regulierung ist nur möglich, entweder durch eine zentrale Regulierung, oder durch automatische Temperaturregler. Bei der Ersteren werden in jedem Schulraum Fernthermometer aufgehängt, welche durch elektrische Verbindung mit einem zentralen Bedienungsraum dem Heizer ermöglichen, von seinem Stand aus jederzeit die Temperaturen des Raumes abzulesen und die örtlichen Heizkörper danach einzustellen. Noch zweckmässiger sind vielleicht die automatischen Temperaturregler, die in den Schulzimmern selbst angebracht direkt die Heizkörper regulieren. Es gibt zuverlässige Konstruktionen, die durch Anwendung von Druckluft, elektrischem Strome oder noch besser durch Ausdehnung und Zusammenziehung einer temperaturempfindlichen Masse sowohl bei Niederdruckdampfheizung, wie bei Warmwasserheizung eine Regulierung der Ventile bewirken. Nach den Untersuchungen *Brabbées* ist es hierdurch möglich, Räume beständig auf derselben Temperatur mit Unterschieden bis höchstens zu 0.5° C. zu halten. Wahrscheinlich ist eine Verminderung des Brennstoffverbrauches dadurch zu errreichen, sodass auch vom wirtschaftlichen Standpunkte aus diese Temperaturregler zu empfehlen sind.

DER EINFLUSS DER KALTEN FÜSSE AUF DIE GEISTESTÄTIGKEIT DER SCHULKINDER

VON

J. BRANDAU

Jahrzehnte lang hatte ich die vielen schädlichen Folgen der habituellen Hyperhidrosis pedum an mir selbst erfahren, nachdem ich einen sehr schweren Gelenk-Rheumatismus in folge Infection bei der Tracheotomie eines an Diptherie erkrankten Knaben, durchgemacht hatte und trotz Anwendung aller Mittel und Bäder denselben nicht los werden konnte, denn die immer nassen Strümpfe und daher, besonders zur Winterszeit, eiskalten Füsse und Beine, standen regelmässig in ursächlichem Zusammenhang mit den Verschlimmerungen desselben und manchen Begleiterscheinungen z. B. chronischem Bronchial-Catarrh, Nasen- und Rachen-Catarrh, etc., die aber vollständig verschwanden, nachdem es mir gelungen war, ein in Form eines Fusssohlenbades anzuwendendes Präparat zu finden, das nach und nach den profusen Schweiss beseitigte und in den nunmehr stets trockenen Strümpfen, warme Füsse herbei führte und danach die Heilung aller meiner Beschwerden mir brachte! Das war vor ca. 30 Jahren!

Hierdurch wurde ich nun aufmerksam auf die mit chronischem Nasen- Rachencatarrh behafteten Schulkinder mit ihrem stupiden Gesichtsausdruck, ihrer oft sehr beschränkten Intelligenz und mit ihrer leichteren Infection bei ausbrechenden Masern- und Scharlach-Epidemien, wie auch auf manche schwerere Leiden z. B. Asthma bronchiale, Epilepsie, Tuberculose, verschiedene Magen- und Unterleibs-Krankheiten bei Erwachsenen männlichen und weiblichen Geschlechts was auch von mir in mehreren wissenschaftlichen Arbeiten (1) veröffentlicht und andererseits auch anerkannt worden ist.

Um nun nach so langen theoretischen und poliklinisch-praktischen Untersuchungen mit einwandfreiem und unter doppelter Kontrolle angestellten Versuchen über den segensreichen Erfolg der Heilung der

1. Ueber die habituelle Hyperhidrosis pedum. Deutsche Medizinal Zeitung No. 68 und 69 von 1886. Ueber den Zusammenhang des Asthmas mit der habituellen Hyperhidrosis pedum ebendaselbst No. 69 1887.—Ein Fall von Hyperhidrosis manuum und pedum von Dr. E. Hohmann ebendaselbst No. 87 1887 im Verlag von Eugen Grosser in Berlin.—Ueber Asthma sein Wesen und seine Behandlung von Dr. Briegelmann, Heusers Verlag in Neuwied.—C. Spener Die habituelle locale Hyperhidrosis, ihre Folgen und ihre Behamdlung-Jnaugural—Dissertation Halle a/S. 1888. Dr. Kretschmann Privat-Docent in Halle a/S. Ueber die Anwendung einiger neuen Arzenei Mittel in Band XXVIII 6 des Archivs für Ohrenheilkunde.

Hyperhidrosis pedum, vor die Oeffentlichkeit treten zu können, wurden im Frühjahr 1912 von mir in Mühlhausen i.E., mit Genehmigung der Ober-Schulbehörde und der Einwilligung der Eltern, an einer Anzahl der dümmsten und faulsten Schüler einer Klasse der Volksschule, Untersuchungen angestellt, über den von mir schon lange erkannten Einfluss von kalten Füssen auf die geistige Leistungsfähigkeit derselben und den segensreichen Erfolg ihrer Heilung. Es stellte sich in jedem Falle heraus, dass die kalten Füsse durch die mehr oder weniger profuse Schweissabsonderung an denselben bedingt war, weil naturgemäss durch die Verdunstung desselben in den nassen Strümpfen, den Füssen rasch viel Wärme entzogen wird, geradeso, als wenn dieselben von Wasser oder Schnee nass geworden sind. Ich habe früher schon in meiner Poliklinik durch genaue Wägungen der absolut trockenen Strümpfe festgestellt, dass dieselben nach einem 2 - 3 stündigen Spaziergang oft um 8 - 10 - 15 Gramm schwerer geworden waren!

Durch die bald eintretende Zersetzung des Schweisses, die selbst wieder die Absonderung desselben steigert, entsteht besonders in unreinen Strümpfen und für Verdunstung unzulässiger Fussbekleidung, der bekannte Geruch nach flüchtigen Fettsäuren, und diese sind es auch, welche das Epithel bis in die tieferen Schichten der Epidermis hinein oftmals hochgradig mazerieren.

Es ist nun eine längst bekannte Tatsache, dass bei habitueller Kälte der Füsse Blutstauungen, eine Disposition zu Katarrhen, insbesondere der oberen Luftwege entsteht, und dass ferner durch sie Zirkulationsstörungen in der Hirnrinde hervorgerufen werden, was Professor Dr. Winternitz in Wien experimentell durch längere Anwendung eines kalten Fussbades erforscht und dabei nachgewiesen hat, dass durch vasomotorischen Reflex eine Contraction der Blutgefässe im Gehirn verursacht wird, wodurch consecutiv eine geringere Blutzufuhr und mangelhaftere Ernährung desselben und daher geringere Leistungsfähigkeit stattfindet. Die in den äusseren Gehörgang wohlverwahrt und fest eingefügten Thermometer sinken bald um 0.5 - 0.6° C. die Conjunktival-Gefässe werden blasser, während das Thermometer in der Achselhöhle konstant bleibt. (1) Gleichzeitig kommt es auch wohl zu einer Anhäufung von Ermüdungsstoffen und eigenartigen, mit Abnahme des Hämoglobingehaltes einhergehenden Schrumpfungsvorgängen und Zerfallerscheinungen der roten Blutkörperchen, und man kann sich daraus leicht vorstellen, welch einen verderblichen Einfluss die *jahrelang* kalten Füsse im *jugendlichen Alter* nicht nur auf die geistige Leistungsfähigkeit, sondern auch auf die Entwicklung des Gehirns ausüben muss!

1. Hydrotherapile von Dr. W. Winternitz, Leipzig, Verlag von Vogel 1881.

Ich habe schon in früheren Arbeiten nachgewiesen, dass die Blutstauungen in den oberen Luftwegen congestive Zustände mit sich bringen, welche sich, unter Schwellung der Gaumentonsillen, Rötung und Schwellung der Rachen- und Nasenschleimhaut, und erschwerter Nasenatmung offenbaren. Meine langjährigen Erfahrungen haben sogar noch viel schlimmere Folgen solcher Zirkulationsanomalien erwiesen. Durch diese Hyperämischen Zustände wird der Einwanderung von allerhand perniciösen Keimen Vorschub geleistet, insbesondere sind es Anginen, Diptherie, und Gelenkrheumatismus, welche auf diese Weise entstehen können.

Die Untersuchung von 22 Schulknaben im Alter von 13 - 15 Jahren hat denn auch die Bestätigung erbracht, dass bei denjenigen, die mit schwitzenden und infolge dessen kalten Füssen behaftet waren, Affektionen des Nasen-Rachenraumes entstanden. Es hatte sich ferner herausgestellt, dass gerade diejenigen unter den Schülern der beiden von mir zur Untersuchung herangezogenen Volksschulklassen, nach Aussage ihrer Lehrer, nur sehr mittelmässige Leistungen aufwiesen, nur wenige oder gar keine Fortschritte machten, zerstreut und unaufmerksam waren und wenig geistige Regsamkeit zeigten. Es hängt also zweifelsohne die oben auseinander gesetzte Anämie des Gehirns mit ihren Folgen mit diesen Zuständen zusammen, wodurch eben sich im Verein mit der Anhäufung von Ermüdungsstoffen die geringe Leistungsfähigkeit erklären lässt.

Um nun über den Zusammenhang zwischen kalten Füssen und geistiger Leistung definitiv Aufschluss zu erhalten, musste es mein Bestreben sein, die Kinder während ihrer Schultätigkeit, erstens: unter solchen Verhältnissen zu beobachten, unter denen sie bisher bei Einwirkung kalter Füsse standen und zweitens: festzustellen, ob nach Beseitigung des Leidens, also mit warmen Füssen, ein Aufschwung ihrer geistigen Leistungsfähigkeit vorhanden war. Diese Beobachtungen sind von zwei sehr erfahrenen und tüchtigen Volksschullehrern durch pädagogische Massnahmen, insbesondere durch schriftliche und mündliche Prüfung auf das Gewissenhafteste vorgenommen worden. Ich musste also zunächst darauf bedacht sein, den Fussschweiss und damit die kalten Füsse zu beseitigen. In meiner früheren Praxis, die ich in meiner Poliklinik ausübte, bediente ich mich zu diesem Zweck noch eines von mir komponierten sog. Liquor antihidrorrhoicus, dessen wirksames Prinzip wesentlich in seinem Gehalt an Acidum hyprochloricum bestand, und der als Fusssohlenbad angewandt wurde. Dieser Liquor, der besonders für schwerere Fälle ausgezeichnet wirkt, und dem ich zunächst alle meine Erfahrungen verdanke- da es ja früher kein sicher wirkendes Mittel gab- ist indessen umständlich anzuwenden, weshalb für leichtere Fälle und besonders in der Kinderpraxis, das viel einfachere Pinseln der Fusssohlen mit einer Mischung von Formaldehyd und Spiritus zu gleichen Teilen, sich empfiehlt. Mit diesem Gemisch wurden die Fussohlen und die Zwischenräume der Zehen, je nach der Stärke der Schweissabsonderung jeden zweiten oder dritten Tag und später seltener, gepinselt. Schon nach wenigen Tagen verlor sich die profuse Schweissabsonderung, die Kinder gaben an, sich im Allgemeinen viel wohler und aufgelegter zu fühlen, und in ihren Füssen eine wohltuende Wärme zu verspüren. Diese Angabe fand in dem Abtasten der Füsse und der Unterschenkel Bestätigung und mit dem Bestehenbleiben der warmen Füsse hob sich auch in auffallender Weise die geistige Regsamkeit und Leistungsfähigkeit der genannten 22 Schüler, was sich am besten aus den beiliegenden Tabellen ersehen lässt.

Um indessen eine doppelte Kontrolle zu führen, wurden, ausser den darin verzeichneten pädagogischen Methoden, auch noch genaue ästhesionetrische Messungen und zwar von Professor Dr. Griesbach selbst, mit dem von ihm angegebenen Aesthesiometer ausgeführt, die ebenfalls aus den Tabellen ersichtlich sind. Während nun die Schwellenwerte *vor der Pinselung* und *noch in den ersten Tagen* derselben im Schulbetriebe *gross* waren, und von schneller und hochgradiger Ermüdung zeugten, nahmen dieselben im Laufe der Pinselung unter Beobachtung *deutlich ab.* Dieser Umstand weist darauf hin, dass die Schüler ihre Arbeiten mit weniger geistiger Anstrengung vollbrachten, als früher, und dass sie dafür eine geringere intellektuelle Aufmerksamkeit bedurften und infolge dessen auch weniger leicht ermüdeten.

Es lag nun der Gedanke nahe, dass, und um allen Zweifel an dem herrlichen und segensreichen Erfolg der geschilderten Behandlung auszuschliessen, ein forcirter und intensiver Unterricht die Schüler auch ohne Behandlung der schwitzenden und kalten Füsse von geringen zu höheren Leistungen führen könnte. Es wurden daher im Hinblick auf diese Möglichkeit noch sieben weitere Schüler derselben Klasse, die auch mit Schweissfüssen behaftet waren, mit denen aber keine Kur vorgenommen wurde, in Bezug auf die Gesamtergebnisse des Unterrichts genau beobachtet und geprüft. Dabei ergab sich die interessante Tatsache, dass die Gesamtleistungen bei diesen Schülern sich *gleich blieben*, zum Teil *sogar noch verminderten*, und jedenfalls weit hinter den Leistungen derjenigen Schüler, denen eine Fussbehandlung zu teil geworden war, *zurückstanden.*

Ich fasse meine Beobachtungen nun mit folgenden kurzen Schlusssätzen zusammen, halte es aber noch für angebracht, unter Hinweis auf die früher in der Medizin herrschende humoral- pathologische Lehre und auf die heute noch in weiten Kreisen des Volkes herrschende Meinung, dass man den „Fussschweiss" nicht vertreiben dürfe, auf Grund meiner langjährigen an vielen Tausenden von „Schweissfüsslern" gemachten Special—Beobachtungen und Erfahrungen feierlich zu erklären, dass dies ein sehr trauriger und verhängnisvoller Irrtum ist, und dass ich niemals irgendwie schädliche Folgen durch die Heilung des Leidens, das ausserdem bisweilen ohne irgend einen erkenntlichen Grund von selbst vergeht und im höheren Alter immer mehr abnimmt und verschwindet, beobachtet habe! Ausserdem ist die gründliche Heilung dieses Leidens, wodurch nur das allzuviele, krankhafte Schwitzen beseitigt wird, die normale Perspiration aber bestehen bleibt, in ähnlichem Verhältnisse wie die chronische Diarrhoe zum normalen Stuhlgang—gar nicht so einfach und kurz und es gehört oft eine Monate und Jahrelange Kur dazu, anderenfalles es sich langsam, aber sicher wieder einstellt! Jedenfalls ist dies der sicherste Beweis gegen die obenangedeuteten Anschauungen von der grossen Gefährlichkeit des Vertreibens des Fussschweisses.

In Anbetracht der unendlichen Schädlichkeit dieses heimtükischen, Jahrhunderte lang verkannten und noch dazu gehegten und gepflegten Leidens richte ich an alle Collegen und Menschenfreunde die dringende Bitte, demselben ihre Aufmerksamkeit zur Bekämpfung und zu weiteren Erforschungen zuzuwenden zum Heil und Segen von Jugend und Alter!

Zusammenfassung.

1. Habituelle Kälte der Füsse wird in allen Fällen durch Hyperhidrosis derselben hervorgerufen.

2. Ein Gemisch gleicher Teile von wässriger Formalinlösung und Alkohol eignet sich, ohne Nachteil für die Gesundheit, zur Beseitigung des profusen Schweisses und der Kälte der Füsse.

3. Habituelle Kälte der Füsse kann Zirkulationsstörungen im Gehirn und kongestive Zustände in verschiedenen anderen Organen, insbesondere auch in den Luftwegen, mit sich bringen.

4. Durch Zirkulationsstörungen in den Hirngefässen wird eine gewisse Anämie, eine mangelhafte Ernährung und bei längerer Dauer eine geringere Leistungsfähigkeit desselben bewirkt und möglicherweise der Anhäufung von Ermüdungsstoffen und mancherlei Anomalien der Blutmischung Vorschub geleistet.

5. Hierdurch wird, wie die Vergrösserung der ästhesiometrischen Schwellen zeigt, das Unterscheidungsvermögen für aktile Eindrücke herabgesetzt und die in Aufmerksamkeit, Auffassungs-und Urteilsvermögen sowie in den Leistungen im Schulunterricht zum Ausdruck kommende geistige Betätigung, empfindlich geschädigt.

6. Die vorstehenden, an Schülern vorgenommenen Beobachtungen haben unzweideutig ergeben, dass durch Beseitigung der Hyperhidrosis

und der kalten Füsse, das körperliche Befinden sowie die geistige Leistungsfähigkeit der Schüler sich heben.

7. Vom unterrichtshygienischen und pädagogischen Standpunkte aus betrachtet, empfiehlt sich daher eine rationelle Behandlung der Schweissfüsse im schulpflichtigen Alter.

Résumé.

1. Le froid aux pieds habituel est dû dans beaucoup de cas à l'hyperhidrose des pieds.

2. Pour empêcher l'excès de transpiration on peut employer sans danger pour la santé un mélange à parties égales d'alcool et de solution de formaline dans l'eau.

3. Le froid aux pieds habituel peut provoquer des troubles circulatoires au cerveau et des congestions dans différents organes, les voies respiratoires entre autres.

4. Les troubles circulatoires du cerveau peuvent donner lieu à l'accumulation de déchets de la fatigue et à diverses anomalies du mélange sanguin.

5. Il en résulte, ainsi que le montre l'augmentation des seuils esthésiometriques, que la faculté de discernement pour les sensations tactiles est diminuée et que l'activité intellectuelle, se traduisant par l'attention, les facultés de réception et de jugement et par les progrés de l'éléve, en souffre sensiblement.

6. Ces observations, pratiquées sur des écoliers, ont prouvé avec certitude qu'avec la disparition de l'hyperhidrose et des pieds froids la santé corporelle ainsi que les facultés intellectuelles s' amélioraient.

7. Au point de vue de l'hygiène et de la pédagogie la traitement rationnel de l'hyperhidrose des pieds est donc recommandable.

Summary.

1. Chronic coldness of the feet is in many cases due to hyperidrosis of the feet.

2. A mixture of equal parts of the aqueous solution of Formalin and alcohol may be applied without prejudice to health for suppressing the excessive perspiration and the coldness of feet engendered by it.

3. Habitual coldness of the feet may induce disturbances of the cerebral circulation and states of congestion in other organs, especially the respiratory.

4. It is probable that accumulation of the products of fatigue and other anomalous states of the constitution of the blood are favoured by disturbances of the cerebral circulation.

5. The magnification of the aesthesiometric thresholds proves that the power of distinguishing tactile impressions is diminished by the condition; and that the intellectual faculties must be depressed which are normally manifested in power of application or attention, receptivity and judgment, and of dealing with school tasks in general.

6. Observations made upon school children (and tabulated above) conclusively prove that the remedy of the hyperidrosis and the attending condition of cold extremities results in improvement of both the physical and intellectual abilities of the scholars.

7. Both from the pedagogic point of view and from that of educational hygiene, it is accordingly desirable that excessive perspiration of the feet should be intelligently treated during the period of the school attendance.

Riassunto.

1° Il freddo ai piedi abituale in molti casi é causato da inperidrosi, dei piedi.

2° Per impredire il sudore profuso dei piedi ed il loro raffreddamento, é da raccomandarsi l' uso, innocuo alla salute, di una miscela apparti uguali di una soluzione acquosa di formalina e di alcool.

3° Il freddo ai piedi abituale puó determinare disturbi della circolazione cerebrale e congestione in varii altri organi e particolarment anche nelle vie respiratorie.

4° I disturbi circolatorii cerebrali possono favorire l'accumulo dei prodotti della fatica e la produzione di svariate anomalie della crasi sanguigna.

5° Per tal modo, come lo dimonstra l'ampliamento del soglio estesiometrico, viene diminuita la facolta' di discernimento delle sensazioni tattili, e danneggiata sensibilmente l'attivitá intellettuale e quindi l'attenzione, le facolta percettive e critiche, come pure il progresso nello studio.

6° Le osservazioni precedenti compiute su scolari, hanno dimostrato in modo indubbio che curando l'iperidrosi, ed impedendo il freddo ai piedi, si migliora le condizioni di salute fisca, e le facoltá intellettuali degli allievi.

7° Deve quindi raccomandarsi, sia dal punto di vista dell'igiene scolastica, che da quello pedagogico, di sottomettere ad un trattamento razionale l'iperidrosi dei piedi nell' étá giovanile.

Tabelle II

Erklärung der Abkürzungen.

l. = links (linke Gesichtseite).
r. = rechts (rechte Gesichtseite).
P. = Pinselung.
gel. B = gelinde Besserung, d. i. die Füße sind noch etwas kalt, jedoch weniger als vor der Behandlung.
gt. B. = gute Besserung, d. i. warme Füße.
z. gt. = ziemlich gut.
gegd. = genügend.
9./2. usw. = Zahlen und Monat des Jahres 1912.

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	Schwellenwerte in Millimetern r.
1. Artur Andre.	9./2.	— — —	—	—	—	—	—	10	9,5
	10./2.	— — —	—	—	—	—	P.	5	5,5
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Etwas kalte Füße	frisch	—	—	—	P. gel. B	—	—
	13./2.	Warme Füße	„	—	—	klar gedacht	—	—	—
	14./2.	„ „	„	—	z. gt.	z. gt.	P. gt. B.	—	—
	15./2.	„ „	„	—	—	—	—	—	—
	16./2.	„ „	„	—	—	—	P. gt. B.	—	—
	17./2.	„ „	„	—	—	—	—	—	—
	18./2.	„ „ wund (Füße eingeschmiert)	„	—	—	—	—	—	—
	19./2.	Warme Füße, wund	„	—	—	—	P. gt. B.	—	—
	20./2.	„ „ „	„	—	z. gt.	—	—	—	—
	21./2.	„ „ „	„	gering	—	—	P. gt. B.	—	—
	22./2.	„ „ nicht mehr wund	„	—	z. gt.	—	—	—	—
	23./2.	Wohl	„	—	—	z. gt.	—	5,5	5,5
	24./2.	Warme Füße, müde, um 11 Uhr zu Bett	erholt sich rasch	ziemlich	—	z. gt.	P. gt. B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße, wund, Kopfweh	—	—	nicht wie sonst gut	z. gt.	—	—	—
	27./2.	„ „	frisch	—		—	P. gt. B.	—	—
	28./2.	„ „	„	—	—	—	—	—	—
	29./2.	„ „	„	—	—	—	—	—	—
	1./3.	„ „	„	—	—	—	P. gt. B.	5,6	7,5
	2./3.	„ „ etwas Kopfweh	—	—	gut	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, etwas Kopfweh, spät zu Bett	—	—	—	z. gt.	—	—	—
	5./3.	Warme Füße	frisch	—	—	—	P. gt. B.	—	—
	6./3.	„ „ wohl	„	—	—	—	—	—	—
	7./3.	„ „ „	„	—	—	—	—	—	—
	8./3.	„ „ „	„	—	—	gut	—	6	5,5
	9./3.	Fehlt wegen Kopfweh	—	—	—	—	—	—	—
	10./3.	Warme Füße, wohl	—	—	—	—	—	—	—
	11./3.	„ „ „	frisch	—	gut	—	—	—	—
	12./3.	„ „ „	„	—	—	—	—	—	—
	13./3.	„ „ „ wund . .	—	gegd.	—	—	P. gt. B.	—	—
	14./3. [1]	„ „ „	frisch	—	—	—	—	—	—
	15./3.	„ „ „	„	—	—	—	—	5,5	5,5
	16./3.	„ „ „	„	gut	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Warme Füße, wohl	frisch	—	—	—	P. gt. B.	—	—
	19./3.	„ „ „	„	—	—	—	—	—	—
	20./3. [2]	Fehlt	—	—	—	—	—	—	—
	21./3.	Warme Füße, wohl	frisch	—	—	—	—	—	—
	22./3.	„ „ „	„	—	—	—	P. gt. B.	5,5	5,5
	23./3.	„ „ „	„	gut	z. gt.	z. gt.	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Fehlt wegen Unwohlseins . .	—	—	—	—	—	—	—
	26./3.	Nicht ganz wohl	—	—	z. gt.	—	—	—	—
	27./3.	Warme Füße, wohl	frisch	gut	z. gt.	—	P. gt. B.	—	—

[1]) Schriftliche Prüfung.
[2]) Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	Schwellenwerte in Millimetern r.
2. *Joh. Bapt. Eidenschenck.	9./2.	— — —	—	—	—	—	—	7	6
	10./2.	— — —	—	—	—	—	P.	7	5
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Etwas kalte Füße	—	—	—	—	P. gel. B.	—	—
	13./2.	" " "	—	—	—	nicht klar gedacht	—	—	—
	14./2.	Warme Füße	frisch	1. Std. unaufmerksam, 2. Std gut	z. gt.	gut	P. gt. B.	—	—
	15./2.	" "	"	—	—	—	—	—	—
	16./2.	" "	"	—	—	—	P. gt. B.	—	—
	17./2.	" "	"	—	—	—	—	—	—
	18./2.	" " abends krampfartige Schmerzen in d. Füßen	"	—	—	—	—	—	—
	19./2.	Warme Füße	"	—	—	gut	P. gt. B.	—	—
	20./2.	" " Haut zwischen den Zehen aufgesprungen .	weniger frisch	—	z. gt.	—	—	—	—
	21./2.	Warme Füße, Kopfweh . . .	—	—	—	—	P. gt. B.	—	—
	22./1.	" " wund, etwas Kopfweh bis Mittag	nichtfrisch	—	nicht wie sonst	—	—	—	—
	23./2.	Warme Füße, wund, ein wenig Kopfweh	—	—	—	gut	—	5,5	7
	24./2.	Warme Füße, wund	frisch	gut	—	"	P. gt. B.	—	—
	25./2.	" " "	"	—	—	—	—	—	—
	26./2.	Wohl	"	—	gut	gut	—	—	—
	27./2.	Warme Füße	"	—	"	—	P. gt. B.	—	—
	28./2.	" "	"	—	—	—	—	—	—
	29./2.	" " Kopfweh . . .	—	—	—	—	—	—	—
	1./3.	" "	frisch	—	—	—	P. gt. B.	4,5	4,5
	2./3.	" " wohl	"	gut	gut	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, wohl	frisch	—	—	gut	—	—	—
	5./3.	" " "	"	—	—	—	P. gt. B.	—	—
	6./3.	Wohl	"	—	—	—	—	—	—
	7./8.	"	"	—	—	gut	—	—	—
	8./3.	"	"	—	—	"	—	4	5
	9./3.	"	"	—	—	—	fehlt	—	—
	10./3.	"	"	—	—	—	—	—	—
	11./3.	"	"	—	gut	—	—	—	—
	12./3.	"	"	—	—	—	—	—	—
	13./3.	"	"	gut	—	gut	P. gt. B.	—	—
	14./3. [1]	"	"	—	—	—	—	—	—
	15./3.	"	"	—	—	gut	—	8	7
	16./3.	"	"	gut	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Wohl	frisch	—	—	—	P. gt. B.	—	—
	19./3.	"	"	—	—	gut	—	—	—
	20./3. [2]	"	"	—	—	—	—	—	—
	21./3.	Etwas müde, sonst wohl, Fußball gespielt (tags vorher) .	ziemlich frisch	—	—	—	—	—	—
	22./3.	Wohl	frisch	—	—	gut	P. gt, B.	7	6
	23./3.	"	"	—	gut	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Wohl	—	—	—	—	—	—	—
	26./3.	"	frisch	—	gut	—	—	—	—
	27./3.	"	"	gut	"	—	P. gt. B.	—	—

[1] Schriftliche Prüfung.
[2] Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	Schwellenwerte in Millimetern r.
3. Renatus Faisst.	9./2.	— — —	—	—	—	—	—	5,6	5,8
	10./2.	— — —	—	—	—	—	P.	5,5	5,5
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Warme Füße	—	—	—	—	P. gel. B.	—	—
	13./2.	" "	—	—	—	schwach	—	—	—
	14./2.	" "	—	z. gt.	z. gt.	ziemlich	P. gt. B.	—	—
	15./2.	" " etwas Husten	frisch	—	—	—	—	—	—
	16./2.	" "	"	—	—	—	P. gt. B.	—	—
	17./2.	" " wund, Husten	"	—	—	—	—	—	—
	18./2.	" " "	"	—	—	—	—	—	—
	19./2.	" " "	"	—	—	—	P. gt. B.	—	—
	20./2.	" " "	"	—	z. gt.	—	—	—	—
	21./2.	" " "	"	—	—	—	P. gt. B.	—	—
	22./1.	" " "	"	—	z. gt.	—	—	—	—
	23./2.	Wohl	"	z. gt.	—	z. gt.	—	5,2	5
	24./2.	Müde, um 11 Uhr zu Bett .	abgespannt	—	—	—	P. gt. B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße, wund, sonst wohl	—	—	nicht wie sonst	z. gt.	—	—	—
	27./2.	Warme Füße, wund	—	—	gut	—	P. gt. B.	—	—
	28./2.	" " "	—	—	—	—	—	—	—
	29./2.	" " nicht mehr wund	frisch	—	—	—	—	—	—
	1./3.	Warme Füße	—	—	—	—	P. gt. B.	5,5	5,5
	2./3.	" " schläfrig, etwas Kopfweh	—	gering	gut	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße	frisch	—	—	z. gt.	—	—	—
	5./3.	" "	"	—	—	—	P. gt. B.	—	—
	6./3.	" " wund	—	—	—	—	—	—	—
	7./3.	" " "	faul	unaufmerksam	—	—	—	—	—
	8./3.	" " "	frisch	gut	—	gut	—	4	5,6
	9./3.	" " wenig wund, wohl	—	—	—	—	P. gt. B.	—	—
	10./3.	Wohl	—	—	—	—	—	—	—
	11./3.	"	—	—	gut	—	—	—	—
	12./3.	"	—	—	—	—	—	—	—
	13./3.	"	—	gegd.	—	—	P. gt. B.	—	—
	14./3.[1]	"	—	—	—	—	—	—	—
	15./3.	"	—	—	—	gut	—	4,5	4
	16./3.	" wund	—	gering	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Wohl, wund	—	—	—	—	P. gt. B.	—	—
	19./3.	" "	frisch	—	—	gut	—	—	—
	20./3.[2]	" "	"	—	—	—	—	—	—
	21./3.	" " spät zu Bett . .	—	—	—	—	—	—	—
	22./3.	" "	—	—	—	z. gt.	P. gt. B.	6,5	5,6
	23./3.	" wenig wund, spät zu Bett, Turnverein	—	—	gegd.	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Wohl, nicht wund	—	—	—	—	—	—	—
	26./3.	"	frisch	—	gut	—	—	—	—
	27./3.	"	"	—	z. gt.	—	P. gt. B.	—	—

1) Schriftliche Prüfung.
2) Mündliche Prüfung.

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4. Armand Giller.	9./2.	— — —	—	—	—	—	—	7	7
	10./2.	— — —	—	—	—	—	P.	6	6
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Kalte Füße	—	—	—	—	P. gcl. B.	—	—
	13./2.	Warme Füße	abgespannt	—	—	schwach	—	—	—
	14./2.	„ „	—	schwach	schwach	—	P. gt. B.	—	—
	15./2.	„ „	frisch	—	—	gut	—	—	—
	16./2.	„ „	—	—	—	—	P. gt. B.	—	—
	17./2.	„ „ wund, abends Kopfweh	—	gegd.	—	—	—	—	—
	18./2.	Warme Füße, wund, abends Kopfweh	—	—	—	—	—	—	—
	19./2.	Warme Füße, wund	—	—	—	—	P. gt. B.	—	—
	20./2.	„ „ „	nicht frisch	—	ziemlich	—	—	—	—
	21./2.	„ „ „	frisch	—	—	gut	P. gt. B.	—	—
	22./2.	„ „ wenig wund	„	—	—	—	—	—	—
	23./2.	„ „ Kopfweh	—	—	—	schwach	—	10	10
	24./2.	„ „ um 1/2 11 Uhr zu Bett, hat gelesen	schläfrig	—	—	gegd.	P. gt. B.	—	—
	25./2.	Wohl	—	—	—	—	—	—	—
	26./2.	„	—	—	z. gt.	z. gt.	—	—	—
	27./2.	Warme Füße, Kopfweh	—	—	—	—	P. gt. B.	—	—
	28./2.	„ „ wohl	—	—	—	—	—	—	—
	29./2.	„ „ Kopfweh	—	—	—	—	—	—	—
	1./3.	„ „ wohl	—	—	—	—	—	fehlt	
	2./3.	„ „ Kopfweh	schläfrig	—	—	—	P. gt. B.	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, spät zu Bett	schläfrig	—	—	z. gt.	—	—	—
	5./3.	„ „	—	—	—	—	P. gt. B.	—	—
	6./3.	Wohl	—	zerfahren	—	—	—	—	—
	7./3.	„	—	—	z. gt.	z. gt.	—	—	—
	8./3.	„	—	—	—	z. gt.	—	8	8
	9./3.	Warme Füße	träge	—	schwach	—	P. gt. B.	—	—
	10./3.	Wohl	—	—	—	—	—	—	—
	11./3.	„	—	—	erst schwach, dann ziemlich	—	—	—	—
	12./3.	„	—	—	—	—	—	—	—
	13./3.	Müde, spät zu Bett, Turnverein	abgespannt	mangelhaft	—	—	P. gt. B.	—	—
	14./3. [1]	Wohl	—	—	—	—	—	—	—
	15./3.	Müde, spät zu Bett, Turnverein	—	—	—	gering	—	9,2	9,4
	16./3.	Wohl	—	unaufmerksam	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./2.	Wohl	—	—	—	—	P. gt. B.	—	—
	19./3.	Müde, 11 Uhr zu Bett, gearbeitet	abgespannt	—	—	gegd.	—	—	—
	20./3. [2]	Wohl	frisch	—	—	—	—	—	—
	21./3.	„ etwas kalte Füße	—	—	—	—	—	—	—
	22./3.	„	—	—	—	z. gt.	P. gt. B.	6,2	6
	23./3.	Kopfweh, spät zu Bett	—	—	gegd.	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Wohl	—	—	—	—	—	—	—
	26./3.	„	—	—	gut	—	—	—	—
	27./3.	„ etwas müde, 4—7 Uhr Gartenarbeit (26./3.)	frisch	—	z. gt.	—	P. gt. B.	—	—

[1]) Schriftliche Prüfung.
[2]) Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	Schwellenwerte in Millimetern r.
5. Julius Meier.	9./2.	— — —	—	—	—	—	—	7	7
	10./2.	½ Stunde Zeitungen ausgetragen nach d. Mittagessen (trägt überhaupt jeden Tag ½ Stunde Zeitungen aus) .	—	--	—	—	P.	10,2	8
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Kalte Füße	—	—	—	—	P. gel. B.	—	—
	13./2.	Etwas kalte Füße	schläfrig	—	—	—	—	—	—
	14./2.	Warme Füße	—	gering	1. Stunde z. gt., 2. Stunde gering	—	P. gt. B.	—	—
	15./2.	„ „	—	—	—	gut	—	—	—
	16./2.	„ „	—	—	—	—	P. gt. B.	—	—
	17./2.	„ „	frischer, geworden	—	—	—	—	—	—
	18./2.	— — —	—	—	—	—	—	—	—
	19./2.	Warme Füße	—	—	—	—	P. gt. B.	—	—
	20./2.	„ „	frisch	—	z. gt.	—	—	—	—
	21./2.	„ „	„	unaufmerksam	—	—	P. gt. B.	—	—
	22./2.	„ „	„	—	—	—	—	—	—
	23./2.	„ „ wohl	—	—	—	gut	—	6,5	6,5
	24./2.	„ „ um ½ Uhr zu Bett, gearbeitet	schläfrig	gering	—	—	P. gt. B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße	schläfrig	—	—	gut	—	—	—
	27./2.	„ „	frisch	—	gut	—	P. gt. B.	—	—
	28./2.	„ „	„	—	—	—	—	—	—
	29./2.	„ „	„	—	—	—	—	—	—
	1./3.	„ „	„	—	—	—	P. gt. B.	5	6
	2./3.	„ „	„	gut	—	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße	schläfrig	—	—	z. gt.	—	—	—
	5./3.	„ „	frisch	—	—	—	P. gt. B.	—	—
	6./3.	„ „ wund, wohl .	—	—	—	—	—	—	—
	7./3.	„ „ „ „ .	—	—	—	—	—	—	—
	8./3.	„ „ „ „ .	—	—	—	gut	—	5,6	5,6
	9./3.	„ „ „ „	frisch	—	—	—	P. gt. B.	—	—
	10./3.	„ „ nicht wund . .	„	—	—	—	—	—	—
	11./3.	„ „	„	—	—	—	—	—	—
	12./3.	„ „	„	—	—	—	—	—	—
	13./3.	„ „ ½ Uhr zu Bett	schläfrig	—	z. gt.	z. gt.	P. gt. B.	—	—
	14./3. ¹)	„ „ wohl	frisch	—	—	—	—	—	—
	15./3.	„ „ müde (morgens)	schläfrig	—	—	gegd.	—	5,2	5.5
	16./3.	Wohl	frisch	gegd.	—	—	—	—	—
	17./3.	— — —	—	--	—	—	—	—	—
	18./3.	Wohl	frisch	—	—	—	P. gt. B.	—	—
	19./3.	„	„	—	—	gegd.	—	—	—
	20./3. ²)	Fehlt	—	—	—	—	—	—	—
	21./3.	Wohl	frisch	—	—	—	—	—	—
	22./3.	„	„	—	—	gut	P. gt. B.	5,4	5,4
	23./3.	„	„	—	z. gt.	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Wohl	—	—	—	—	—	—	—
	26./3.	„	—	—	gut	—	—	—	—
	27./3.	„	frisch	—	z. gt.	—	P. gt. B.	—	—

¹) Schriftliche Prüfung.
²) Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	Schwellenwerte in Millimetern r.
6. Artur Reibel.	9./2.	— — —	—	—	—	—	—	7,5	7,5
	10./2.	— — —	—	—	—	—	P.	6	7
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Kalte Füße, ein Brennen nach dem Pinseln	—	—	—	—	P. gel. B.	—	—
	13./2.	Warme Füße	—	—	—	ziemlich	—	—	—
	14./2.	" "	—	—	schwach	—	P. gt. B.	—	—
	15./2.	" " Brennen . . .	—	—	—	—	—	—	—
	16./2.	" "	—	—	—	—	P. gt. B.	—	—
	17./2.	" "	—	—	—	—	—	—	—
	18./2.	— — —	—	—	—	—	—	—	—
	19./2.	Warme Füße	—	—	—	ziemlich	P. gt. B.	—	—
	20./2.	" " abends vorher Kopfweh	frisch	—	ziemlich	—	—	—	—
	21./2.	Warme Füße	"	ziemlich	—	—	P. gt. B.	—	—
	22./2.	" "	abgespannt	—	—	—	—	—	—
	23./2.	" " wohl	—	—	—	—	—	6	6
	24./2.	" "	schläfrig	—	—	—	P. gt. B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße, wunde Füße, wohl	frisch	—	—	gut	—	—	—
	27./2.	Warme Füße, müde vom Arbeiten zu Hause	—	—	ziemlich	—	P. gt. B.	—	—
	28./2.	Warme Füße, wohl	—	—	—	—	—	—	—
	29./2.	" " ½12 Uhr zu Bett, gelesen	schläfrig	—	—	—	—	—	—
	1./3.	Warme Füße	frisch	—	—	—	P. gt. B.	5	5
	2./3.	" "	munter	ziemlich	—	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße	schläfrig	—	—	z. gt.	—	—	—
	5./3.	" "	—	—	—	—	P. gt. B.	—	—
	6./3.	" " wohl	—	—	—	—	—	—	—
	7./3.	" " "	—	—	—	—	—	—	—
	8./3.	" " "	—	zerfahren	—	—	—	5	5
	9./3.	" " "	frisch	—	—	—	P. gt. B.	—	—
	10./3.	" " "	—	—	—	—	—	—	—
	11./3.	" " "	—	—	ziemlich	—	—	—	—
	12./3.	" " "	—	—	—	—	—	—	—
	13./3.	" " müde, ½12 Uhr zu Bett (Umzug)	abgespannt	—	—	—	P. gt. B.	—	—
	14./3. [1]	Warme Füße, wohl	—	—	—	—	—	—	—
	15./3.	" " "	—	—	—	z. gt.	—	9	8,5
	16./3.	" " "	—	mangelhaft	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Warme Füße, wohl	—	—	—	—	P. gt. B.	—	—
	19./3.	" " "	—	—	—	z. gt.	—	—	—
	20./3. [2]	Fehlt	—	—	—	—	—	—	—
	21./3.	— — —	—	—	—	—	—	—	—
	22./3.	Warme Füße, wohl	—	—	—	—	P. gt. B.	fehlt	
	23./3.	" " "	—	—	gegd.	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Warme Füße, wohl	—	—	—	—	—	—	—
	26./3.	" " "	—	—	gegd.	—	—	—	—
	27./3.	" " "	frisch	—	—	—	P. gt. B.	—	—

[1] Schriftliche Prüfung.
[2] Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	Schwellenwerte in Millimetern r.
7. Marzel Bückly.	9./2.	— — —	—	—	—	—	—	7	11
	10./2.	— — —	—	—	—	—	P.	12,2	10,5
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Warme Füße	—	—	—	—	P. gt. B.	—	—
	13./2.	Etwas kalte Füße	—	—	—	—	—	—	—
	14./2.	Kalte Füße	—	—	schwach	—	P. gel. B.	—	—
	15./2.	Warme Füße, abends vorher bis 11 Uhr Musikprobe . .	—	—	—	—	—	—	—
	16./2.	Warme Füße	—	—	—	—	P. gt. B.	—	—
	17./2.	Etwas kalte Füße	frisch	z. gt.	—	—	—	—	—
	18./2.	Etwas Brennen in den Füßen	—	—	—	—	—	—	—
	19./2.	Warme Füße	—	—	—	gut	P. gt. B.	—	—
	20./2.	„ „ spät zu Bett, Musikprobe	—	—	ziemlich	—	—	—	—
	21./2.	Warme Füße	ab-gespannt	gering	—	—	P. gt. B.	—	—
	22./2.	„ „ müde, 10 Uhr zu Bett (21./2.)	—	—	—	—	—	—	—
	23./3.	Warme Füße, wohl	—	—	—	—	—	6	5,5
	24./2.	„ „ „ 9 Uhr zu Bett	frisch	gut	—	—	P. gt. B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße, wohl	frisch	—	—	z. gt.	—	—	—
	27./2.	„ „ „	„	—	gut	—	P. gt. B.	—	—
	28./2.	„ „ „	—	—	—	—	—	—	—
	29./2.	„ „ „	—	—	—	—	—	—	—
	1/3.	„ „ „ wund	—	—	—	—	P. gt. B.	6	8,5
	2./3.	„ „ müde, Kopfweh, Musikprobe	schläfrig	gering	—	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, wohl	frisch	—	—	gut	—	—	—
	5./3.	„ „ „	„	—	—	—	P. gt. B.	—	—
	6./3.	„ „ „	„	—	—	—	—	—	—
	7./3.	„ „ „	„	—	—	—	—	—	—
	8./3.	„ „ „	„	—	—	gut	—	7,5	7,5
	9./3.	Etwas kalte Füße, ½11 Uhr zu Bett, Musikprobe	schläfrig	—	—	—	P. gel. B.	—	—
	10./3.	Wohl, wund	—	—	—	—	—	—	—
	11./3.	„ „	—	—	gut	—	—	—	—
	12./3.	„ „	—	—	—	gut	—	—	—
	13./3.	„ „	frisch	gegd.	—	—	P. gt. B.	—	—
	14./3. [1]	Warme Füße, wund, bis 11 Uhr im Musikverein . .	schläfrig	—	—	—	—	—	—
	15./3.	Warme Füße, müde, bis ½12 Uhr im Musikverein .	ab-gespannt	—	—	gering	—	6	6
	16./2.	Warme Füße, wund, wohl .	etwas ab-gespannt	mangel-haft	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Warme Füße, wund, bis 11 Uhr im Musikverein . .	etwas ab-gespannt	—	—	—	P. gt. B	—	—
	19./3.	Etwas kalte Füße, wund, Regenwetter, schlechte Schuhe	—	—	—	gut	—	—	—
	20./3 [2]	Wohl	—	—	—	—	—	—	—
	21./3.	„ wund	frisch	—	—	—	—	—	—
	22./3.	„ nicht wund	„	—	—	z. gt.	P. gt. B.	6,5	5
	23./3.	„	—	—	gegd.	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Schläfrig, um 2 Uhr zu Bett, zum Tanz aufgespielt . . .	ab-gespannt	—	—	—	—	—	—
	26./3.	Munter	—	—	gut	—	—	—	—
	27./3.	Wohl	frisch	—	„	—	P. gt. B.	—	—

[1]) Schriftliche Prüfung.

[2]) Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	r.
8. Eugen Ruß.	9./2.	— — —	—	—	—	—	—	7	7
	10./2.	— — —	—	—	—	—	P.	9,5	9,5
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Kalte Füße	—	—	—	—	P. gel. B.	—	—
	13./2.	Warme Füße	—	—	—	ziemlich	—	—	—
	14./2.	Etwas kalte Füße	—	—	gut	—	P. gel. B.	—	—
	15./2.	Warme Füße	frisch	—	—	—	—	—	—
	16./2.	„ „	„	—	—	—	P. gt. B.	—	—
	17./2.	„ „	„	z. gt.	—	—	—	—	—
	18./2.	— — —	—	—	—	—	—	—	—
	19./2.	Warme Füße	frisch	—	—	gut	P. gt. B.	—	—
	20./2.	Etwas kalte Füße	„	—	gut	—	—	—	—
	21./2.	„ „ „	—	—	—	—	P. gel. B.	—	—
	22./2.	Warme Füße „	frisch	—	—	—	—	—	—
	23./2.	„ „ wund	—	z. gt.	ziemlich	ziemlich	—	5,5	5,5
	24./2.	„ „	frisch	z. gt.	—	—	P. gt. B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße, etwas Kopfweh	frisch	—	z. gt.	z. gt.	—	—	—
	27./2.	„ „	„	—	—	z. gt.	P. gt B.	—	—
	28./2.	„ „	„	—	—	—	—	—	—
	29./2.	„ „	„	—	—	—	—	—	—
	1./3.	„ „	„	—	—	—	P. gt. B	5,5	6
	2./3.	„ „	schläfrig	—	—	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, wohl	—	—	—	gut	—	—	—
	5./3.	„ „ „	—	—	—	—	P. gt. B.	—	—
	6./3.	„ „ „	—	—	—	—	—	—	—
	7./3.	„ „ „	—	—	—	—	—	—	—
	8./3.	„ „ „	—	—	—	z. gt.	—	8	7,5
	9./3.	„ „ etwas wund .	—	—	—	—	P. gt. B.	—	—
	10./3.	„ „ nicht wund, wohl	frisch	—	—	—	—	—	—
	11./3.	Warme Füße	„	—	gut	z. gt.	—	—	—
	12./3.	„ „	„	—	—	—	—	—	—
	13./3.	„ „	„	gegd.	—	z. gt.	P. gt. B.	—	—
	14./3. [1]	„ „ wohl	„	—	—	—	—	—	—
	15./3.	„ „ „	—	—	—	—	—	8,5	8,5
	16./3.	„ „ spät zu Bett .	schläfrig	gegd.	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Warme Füße, wohl	frisch	—	—	—	P. gt. B.	—	—
	19./3.	„ „ „	„	—	—	z. gt.	—	—	—
	20./3. [2]	Fehlt	—	—	—	—	—	—	—
	21./3.	Warme Füße, wohl	frisch	—	—	—	—	—	—
	22./3.	„ „ „	„	—	—	—	P. gt. B.	5,5	6
	23./3.	„ „ „	„	—	gegd.	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Warme Füße, wohl	frisch	—	—	—	—	—	—
	26./3.	„ „ „	„	—	gut	—	—	—	—
	27./3.	„ „ „	„	—	„	—	P. gt. B.	—	—

[1] Schriftliche Prüfung.
[2] Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	r.
9. Georg Scheidecker.	9./2.	— — —	—	—	—	—	—	7	5
	10./2.	— — —	—	—	—	—	P.	5,2	5,2
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Kalte Füße	—	—	—	—	P. gel. B.	—	—
	13./2.	Etwas kalte Füße	—	zerfahren	—	schwach	—	—	—
	14./2.	" " "	—	—	schwach	—	P. gel. B.	—	—
	15./2.	Warme Füße	frisch	—	—	—	—	—	—
	16./2.	" "	"	—	—	—	P. gt. B.	—	—
	17./2.	" "	"	—	—	—	—	—	—
	18./2.	— — —	—	—	—	—	—	—	—
	19./2.	Warme Füße	frisch	—	—	z. gt.	P. gt. B.	—	—
	20./2.	" " wund	"	—	schwach	—	—	—	—
	21./2.	" " "	schläfrig	gering	—	—	P. gt. B.	—	—
	22./2.	" " " ein Brennen an den Füßen	frisch	—	—	—	—	—	—
	23./2.	Warme Füße, wohl	"	—	z. gt.	—	—	5,5	5,5
	24./2.	" " "	"	gegd.	—	—	P. gt. B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2	Warme Füße, wund, ein wenig Kopfweh	—	—	schwach	ziemlich	—	—	—
	27./2.	Warme Füße, wund	—	—	gut	—	P. gt. B.	—	—
	28./2.	" " "	frisch	—	—	z. gt.	—	—	—
	29./2.	" " "	"	—	—	—	—	—	—
	1./3.	" " "	"	—	—	—	P. gt. B.	4,5	4,5
	2./3.	" " "	schläfrig	—	—	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, wohl	—	—	—	gut	—	—	—
	5./3.	" " wund	—	—	—	—	P. gt. B.	—	—
	6./3.	Etwas kalte Füße	—	—	—	—	—	—	—
	7./3.	" " " sonst wohl	—	—	—	—	—	—	—
	8./3.	" " " " "	frisch	ziemlich	—	gut	—	4,9	4,9
	9./3.	Warme Füße, wund	ziemlich frisch	—	—	—	P. gt. B.	—	—
	10./3.	" " "	"	—	—	—	—	—	—
	11./3.	" " "	"	—	gut	—	—	—	—
	12./3.	" " "	"	—	—	—	—	—	—
	13./3.	" " "	"	gegd.	—	—	P. gt. B.	—	—
	14./3. [1]	" " wohl	—	—	—	—	—	—	—
	15./3.	" " müde, Kopfweh, schlecht geschlafen .	schläfrig	—	—	—	—	8	8
	16./3.	Warme Füße, wohl	frisch	—	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Warme Füße, wohl	frisch	—	—	—	P. gt. B.	—	—
	19./3.	Kalte Füße, Regenwetter, schlechte Schuhe	—	—	—	gut	—	—	—
	20./3 [2]	Warme Füße, wohl . . .	frisch	—	—	—	—	—	—
	21./3.	" " "	"	—	—	—	—	—	—
	22./3.	" " "	"	—	—	—	P. gt. B.	fehlt	
	23./3.	" " "	"	—	z. gt.	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Warme Füße, wohl	frisch	—	—	—	—	—	—
	26./3.	" " " . .		—	z. gt.	—	—	—	—
	27./3.	" " "		—	z. gt.	—	P. gt. B.	—	—

[1]) Schriftliche Prüfung.

[2]) Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	Schwellenwerte in Millimetern r.
10. ** Artur Schirmann.	9./2.	— — —	—	—	—	—	—	6,5	7,5
	10./2.	— — —	—	—	—	—	P.	6	6
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Kalte Füße	—	—	—	—	P. gel. B.	—	—
	13./2.	„ „	—	—	—	—	—	—	—
	14./2.	Etwas kalte Füße	—	—	schwach	—	P. gel. B.	—	—
	15./2.	Weniger kalte Füße als gestern	frisch	—	—	—	—	—	—
	16./2.	Warme Füße	„	—	—	—	P. gt. B.	—	—
	17./2.	Etwas kalte Füße	„	—	—	—	—	—	—
	18./2.	— — —	—	—	—	—	—	—	—
	19./2.	Warme Füße	frisch	ziemlich rege	—	ziemlich	P. gt. B.		—
	20./2.	Etwas kalte Füße, wund, fühlt sich wohl	„	—	z. gt.	—	—	—	—
	21./2.	Warme Füße, wund	„	—	—	—	P. gt. B.	—	—
	22./2.	„ „ „	„	—	—	—	—	—	—
	23./2.	„ „ „	„	—	—	—	—	5,5	4,8
	24./2.	„ „ „	„	rege	z. gt.	—	P. gt B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße, wund	frisch	—	—	gut	—	—	—
	27./2.	„ „ „	„	—	gut	—	P. gt. B.	—	—
	28./2.	„ „ „ morgens etwas Kopfwch	—	—	—	—	—	—	—
	29./2.	Warme Füße, wund, etwas Kopfweh	—	—	—	—	—	—	—
	1./3.	Warme Füße, wund	frisch	—	—	—	P. gt. B.	4,5	4,5
	2./3.	„ „ „ etwas Kopfweh, doch munter . .	munter	rege	—	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, wohl	—	—	—	z. gt.	—	—	—
	5./3.	„ „ wund	—	—	—	—	P. gt. B.	—	—
	6./3.	Etwas kalte Füße	—	—	—	—	—	—	—
	7./3.	„ „ „ wohl . . .	—	—	—	—	—	—	—
	8./3.	„ „ „ „ . . .	—	gut	—	gut	—	4,9	4,5
	9./3.	Kalte Füße, wund, Kopfweh, bis 1/2 11 Uhr im Turnverein	—	—	gut	—	P. gel. B.	—	—
	10./3.	Warme Füße, wohl	frisch	—	—	—	—	—	—
	11./3.	„ „ „	„	—	—	—	—	—	—
	12./3.	„ „ „	„	—	—	—	—	—	—
	13./3.	Etwas kalte Füße, wohl . .	„	gut	—	—	P. gel. B.	—	—
	14./3. [1]	„ „ „ „ . .	„	—	—	—	—	—	—
	15./3.	Warme Füße	„	—	—	gut	—	6	6
	16./3.	„ „ müde, geturnt bis 3/4 11 Uhr	—	—	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Wohl	—	—	—	—	P. gt. R.	—	—
	19./3.	Warme Füße, wund	frisch	—	—	gut	—	—	—
	20./3. [2]	Wohl	„	—	—	—	—	—	—
	21./3.	„ abends vorher geturnt	„	—	—	—	—	—	—
	22./3.	„	„	—	—	z. gt.	P. gt. B.	4,5	4
	23./3.	„	„	—	gut	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Nicht ganz wohl, Kopfweh und Schnupfen	—	—	—	—	—	—	—
	26./3.	Nicht ganz wohl, Kopfweh bis Mittag	—	—	—	—	—	—	—
	27./3.	Wohl	frisch	—	gut	—	P. gt. B.	—	—

[1] Schriftliche Prüfung.
[2] Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür *	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	r.
11. Heinrich Weber.	9./2.	— — —	—	—	—	—	—	8,5	6,2
	10./2.	— — —	—	—	—	—	P.	6	6
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Kalte Füße	—	—	—	—	P. gel. B.	—	—
	13./2.	Warme Füße	—	—	—	—	—	—	—
	14./2.	„ „	—	—	schwach	—	P. gt. B.	—	—
	15./2.	„ „	—	—	—	—	—	—	—
	16./2.	„ „	—	—	—	—	P. gt. B.	—	—
	17./2.	„ „ wund	—	—	—	—	—	—	—
	18./2.	— — —	—	—	—	—	—	—	—
	19./2.	Warme Füße, wund	frisch	ziemlich	—	wenig	P. gt. B.	—	—
	20./2.	„ „ „	„	—	ziemlich	—	—	—	—
	21./2.	„ „ „	„	—	—	gering	P. gt. B.	—	—
	22./2.	„ „ „	„	—	—	—	—	—	—
	23./2.	„ „ „	„	—	—	—	—	5	5
	24./2.	„ „ „	„	—	—	—	P. gt. B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße, nicht mehr wund	frisch	—	—	—	—	—	—
	27./2.	Warme Füße	„	—	ziemlich	—	P. gt. B.	—	—
	28./2.	„ „	„	—	—	—	—	—	—
	29./2.	— — —	—	—	—	—	—	—	—
	1./3.	Warme Füße, wohl	frisch	—	—	—	P. gt. B.	4,2	5
	2./3.	„ „	—	unaufmerksam	—	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, wohl	frisch	—	—	—	—	—	—
	5./3.	„ „ „	„	—	—	—	P. gt. B.	—	—
	6./3.	„ „ „	„	—	—	—	—	—	—
	7./3.	„ „ „	„	—	—	—	—	—	—
	8./3.	„ „ „	„	gering	—	ziemlich	—	4,5	4,5
	9./3.	„ „ „	„	—	—	—	P. gt. B.	—	—
	10./3.	„ „ „	„	—	—	—	—	—	—
	11./3.	„ „ „	„	—	ziemlich	—	—	—	—
	12./3.	„ „ „	„	—	—	—	—	—	—
	13./3.	„ „ „	—	mangelhaft	—	—	P. gt. B.	—	—
	14./3. [1]	„ „ „	frisch	—	—	—	—	—	—
	15./3.	„ „ „	„	—	—	ziemlich	—	6,5	6,9
	16. 2.	„ „ „	—	mangelhaft	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Warme Füße, wohl, Klasse hat gebadet	—	—	—	—	P. gt. B.	—	—
	19./3.	Warme Füße, wohl	frisch	besser	—	z. gt.	—	—	—
	20./3. [2]	„ „ „	„	—	—	—	—	—	—
	21./3.	„ „ „	„	—	—	—	—	—	—
	22./3.	„ „ „	„	—	—	z. gt.	P. gt. B.	5,2	5,2
	23./3.	— — —	—	—	—	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	— — —	—	—	—	—	—	—	—
	26./3.	Warme Füße, wohl	frisch	—	gegd.	—	—	—	—
	27./3.	„ „ „	„	—	z. gt.	—	P. gt. B.	—	—

[1] Schriftliche Prüfung.
[2] Mündliche Prüfung.

Tabelle II (Fortsetzung).

Namen der Schüler	Datum	Körperliches Befinden und eventuell Ursache dafür	Allgemeiner geistiger Zustand	Aufmerksamkeit	Auffassung	Urteilskraft	Pinselung	Schwellenwerte in Millimetern l.	Schwellenwerte in Millimetern r.
12. Alfred Wolff.	9./2.	— — —	—	—	—	—	—	10	7,5
	10./2.	— — —	—	—	—	—	P.	7	8
	11./2.	— — —	—	—	—	—	—	—	—
	12./2.	Warme Füße	—	—	—	—	P.gt.B.	—	—
	13./2.	" "	—	—	—	—	—	—	—
	14./2.	" "	frisch	—	—	—	—	—	—
	15./2.	" "	"	—	—	—	P.gt.B.	—	—
	16./2.	" "	"	—	—	—	—	—	—
	17./2.	" " wund	"	—	—	—	—	—	—
	18./2.	— — —	—	—	—	—	—	—	—
	19./2.	Warme Füße, wund	frisch	—	—	—	P gt.B.	—	—
	20./2.	" " "	"	—	z. gt.	—	—	—	—
	21./2.	" " "	"	—	—	gut	P.gt.B.	—	—
	22./2.	" " "	"	—	—	—	—	—	—
	23./2.	" " "	"	—	z. gt.	gut	—	6,2	5,5
	24./2.	" " "	"	—	—	—	P.gt.B.	—	—
	25./2.	— — —	—	—	—	—	—	—	—
	26./2.	Warme Füße, nicht wund .	frisch	—	—	gut	—	—	—
	27./2.	" "	"	—	gut	—	P.gt.B.	—	—
	28./2.	" "	"	—	—	—	—	—	—
	29./2.	" "	"	—	—	—	—	—	—
	1./3.	" "	"	—	—	—	P.gt.B.	5,2	6,5
	2./3.	" "	schläfrig	—	—	—	—	—	—
	3./3.	— — —	—	—	—	—	—	—	—
	4./3.	Warme Füße, wohl	frisch	—	—	gut	—	—	—
	5./3.	" " "	—	—	—	—	P.gt.B.	—	—
	6./3.	Erkältet, rote Flecke auf der Rachenschleimhaut	—	—	—	—	—	—	—
	7./3.	Erkältet	—	—	—	—	—	—	—
	8./3.	"	—	—	—	gut	—	7	4,5
	9./3.	Erkältung fast vorbei	—	—	—	—	P.gt.B.	—	—
	10./3.	Wohl	frisch	—	—	—	—	—	—
	11./3.	"	"	—	gut	—	—	—	—
	12./3.	"	"	—	—	—	—	—	—
	13./3.	Müde, spät zu Bett, Eltern ausgegangen, mußte kleines Kind hüten	ab-gespannt	gegd.	—	z. gt.	P.gt.B.	—	—
	14./3. [1]	Ein wenig schläfrig, bis 11 Uhr im Musikverein . .	—	—	—	—	—	—	—
	15./3.	Wohl	frisch	—	—	—	—	5,5	5,5
	16./3.	"	—	mangelhaft	—	—	—	—	—
	17./3.	— — —	—	—	—	—	—	—	—
	18./3.	Wohl	frisch	—	—	—	P.gt.B.	—	—
	19./3.	"	"	—	—	gut	—	—	—
	20./3. [2]	"	"	—	—	—	—	—	—
	21./3.	"	"	—	—	—	—	—	—
	22./3.	"	"	—	—	z. gt.	P.gt.B.	5,8	6,2
	23./3.	— — —	—	—	—	—	—	—	—
	24./3.	— — —	—	—	—	—	—	—	—
	25./3.	Wohl	frisch	—	—	—	—	—	—
	26./3.	"	"	—	gut	—	—	—	—
	27./3.	— — —	—	—	—	—	fehlt	—	—

[1]) Schriftliche Prüfung.

[2]) Mündliche Prüfung.

BOOK DISINFECTION—A NEGLECTED FACTOR IN SCHOOL SANITATION

BY

L. B. Nice

In the rapid advance of school hygiene and public sanitation no satisfactory method for disinfecting school and library books has been put into general use in this country. This problem has been neglected in spite of the fact that books seem well adapted for carrying scarlet fever, measles, smallpox, diphtheria, trachoma, erysipelas, typhoid fever, dysentery and tuberculosis. The increase in children's diseases during the months of school might well be due in part to contagion from their books.

Library books are in danger of becoming contaminated since they are one of the chief diversions of invalids and convalescents. Such persons are apt to hold their books in front of the face in sneezing and coughing. Flügge placed petri dishes around tubercular persons and found that tubercle bacilli are thrown as far as a yard in the coughing, sneezing or even talking of such patients. Besides the danger of books becoming contaminated by spray from the mouth and nose, many persons have the uncleanly habit of turning the leaves with saliva-moistened fingers.

Many pathogenic bacteria are very resistant to the effects of drying. Measles, scarlet fever and smallpox are known to be virulent on toys, clothing and other articles for a very great length of time. Investigations have shown that bacteria retain their virulency as follows: Cholera for 1 month; Bacillus enteritidis of Gärtner, 3 months; Bacillus Friedländer, 7 months; typhoid, 7 months; tubercle bacillus, 9 months; Pneumococcus, 11 months; Streptococci, 11 months; Streptococci from peritonitis, 1 year, 4 months; Staphylococci in pus from an abcess, 1 year, 6 months; diphtheria, 1 year, 11 months, and tetanus, 2 years (6).

Two French investigators examined a book that had been used for a long time in a hospital. They found on a hundred square centimeters (about 16 sq. in.) 1,600, 2,400 and 4,700 bacteria (4). Lion made many experiments on the number of bacteria in used books. He found that a novel from a public library with rather dirty leaves had from 1,250 to 3,350 bacteria per 100 square centimeters. The binding of this book had 7,550 bacteria per 100 square centimeters. An atlas of anatomy that had formerly been used a great deal, but had been out of use for three years showed from 125 bacteria per 100 square centimeters on a clean page to 1,075 on an especially dirty page. Although this is less than another anatomy book, only a short time out of use, which had 2,275 and 3,700 bacteria per 100 square centimeters, yet it is significant that such large numbers of bacteria had resisted drying for three years (10).

Staphylococcus pyogenes aureus was found on an old book in a hospital (4). Krausz (9) cut pieces from the edges of much used books and from the edges of clean books. These pieces of paper were placed in the abdominal cavities of seven guinea pigs. The three animals inoculated from dirty books, died of peritonitis in 48, 51 and 63 hours, while the four inoculated from clean books remained healthy. Pieces of dirty and of clean books were placed in bouillon for 24 hours. One c.c. of this bouillon was injected into the abdominal cavity of each of 18 guinea pigs. The four injected with bouillon from the dirtiest books died of septic peritonitis.

Mitulescu (11) took 60 much used books that had been in the Berlin Public Library from six months to two years. He cut pieces from the dirtiest parts, soaked them in normal salt solutions, centrifuged the liquid and inoculated 120 guinea pigs with the sediment. Twelve died of streptococcus infection and nineteen of septicemia. He repeated the experiment with thirty-seven books from three to six years old, using fifty-seven animals. Fourteen of the guinea pigs died of septicemia and fifteen contracted tuberculosis. It is significant to note that of the older and dirtier books one third were infected with tubercle bacilli.

Letters have been proved to have transmitted disease. Four cases are reported from France and Germany where scarlet fever was carried long distances by letters (4 & 7). The postmaster in North Amherst, Mass., contracted scarlet fever during an epidemic in 1913. He knew of no other way in which he could have become infected except by letters which came into his office. During an epidemic of smallpox in Kent, England, the post-office employees contracted the disease (21).

Ten years ago a great deal of smallpox appeared in Kentucky, particularly in one county (17). This county had bought a large number of second-hand school books from a firm in Chicago. This firm had procured these second-hand books from Tennessee where smallpox had been widely distributed. This indicates that the schoolbooks were the probable carriers of the infection.

The library of the Faculty of Medicine in Bordeaux, France, was rearranged. The people who did this work were attacked by a feverish lumbago (4). In France a mother and baby were fatally infected by septicemia which was traced to a library book (7). Two epidemics of tuberculosis have occurred in Russia, one in Kharkow, and the other in St. Petersburg among officials in the State offices (7 & 9). In both cases there had been a tuberculous official who had moistened his fingers with saliva as he turned the pages of the documents.

Methods of Disinfection.

Books are difficult things to disinfect. The method used must kill all the bacteria, it must not injure the books, and finally it should be inexpensive and easy to use. The chief disinfectants that have been tried for books are carbo-gasoline, steam, formalin, steaming formalin vapor under vacuum, and moist hot air.

A 2 per cent. solution of carbolic acid in 88 Baüme gasoline was recently recommended as a book disinfectant (3). I made a careful test of this method and found it absolutely inefficient. It does not kill bacteria (12 & 13).

Steam is a thorough disinfectant but it is injurious to books, especially to those bound with leather. On the other hand letters can be autoclaved without any harmful effects. This was the method used to prevent letters from spreading smallpox in the epidemic at Kent (21).

At least eight investigators have proved by careful experiments that formaldehyde gas will not kill bacteria in closed or open books, unless the test pages are purposely left open and exposed to the gas. To mention the results of one study, Ballner (1) made 204 inoculations in the middle, front and back of large and small books. He stood the books on end, opened them fanwise and subjected them to the fumes of formaldehyde gas from 20 to 48 hours. Eighty-five cultures were sterile and 119 cultures grew. The results of the other investigators are similar (2, 4, 8, 14, 15, 18 and 19). From these results we are forced to conclude that formaldehyde gas at room temperature is an entirely untrustworthy disinfectant, since it does not penetrate between the leaves.

Two effective methods of disinfecting books have been evolved. One is the Rubner apparatus which uses steaming formalin vapor under a vacuum. It employs a vacuum of 600 mm., 8 per cent. formalin and a temperature of 60° to 65° C. It can be used for disinfecting all sorts of articles, mattresses, clothing, etc. Sobernheim and Seligman (16) made extensive experiments with this apparatus in disinfecting books. They found that 200 closed books could be disinfected at one time. This method is not injurious to the books. The advantage of this apparatus is the short time required for disinfection—less than two hours. But it is expensive to buy and to install; the apparatus is complicated and needs skilled management.

The moist hot air method of disinfecting books has been developed by Findel (5) and Xylander (20). The books are subjected to a temperature of 78° to 80° C., combined with a moisture of 30 to 40 per cent. for 32 hours. This method will kill tubercle bacilli in thick layers and all non-sporing bacteria in closed books, and does not injure bindings in any way. The moisture must not exceed 40 per cent. or the heat 80° C., or the books will be injured. A thermometer is placed in the middle of the pile of books and when the temperature registered by this thermometer treaches 70° C. the disinfection is considered as begun. I have tested this method and find that it kills the bacteria without injury to the books. The advantages of this method lie in its simplicity, the ease with which it can be used and the cheapness of installing the apparatus. The disadvantage lies in the length of time the books must be in the disinfector before the process is completed.

The disinfection of books is still a problem. As yet no entirely satisfactory method has been devised. We hope to be able to report results in the near future that will clear up the difficulties.

Status of the Problem in This Country.

Letters were written to the Boards of Health of all cities in this country and in Canada with a population over 100,000. They were asked to give in detail their methods of disinfecting school and library books. Forty-two answers were received. Four cities do nothing at all. Twelve cities burn school and library books that have been exposed to contagion. Eight burn books where the infection is serious, as in case of smallpox, scarlet fever and diphtheria, but fumigate with formaldehyde gas in less serious cases, or when the books are very valuable. Formaldehyde gas is used exclusively by fourteen cities. In six of these the Boards of Health have special closets or small rooms for fumigating books, and in three cities the public libraries are thus equipped. In the others it seems that the books are set on end and fumigated with the room. One city bakes library books that have been exposed to scarlet fever and diphtheria in a gas oven at 105° C. for twenty minutes. Finally two cities depend on sunlight and air.

In two of these cities the Health officer sends a daily report to schools and libraries of the houses where contagious diseases exist. One day, for example, the list showed mumps, measles, whooping cough, chicken-pox and tuberculosis. The books from these houses are fumigated by the Board of Health before they are returned to the school or library.

In 1911 similar letters were sent to the same cities and also to the State Boards of Health. Of the States, 12 did nothing; 9 burned contaminated books; 17 used formaldehyde gas; 2 dry heat and one carbo-gasoline. Sixty-four cities answered; 10 did nothing at all; 22 burned infected books; 25 used formalin; 3 steam, one dry heat and three carbo-gasoline.

The proportion of cities and State Boards of Health which burned and used formalin in 1911 is practically the same as at the present time.

About half of the cities fumigate infected books with formaldehyde gas and the other half burn them.

Formaldehyde gas at room temperature has been proved time and again to be untrustworthy as a book disinfectant. It is much better to burn all contaminated books than to be lured into a false sense of security by such fumigation. None of the dry heat sterilizing used would kill bacteria inside a book.

Conclusions.

Boards of Health should send daily reports to schools and libraries of all contagious and infectious diseases.

Books that have been in the hands of such persons should be disinfected by moist hot air at 80° C. and 30 to 40 per cent. humidity for 32 hours, or by Rubner's method of steaming formalin vapor under vacuum. If neither of these methods are available the books should be burned.

The use of formaldehyde gas at room temperature as a book disinfectant gives a false sense of security and should be discontinued.

We hope in the near future to have an entirely satisfactory method for book disinfection, so that not only can books be disinfected after known exposure to contagion, but that public library books that are much in use and all school books can be disinfected at regular intervals as a matter of precaution.

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PROPER VENTILATION OF SCHOOL BUILDINGS

BY

M. G. OVERLOCK

Boards of Education everywhere, from now on, when seeking appropriations for carrying on their work, which appropriations in 90% of cases are justifiable, will be asked many questions relative to proper ventilation of school buildings. State laws, justifiable in most cases, have been heaped upon the manufacturer, until he is feeling the burden; but to his credit it must be said that he complains but very little, for he looks at the situation with a trained business eye, and is beginning to realize, by observation, that after all, although it costs money to maintain proper ventilation, pure air, pure drinking water, freedom from dust, proper removal of dust, it is purely an economic problem, and one which yields large return in efficiency. In other words, in most states in which factories are located, and in which machines are built, the owner realizes the proper *ventilation* as the one essential element in the production of efficiency, while in 80% of our school rooms to-day where we are building the future generation, improper ventilation is the obstacle to efficiency, and its highest point will never be reached until we change the whole system of ventilation in these various rooms.

For seven years as a member of the Board of Education, of the city of Worcester, and for five years as Chairman of the Committee on Schoolrooms, I give this matter serious consideration, while six years as State Inspector of Health, having supervision over approximately 120 school buildings, in a limited way, and having made many visits at different times during the day, I have arrived at the conclusion that what we need is an entirely new system of ventilation for our school buildings. Without going into the discussion of the evil effects of impure air, one has but to point to the results accomplished and the changes wrought in the physical and mental condition of pupils in outdoor schools. In every instance the deduction can easily be done, if it will restore to health the weakling, and thereby strengthen him mentally. The same principle must apply to those who are well; to be explicit, in a poorly ventilated room, the efficiency of both pupil and teacher is decreased. This must be so, for poor air means lessened vitality, lessened vitality means less mental force. Proper ventilation must work out the same, whether it be factory or school room. I have explained how it has satisfied the *manufacturer*, by practice, not theory, and the principle must work out the same in the construction of mind and body, only to a greater degree.

What are the conditions, and what is the remedy? In too many of our school buildings, the so-called fresh air is dust-laden when it enters the school room, no attempt being made to properly screen the *intakes* for fresh air, then afterwards it becomes polluted with CO_2. 80% of the installed system for its removal are inefficient and do not do their work. This is apparent to anyone who enters a school room, containing say 40 or 50 pupils, stepping in from the fresh air a perceptible odor is present, a perceptible lassitude is at once apparent in teacher and pupil.

The length of this paper does not admit of a discussion of the defects of most systems of ventilation now in use in school buildings, but I, as well as other investigators, know they are legion.

How can they be remedied? Will it pay? Is it possible to bring it about? The equipping of one or two school buildings in a given locality, and then making comparison, will settle the whole question.

First of all, in all large school buildings in the city, the foul air must be withdrawn by a system of electric fans. This system has been tried in some localities, and found to work satisfactorily, with but little, if any, increased cost. The surrounding of the aperature for the intake of fresh air must be kept clean. The aperature must be of sufficient size computed by feet to admit sufficient fresh air for use by each *pupil* which can be readily estimated. The teacher in each room must watch the thermometer and the temperature must never go above 65° Fahrenheit. The pipes over which the cold air passes and is warmed should be easy of access, and so placed that they can be easily reached by the janitor and be kept free from dust. The proper humidity can easily be obtained, in fact by a system of electric motors, which are not expensive. All these changes can be brought about and then, and not until then, will we get proper return for the enormous sum of money expended for educational purposes.

It is a lamentable fact that while municipalities spend approximately one-third of their entire tax levy upon their school system, very few have worked out scientifically the question of ventilation of their school buildings, or have taken into consideration the effect of improper ventilation upon school attendance, or upon the loss of time of teacher and pupil. When this is figured out, the amount in one year would certainly be a surprise to the student of these subjects.

I maintain that the question of improper ventilation has a direct bearing upon the dissemination of many infectious and contagious diseases, which, in the end, become a burden upon the municipality, as well as a drain directly upon school funds. At various times in my writings I have advocated a course of school hygiene, supplemented by a physical examination of school children. I have also called the attention of school authorities to the fact that poor ventilation of school buildings predisposes to tuberculosis.

I am now saying that a proper system of gymnastics should be in vogue in every school in the land; that hygiene should be one of the leading studies, for after all, in the final analysis, what good is a liberal education, without a healthy body to accompany it.

Children are legally enforced to attend school, and surely they should be allowed to do so without encouraging any danger which is avoidable by ordinary means of human precaution.

OZONE IN VENTILATION

BY

MILTON W. FRANKLIN

Early conceptions of atmospheric impurity included the belief that carbon dioxide was poisonous and that its existence in the atmosphere rendered the latter unsuitable for breathing. Later, with the growth of chemical knowledge, the conviction grew that so inert and stable a gas, practically incapable of forming chemical combinations, could scarcely prove poisonous to the animal economy. Coincidentally there developed the opinion that the evil effects of air vitiated by the various processes of vital and industrial activity were due to the presence of organic poisons. This belief gradually expanded to include bacteria and the products of their activities. It was supposed that "Besides carbonic acid, expired air contains various substances which may be spoken of as impurities, many of an unknown nature, and all in small amounts" (1).

More recently the opinion has gained ground that there is nothing poisonous in expired air, but that all evil effects might be charged to the presence of moisture and heat.

"Owing to the unpleasant effects often produced in badly ventilated rooms it was long supposed that some poisonous volatile organic matter is also given off in the breath. Careful investigation has shown that this is not the case. The unpleasant effects are partly due to heat and moisture and partly to odors which are not of a respiratory origin" (2).

Throughout all this evolution of opinion, and even now, there has persisted the belief that insufficient oxygen is at the root of all evils arising from inadequate ventilation.

We will now consider briefly the status of each of these views:

That carbonic gas is not poisonous has been amply substantiated, for air in which the content thereof has been artificially increased to one per cent., with the corresponding diminution of oxygen, is not harmful, while air in which the carbon dioxide content has been raised to one per cent. by breathing, is highly poisonous (3). According to Haldane the effect of one per cent of carbon dioxide in the inspired air is so slight as to be negligible.

For the belief that expired air contains organic matters there appears to be some foundation, as *e. g.* the unavoidable evidence of foul breath. The odors arising in crowded and insufficiently ventilated inclosures give evidence of organic contents, though these may not all be expired from the lungs. "The nose may detect what the analytical methods of the chemist fails to show" (4).

The perspiration contains about 2% of solids and much of this is of highly organic structure and presumably easily decomposed. Sweat contains salts, chiefly sodium chloride and organic waste products. Of the organic solids excreted from this source, urea forms the most important under normal conditions. Under pathological conditions, especially when there is interference with free renal action, the amount of nitrogenous waste excreted may become quite important (5).

The history of experimentation with the analysis of expired air is interesting. Hammond, in 1863, concluded that there were organic poisons in expired air. He confined a mouse under a bell jar absorbing the CO_2 with baryta water and the moisture by calcium chloride with the result that the mouse died after 40 minutes.

Brown-Sequord, in 1889, experimenting with mice proved to his satisfaction the existence of organic poisons in expired air. Subsequently, Haldane and Smith repeated these experiments with negative results.

In 1892 Merkel again repeated these experiments and confirmed the results of Brown-Sequord. Various experiments conducted by Lehman and Jessen, Rauer, Luebbert and Peters, and others, from 1890 to 1893 were productive of negative results with regard to the existence of organic matter in the expired breath. Brown-Sequord confirmed his previous experiences by an elaborate repetition of them in 1894.

Billings, Mitchell and Bergey were appointed by the Smithsonian Institute in 1895 to conduct experiments for the purpose of settling the question. In a monograph published by the Smithsonian Institute (6) they stated that the ill effects of vitiated atmosphere depend almost entirely upon increased temperature and moisture, and not upon an excess of carbon dioxide, bacteria or organic poisons; the existence of the latter being vigorously denied. In addition to excessive temperature and moisture, odors arising from the subject in various ways, bad breath, unclean skin, unclean clothes, sweat and enteric gases are credited with causing very disagreeable sensation amounting even to nausea in the unhabituated.

Benedict (7) has kept persons in his calorimeter breathing and rebreathing the same air with a CO_2 content as high as 2% for 24 hours without discomfort, the only precaution being to keep the temperature down and to remove the moisture. It is to be noted that in these experiments some of the air was passed over lime and sulphuric acid every two hours and the greater part of the moisture was removed by condensation, which may also remove other substances than carbonic acid and moisture.

Thus far the preponderance of evidence seems to be against the existence of organic matter in the expired breath. Quite recently, however, the contrary opinion has been revived by the original and brilliant researches of Rosenau and Amoss (8). Applying the principal of anaphylaxis on guinea pigs with the clear fluid condensed from expired breath, they have proven the existence of organic matter therein.

"This organic matter must, according to the interpretation of our knowledge of anaphylaxis in the guinea pig, be protein in nature." They further add "The logical conclusions from our results is that protein substance, under certain circumstances, may be volatile." Weisman and Bronfenbrenner recently have disputed these results (9).

Further evidence contributing to the proof of the existence of organic matter in expired breath has been obtained by Weichardt and Stötter (10) who passed the air expired by guinea pigs and air from a crowded theatre over glycerole, and obtained an alteration in the guiacum reaction.

The opinion, once almost universal, that aerial transmission was the chief mode of infection of zymotic diseases has been largely modified in recent times. One of the most notable protagonists of the view was Dr. Edward Germano (11).

Bailey (12) speaking of tuberculosis says, "This is a disease in which the germs from the dry sputa are carried in the air, lodged in the air passages, and if they find the system in the right condition, they commence to grow and carry on their deadly work."

Neisser's (13) experiments with various organisms lead him to the conclusion that infection is possible with staphylococcus pyogeneous aureus, bacillus pyocyaneus, bacillus anthracis, bacillus tuberculosis and meningococcus but impossible for the organisms of diphtheria, typhoid fever, cholera, plague and pneumonia.

Credence in the belief of aerial infection however has been losing ground steadily, until it has become almost dispelled. Chapin (14) maintains that while it is not possible at present to state with exactness the part played by aerial infection in the transmission of different infectious diseases, we are, by the evidence, forced to the conclusion that the current ideas in regard to the importance of the infection by air, are unwarranted. It may be fairly affirmed that there is no evidence that aerial infection is an appreciable factor in the maintenance of our most common contagious diseases. We are warranted then in discarding it as a working hypothesis and in devoting our chief attention to the prevention of contact infection. Contact infection with carriers and missed cases affords a better explanation than air transmission for obscure cases of infection. Scarlet fever and diphtheria may be cared for in the same ward if infection by contact be avoided and cleanliness observed.

Most diseases are not dust bourne, they may be spray bourne by coughing, etc., but this is equivalent to contact infection. Tuberculosis is most apt to be air bourne, but even this has never been substantiated by pathology.

Flügge, Esmarch, Goldie, Frankel, Moller, Hubner and others have shown that droplets may be found for nine meters in front and two meters behind a person coughing. Winslow and Robinson by elaborate droplet experiments show that there is no basis for the belief that tuberculosis or any disease is contracted to an appreciable extent through inspired air, and they are in harmony with the conviction that aerial infection of any sort is a minor factor in the spread of zymotic disease.

Doty (15) states that, "The necessity for disinfection is confined chiefly to infected discharges and articles about the patient that may be directly contaminated. Room disinfection is an important factor in the prevention of infection. We have conclusive proof that many of our former theories regarding the transmission of infectious diseases are wrong."

There is a growing belief that scientific proof, that infection may be transmitted for a considerable distance by the air, is wanting. In all probability infection by air does not occur except in the immediate vicinity of the patient and then only in a few diseases. This, however, as pointed out above, is tantamount to contact infection, but, in any event, whatever danger there may be is most menacing in closely crowded places where missed cases are always likely to be present.

An interesting aspect of the subject is presented by Trillat (16) who has demonstrated that microbic life is very sensitive to even slight chemical changes in the air. Alkaline gases like NH3 and amines from fecal matter, etc., favor the development of typhoid bacillus and other microorganisms.

The view that the ill effects of vitiated air are due only to excessive heat and moisture is widely advocated. Haldane, Billings, Mitchell and Bergey (17), Flügge (18), Baruch (19), Formanek (20), and others have arrived at this opinion from experiments.

Respecting the influence of lack of oxygen in ventilation, there is very little difference of opinion. The constitution of air is as follows:

	Atmospheric Air.	*Expired Air.*
Oxygen................	20.93 p. c.	17.0 p. c.
Nitrogen...............	79.04 "	79.04 "
Co2....................	.03 "	3.96 "

Thus the oxygen is diminished approximately 4%, and only 19%, or less than one-fifth of that taken into the lungs is utilized. Flügge, Hill and others have demonstrated in numerous experiments that diminution of oxygen to the extent met with under the worst conditions is not inimical to health. At an altitude of 10,000 feet the density of the air becomes two-thirds that at the sea level, and the oxygen content of a lungful is accordingly lessened one-third, but compensation in the shape of increased lung capacity and accelerated respiration soon overcomes the distress at first experienced.

As contaminating factors of air, offensive odors have not been afforded due prominence. The fact that crowd odors are organic effluvia cannot be disputed. The sensation of smell is due to the presence in the air of substances in a fine state of subdivision, *i. e.* existing in the state of vapors, or of gases. Ramsay points out that as a general rule substances having a low molecular weight have either no smell or simply cause irritation of the nostrils. He also shows that in the carbon compounds, increase in specific gravity of a gas is associated to a certain point with the sense of smell. McKendrick points out that it would appear that odors of animal effluvia are of higher specific gravity than the air and do not readily diffuse. Such smells are very persistent and difficult to remove, and the presence of moisture increases the perceptibility of odors.

The above facts are significant in connection with the results obtained in rendering stale air more tolerable by keeping it in motion and reducing the moisture, which overcomes their tendency to remain in contact with the subjects and lessen their activity. The sources of crowd odor are the skin, enteric gases, localized excretions, bad teeth and fecal matter, rather than the breath.

Aside from the role of smell as an indicator of organic contamination of air, its physiological effects are distinct. The Smithsonian Report cited above gives smell as one of the paramount causes of discomfort. According to Macfie (22) bad smell may cause nausea or faintness, and Parkes and Kenwood say that odors alone may be prejudicial to good health.

Everyone has noted the distress consequent upon the presence of offensive odors. Frequently when entering tanneries, glue factories or other obnoxious plants for the purpose of making observations, men in my employ have been so disturbed as to have their efficiency appreciably lessened; shallow breathing and anorexia have resulted directly with consequent lowered vitality.

Hill (23) has given considerable publicity to the contention that organic odors are innocuous, and he cites the cases of those engaged in disagreeable trades, and their good health and easy habituation as evidence. This, however, is scarcely a parallel case, as the odor from the trades are not the excreta of the men engaged therein.

A consideration of the above data leads to some interesting conclusions:

1. Excess of CO_2 does not constitute a danger of vitiated air in ordinary circumstances.

2. Lack of oxygen is a negligible consideration.

3. Heat and humidity play an important role in rendering "close" air intolerable.

4. Organic matter exists in the air of crowded rooms. Its odors constitute a real nuisance but its toxity has not been established.

5. Bacteria in the air are, at most, a minor factor in the conveyance of infection.

6. The problems involved are of a complexity which renders their solutions extremely difficult and most of them are still more or less debatable.

Ozone. The first attempts at the employment of ozone as an adjunct in ventilation is perhaps to be ascribed to the fact that ozone had been observed in regions remote from human congestion, where the atmosphere was known to be fresh and invigorating, and to its absence from the air of highly populous districts. In an era of conflicting scientific opinion on questions of disease causation it is not to be wondered at that the mysterious gas, ozone, which was enjoying a vogue among chemical investigators, should have been hailed, in the popular mind, as the philosophers' stone of hygiene. This cult, which occupied the middle and latter thirds of the last century, gradually evolved into a period of saner search for sound theoretical justification of the empirically demonstrated effectiveness of ozone. At present there still exists much difference of opinion as to the exact status of ozone in ventilation, it being considered, by some, a disinfectant of polluted air, by others, as a deodorizer, whilst yet another contingent regard it as an oxidizer of the organic content of vitiated atmosphere.

Experimentation for the purpose of ascertaining the effect of ozone on vitiated air has been varied and exhaustive and it will be necessary to confine ourselves to a consideration of the work of only a few of the more prominent authorities.

Scoutetten (24) demonstrated that ozone removed the odor of heaps of decayed manure, even in the presence of the latter, and that it destroyed the odor which remained after the manure had been removed from the experimental chamber.

According to Schoenbein 1-6000 of ozonized oxygen, contained in 60 litres of air sufficed to disinfect 540 times its volume of air charged with miasms and putrid emanation. M. J. Chapuis demonstrated the microbicidic power of ozone by drawing infected dust into cotton tampons and then disinfecting them by drawing ozonized air through (25).

In 1892 Dr. Ohlmüller (26) reported that anthrax, typhus and cholera bacilli, as well as anthrax spores are destroyed by ozone. Typhus and cholera bacilli contained in sewage and water of the Spree were destroyed but ozone apparently has little effect on dry bacteria and bacilli. Two litres of ozonized air killed the bacilli which exist in pus, and living subjects inoculated with such ozonized pus did not suffer any inconvenience. He also pointed out that negative results in attempting to purify air, remedy unsanitary conditions and disinfect dwellings result from inadequate ozone apparatus.

In the face of many positive findings as to the value of ozone, controversy has been rife up to the present. Konrich (27) admits the efficacy of ozone for water purification, but holds that for ventilation its use is still problematical. He maintains that concentrations sufficient to oxidize suspended organic matter would be detrimental to the living organism, and that the most that ozone can accomplish is to cover up odors. "The value of this," he says, "is questionable, since it removes the only warning that we possess of the presence of vitiated air." Schneckenberg (28) holds substantially the same view.

Luebbert (29) states that ozone purifies the air and that the existence of even a slight excess of ozone is proof of the non-existence of the organic dust, ill-smelling particles and agents of infection.

Elrandsen and Schwartz (30) assert that there is no justification for the statement of Luebbert. They experimented with a room of about 14.96 cbm. capacity. The walls were covered with metal plates painted black. They do not definitely state the amount of ozone in the room but the concentration was about 20 to 30 mg. per cbm. of air. Different gases, fumes, etc., were drawn into the room and mixed with ozonized air. After varying periods of time the mixtures were examined. They conclude that oxidation of NH_3 and H_2S cannot be proven, but that the odors can be removed; trimethylamin, valerianic acid, butyric acid, indol and skatol are not destroyed by ozone but their odor can be disguised; tobacco smoke is not influenced so far as can be determined, but if present in small quantities its odor can be removed; they cannot say that ozone purifies the air, but only that its intense odor covers or removes other odors.

Kuckuck (31) claims that in the Heidelberg Public Baths he reduced the bacterial content of the air to 50%, by the application of ozone. Kuppfer (32) finds that a concentration of 0.1 mg. ozone per cbm. air in bathing establishments has an invigorating and purifying effect. Foreign odors are eliminated and the conditions generally are improved.

Bail (33) says that the odor of decaying matter does not recur after having been removed by ozone, and that small ozone concentrations can destroy odoriferous elements in the air, therefore ozone probably can destroy the organic impurities in expired air and animal excretions.

The most recent pronouncement on the subject has been presented at the Ninth Congress for Heating and Ventilating in June of this year at Cöln by Prof. Dr. Czaplewski (34). From an exhaustive series of observations he concludes that there is a wide application for ozone as an adjunct to ventilation. He finds that ozone has a positive effect on certain odoriferous materials and odors emitted by these materials; some odors are destroyed and others lessened; after odors are, in part, referred back to odors absorbed by the walls, furniture, etc.; ozonization of the air should not supplant ventilation but used as an accessory; ventilation can, in many cases, be improved by ozone; discrepancy between the favorable results in practice and the unfavorable results of experimentation should be further investigated.

Experimental Results. In view of the contradictory character of the above cited reports and of the generally unsettled conditions of the questions involved, experiments were conducted for the purpose of attaining definite information.

In determining the action of ozone on odors and certain gaseous emanations, the apparatus shown in figure 1 was used. This consisted of two bottles of 12 L. capacity with suitable connections, a vacuum pump and an ozonator.

One of the bottles was filled with emanation, the odor of which was to be studied, by drawing air slowly over a mass of the material, confined under a bell jar, and thence into the bottle. The other bottle, of equal capacity, was filled with ozonized air. The communication between the two bottles was then established and the two gases permitted to diffuse. After a suitable interval, usually about 48 hours, the emanation, mixed with ozone, was drawn through a neutral solution of K. I. to free it of excess ozone, and the remaining gas examined.

Tests with tobacco smoke and with H_2S proved conclusively that these substances were deodorized and that the absence of odor could not be attributed to the presence of ozone. The tests were by smelling and also by lead sulphide in the case of H_2S. I then had further tests conducted with a refined and elaborated technique.

Natural Food Odors. The substances employed in these experiments were onions, garlic and Limburger cheese. In each case the materials were finely divided and placed in flasks provided with an inlet and an outlet tube, the former reaching to the bottom of the vessel. One hundred and twenty-five cubic centimeters of the effluvium from the flasks were separately collected in two hundred and fifty cubic centimeter gas collection tubes by displacement of water, with which the tubes were previously filled. The remaining one hundred and twenty-five cubic centimeters of water were displaced in one case with ozonized air, and in the other with air. Two tubes were thus prepared with each odor, one containing an addition of ozonized air and the other of ordinary atmospheric air. The tubes were at once clamped in a vertical position and it was then a simple matter to introduce water through the lower stopcock, which thus compressed the gas within the tube. On opening the upper stopcock and holding the exit tube close to the nostrils, the odor of the gas could be noted. A 10% solution of ferrous sulphate was then introduced and the tubes well shaken. The ferrous sulphate was immediately oxidized by the residual ozone, the odor of the latter being thereby destroyed. It was, of course, necessary to treat the tube without ozone in the same manner, so that any possible deodorization due to the ferrous sulphate would not be overlooked. After the ferrous sulphate was introduced, the odor of the gas was again noted, as in the first instance. The results of these tests were as follows:

	Odor Before Treatment with Ferrous Sulphate Solution.		Odor After Treatment with Ferrous Sulphate Solution.	
Odor from	*With Air*	*With Ozone*	*With Air*	*With Ozone*
Onions	Strong	Strong	Strong	None
	Onion	Ozone	Onion	"
Garlic	Strong		Strong	
	Garlic	"	Garlic	"
Limburger	Strong		Strong	
Cheese	Limburger	"	Limburger	"

These results show that odors from onions, garlic, and Limburger cheese are actually destroyed by ozonized air.

Decomposed Food Odors. In these experiments four different raw food materials were placed in flasks and allowed to decay. The substances employed were fish, eggs, meat and oysters. The effluvium was collected as before and examined in the same manner, before and after treatment with ozone and ferrous sulphate.

	Odor Before Treatment with Ferrous Sulphate Solution		Odor After Treatment with Ferrous Sulphate Solution	
Odor from	*With Air*	*With Ozone*	*With Air*	*With Ozone*
Decayed Fish	Very offensive	Strong ozone	Very offensive	None
" Eggs	"	"	"	"
" Meat	"	"	"	"
" Oysters	"	"	"	"

Definite Chemical Compounds of Disagreeable Odors. Experiments under this heading were conducted with Skatol, Valerianic Acid and Butyric Acid. Skatol (C_9H_9N), together with Indol (C_8H_7N) are chiefly responsible for the offensive odor of excrements. Valerianic acid has an odor similar to old cheese and occurs free and as ester in cheese, perspiration of the feet and in human faces. Butyric acid is found in sauerkraut, rancid butter and Limburger cheese. These substances, therefore, represent types of very offensive odors. A series of experiments conducted as before did not give conclusive evidence of these odors and it was necessary to adopt a different procedure in order to determine whether ozonized air destroyed these odors.

The method finally adopted was to impregnate pieces of cheese cloth (12 inches wide and 36 inches long) with the odors. This was accomplished by suspending the cloth in a three-gallon bell jar resting on a ground glass plate lubricated with petrolatum. The substances were vaporized from a watch glass supported on a heated briquette and after two hours a definite volume of ozonized air was passed through one jar and a similar volume of air through another which served as a control. The cloths were then removed and allowed to air in a well ventilated room for twenty-four hours. This was necessary to remove the residual ozone in those cases where the cloths were treated with ozonized air and the controls were treated in like manner, so that any disappearance of odor could not be attributed to ventilation. It was found in each case that the cloths impregnated with the odors still retained these after twenty-four hours, whereas those treated with ozonized air were free from these odors as well as ozone. It is therefore established beyond all question that the odors of Skatol, Valerianic acid and Butyric acid are actually destroyed by ozone.

Offensive Trade Odors. The substance treated in this case was a fertilizer, commonly known as tankage, and is obtained in the treatment of butchers' scrap. It has a very offensive odor. The tests were conducted as before and it was demonstrated that this odor is completely destroyed by ozone.

A number of experiments have also been conducted with odors of common occurrence in dwellings. Among these it has been established that the offensive odor of tobacco smoke, which impregnates the clothing of persons exposed to atmosphere heavily laden with smoke, is also destroyed by ozone. The experiments with tobacco smoke were made by saturating a piece of cheese cloth suspended in a box and blowing the smoke from a pipe into the opening, so that the cloth remained in a dense atmosphere of smoke until it was thoroughly saturated. Ozonized air not only destroyed the odor but also removed the yellow discolorations produced by blowing smoke through cloth.

Conclusions.

1. The experiments described in this report show that ozonized air does not merely mask offensive odors of varied nature, but it actually destroys them.

2. It is shown that the odor of some common food materials, onions, garlic and Limburger cheese, are destroyed by ozonized air.

3. The odors resulting from decayed raw food materials, fish, eggs, meat and oysters, are destroyed by ozonized air.

4. The offensive odors of fertilizers are destroyed by ozonized air.

5. Several definite chemical compounds which contribute to the odor faces, perspiration of feet, rancid butter, sauerkraut and Limburger cheese, namely, Skatol, Valerianic acid and Butyric acid are also destroyed by ozonized air.

6. The persistent odor of tobacco smoke as absorbed by the clothing, is destroyed by ozonized air and the yellow color produced by blowing smoke through cloth is bleached by ozone.

Carbon Monoxide. In these experiments bottles containing the mixed gases (CO and Ozonized air), after standing for a definite length of time, were treated with an oxidizable chemical solution in order to destroy the residual ozone. The gaseous contents of the bottle were then aspirated through wash bottles containing barium hydroxide solution. The bottles were also immersed in warm water in order to drive out any carbon dioxide remaining in the solution.

Experiment 1. One bottle containing 50 c.c. of carbon monoxide and filled with ozonized air, together with a control containing ozonized air only, were allowed to stand over night. One hundred cubic centimeters of a 5% solution of Potassium Ferrocyanide were then added and the contents thoroughly shaken. After aspirating the gas which contains carbon monoxide through barium hydroxide wash bottles; it was found that absolutely no barium carbonate was formed, but the Potassium Ferrocyanide solution was found to be alkaline, thus explaining the phenomena. Before aspirating the controls 5 c.c. of diluted sulphuric acid was added (in order to ensure an acid reaction) but in this instance no definite end point could be obtained. It was found that the difficulty was due to the liberation of hydrocyanic acid. The use of this reagent was therefore abandoned and it was decided to use Ferrous sulphate, which could not give rise to any disturbing volatile substances.

Experiment 2. Three bottles were prepared, No. 1 containing 25 cubic centimeters of carbon monoxide; No. 2, 50 cubic centimeters, and No. 3 was a control containing only ozonized air. After standing over night, 100 c.c. of Ferrous sulphate solution, acidified with sulphuric acid (5 c.c.'s dilute sulphuric acid in 100 c.c.'s of solution) were added and aspirated as in Experiment 1.

Bottle No.	1 containing	25 c.c.'s of CO gave	10.7 c.c. CO_2.
"	" 2 "	50 " " " "	4.0 " "
"	" 3 "	no CO. "	0.4 " "

The small amount of carbon dioxide obtained in bottle 3 was apparently introduced through inefficient washing of the air used in aspiration, but the results were indeed promising. The end point was not as sharp as it should be in Bottles Nos. 1 and 2, and on further investigation we found that the slowly precipitated barium carbonate occluded barium hydroxide, thus causing the end point to return after the completion of the titration. When barium carbonate was rapidly precipitated the phenomenon was not observed. The error due to occlusion corresponds to approximately 0.25 c.c.'s of carbon dioxide. This can be obviated by continuing the addition of standard oxalic acid solution until a permanent end point is obtained.

Experiment 3. This experiment was conducted along the same lines as Experiment 2, but the time of exposure was three days in this case.

Bottle No	1 containing	10 c.c.'s of CO gave	8.7 c.c.'s of CO_2
"	" 2 "	25 " " " "	17.1 " " "
"	" 3 "	no CO "	1.8 " " "

Deducting the blank, the 10 c.c.'s of CO produced 6.9 c.c.'s of CO_2 and the 25 c.c.'s of CO produced 15.3 c.c.'s of CO_2.

A number of preliminary experiments were made to determine the reaction which takes place between hydrogen sulphide and ozone. It was found that the ozone caused an immediate precipitate of sulphur (giving a milky fluid in the presence of water), which gradually became oxidized to sulphuric acid.

From this it is evident that the reaction of ozone on hydrogen sulphide takes place in two stages. In the first stage sulphur is precipitated and this in turn becomes oxidized to sulphuric acid.

Conclusions. These experiments demonstrate conclusively that carbon monoxide is oxidized to carbon dioxide by simple contact with ozonized air.

It is also shown that hydrogen sulphide is changed to sulphur and water, the sulphur being further oxidized to sulphuric acid. Hydrogen sulphide possesses a strong characteristic odor resembling that of rotten eggs. The chemical change, which takes place under the action of ozone, results in a destruction of this odor.

Bacteriacidal Action of Ozone. Numerous experiments to determine the action of ozone on bacteria were conducted. Only a résumé of the results is presented. The ozonator was of a common portable type, found in the American market, and the concentrations of ozone varied from 1 to 10 mg. per cbm. air, the difference being accounted for by the varying lengths of the periods of operation and of room sizes.

Experiment No. 1. The ozonator run in an open room of approximately 1,000 cubic feet for twenty minutes, gave no reduction in the small number of bacteria present.

Experiments Nos. 2 *and* 3. The ozonator run in a closed room of 200 cubic feet for thirty minutes removed 95.4% of the small number of bacteria present. The test repeated with a very small number of bacteria present in the air showed the removal of 77.9% in thirty minutes, and 69% in one hour.

Experiment No. 3. Agar plates streaked with cultures of B. coli and exposed for one hour, showed that ozone had a slight inhibitive action.

Experiment No. 4. Although the cotton batting screen over the air inlet may remove large numbers of bacteria from the air, the ozonator without the cotton batting screen was found to be capable of removing a greater number of bacteria entirely independent of cotton.

Experiments Nos. 5 *and* 6. B. typhosus, B. coli, and staphylococcus pyogenes aureus streaked on agar plates, exposed to the action of Ozonator products for 6 hours, and then incubated at 37° C. for three days, showed a slightly inhibited growth after exposure of 4 to 6 hours.

Experiments Nos. 7 *and* 8. B. typhosus, B. coli, and staphylococcus pyogenes aureus, dried on glass rods, and exposed to Ozonator products for two hours, showed inhibition to the extent that no growth was visible in the broth culture media until 48 hours incubation at 37° C. The same organisms exposed to Ozonator products for two hours, while in a moist condition, and then incubated at 37° C. in broth culture media, with the result that all the B. typhosus and B. coli were killed or attenuated so that growth did not appear, and the number of staphylococci killed or attenuated so that growth did not appear until the fourth day of incubation.

All the above investigations were carried on under conditions which were not possible to control on a strictly scientific basis. For example, Experiments 2, 3, 4, 5 and 6 were performed in a small toilet room in which there was a tank of water together with a flush closet. What effect these bodies of water may have had upon the ozone content of the atmosphere of the room was not taken into consideration. Moreover, the room was not of a size or shape likely to be met with frequently in practice, nor were the character of the walls taken into consideration; how much ozone might have been absorbed by the latter is not known.

In Experiments 1, 2, 3, 4, 5 and 6 the ozone apparatus was present in the room in which the investigation was being conducted, whereas in Experiments 7 and 8 the ozone products were led from the Ozonator to the experimental apparatus as indicated.

These experiments depended, in large part, upon the bacteria naturally present in the air, and it was found, as might be expected, that the numbers were too small for the results to be considered as clearly indicative of the action of the ozone, or its failure to act.

In the experiments above outlined, especially Nos. 4, 5 and 6, it will be noted that the moist culture media was present in the investigating chamber and undoubtedly absorbed ozone from the atmosphere.

It should also be noted that in the preliminary studies, questions of temperature and humidity of the atmosphere at the time of the tests, were not undertaken, it being considered more advisable to eliminate such refinement from the preliminary investigations.

A consideration of the above facts leads to the conclusion that the normal bacterial contents of air may be reduced by the injection of even moderate amounts of ozone. Failures in this direction are probably due to faulty technique. Dried bacteria on rods, tubes or threads are affected little or not at all by ozone, but constitute no danger to health and their resistance to ozone is of no significance.

It should be noted in this connection that whatever danger there may be from bacteria in the air, it exists only when these are in a state of moist suspension, *e. g.* droplet infection, and it is in such circumstances that ozone is most effective as a bacteriacide. Czaplewski mentions the drying effect of ozone as noticed in cold storage plants, and it has been shown above that dry bacteria are comparatively innocuous.

With regard to suspended organic matter in the air, its poisonous nature has not been conclusively proven, but its prominence in the capacity of a nuisance in vitiated air is self-evident and it has been sufficiently demonstrated that ozone destroys organic odoriferous particles in the air. Ozone is therefore an aerial detergent and from an aesthetic as well as from a sanitary point of view, its use is fully justified.

Aside entirely from all theoretical aspects, we must give some consideration to the results obtained in practice. Bass (35) has experimented with reduced air supply through individual ducts in school ventilation, and has shown that the addition of a small amount of ozone to the air greatly lessens the amount of air required for comfort. Leonard Hill (36) states that the ventilation of the London Tubes has been greatly improved by ozone and that the smell has been much less and the air improved in every way since its introduction. Instances of the successful employment of ozone in ventilation are too numerous to mention and have been given wide publicity of late. In the tubes of the Hudson and Manhattan Railway there is a point at which there has been some trouble from disagreeable odors arising from the seeping in of sewage. A trial installation has shown that this odor, which was unamenable to treatment by any degree of air flushing, could be totally and conveniently eliminated by ozone, and a modern ozone plant has recently been installed.

A practical example of the destruction of organic odors by ozone is afforded by a fish glue factory where recently some observations were made. The emanations from a caldron of boiling fish scrap are passed through water, and thence by a stack into the air. The resulting vapor is very offensive as the fish scrap is often in an advanced state of fermentation. The injection of ozonized air into the base of the stack rendered the vapor totally unobnoxious; it resembled a clean sea fog.

I have endeavored to show that the dangers of vitiated air are due to heat, moisture, and organic contents, and that the latter, whether poisons or only odors, constitute a real nuisance. The first two factors may be compensated for by stirring the air and providing sufficient new air to absorb the heat and moisture. The average perspiration of a man is roughly 40 gm. per hour, and this amount would saturate approximately 3 cbm. (100 cu. ft.) of air at 65° F. (18.3° C.). This amount of air would supply more than 136 times the oxygen consumed by a man. The specific heat of air is about .24 so that the 100 cubic feet of air would require approximately .88 Cals. to raise its temperature 1 degree C. Thus by simple calculations the amount of air necessary in any circumstances may be computed.

Odors may best be removed by ozone. The frequent assertion that they constitute only an index of bad air is not substantiated unless it can be proven that there exists a new, and at present unknown, danger in vitiated air. Certainly we need no vicarious indicator of heat and humidity so that smell exists only as a discreet independent offense, or it is the indicator of its own organic poison. If the former, it should be removed, and if the latter, it should be destroyed.

Conclusions.

1. Ozone is a valuable accessory to ventilation.

2. It is applicable wherever mechanical ventilation is required and in general wherever organic odors are generated.

3. Ozone destroys, rather than masks, organic odors.

4. In breathable concentrations ozone inhibits the growth of micro-organisms suspended in the air.

5. Conflicting results obtained in laboratory experiments can be attributed to diversity of methods.

6. Practical results of actual applications of ozone have been uniformly favorable.

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DIE REINHALTUNG DER SCHULRÄUME

VON

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Meine Herren! Dass in Räumlichkeiten mit starkem Menschenverkehr die peinlichste Sauberkeit herrschen sollte, darüber brauchen im Zeitalter der Hygiene kaum mehr Worte verloren zu werden. Wenn wir uns klar sind darüber, dass heute selbst in Bahnhofs Warteräumen, an Postschalternd, nur durch grösste Reinlichkeit hygienische Schädigungen von den dort nur vorübergehend verkehrenden Personen ferngehalten, Ansteckungen vermieden werden können, dann werden wir Reinlichkeit in noch viel höherem Masse verlangen in solchen Gebäuden, in denen grosse Menschenmassen viele Stunden des Tages, wohl gar Jahre ihres Lebens zubringen, wie z. B. in Kasernen, und wir werden die allerstrengsten Anforderungen stellen müssen da, wo es sich um jugendliche Personen in zarterem Alter handelt.

Das Kind, das infolge gesetzlicher Bestimmungen in den Kulturländern vom Staate während des wichtigsten Zeitabschnittes seiner körperlichen Entwicklung in den Schulen festgehalten wird, muss von diesem Staate erwarten, dass es auch gegen Schädigungen geschützt wird, die aus der Unsauberkeit der Schulräume ihm erwachsen können.

Die Reinigungsfrage beschäftigt deshalb mit Recht die Schulhygieniker und Schulverwaltungen und zwar um so lebhafter, je mehr man die Gefahren, die in der Aufwirbelung und Einatmung von Staub für die Lungen der in staubreichen Berufen tätigen Arbeiter das bestehen, beachten gelernt hat, je mehr man sich überzeugt hat, dass was schon dem Erwachsenen von gesundheitlichem Nachteil sein, den Kindeskörper in um so höherem Masse angreifen muss.

Über die Grösse dieser Gefahr war man lange im Dunkeln. Sie wurde ebenso oft unterschätzt wie überschätzt. Exakte Versuche anzustellen hielt man lange für ebenso überflüssig, wie unmöglich. Es ist das Verdienst der Hamburger Schulverwaltung, angeregt zu haben, dass das Hygienische Institiut des Hamburger Staates exakte Versuche vorgenommen hat über das Reinigungsbedürfnis in den Schulen und das zweckmässigste Reinigungsverfahren, und es ist das Verdienst der wissenschaftlichen Leiter dieses Instituts, des Prof. Dr. Dunbar und seiner Mitarbeiter des Prof. Trautmann und Dr. Hanne, Methoden angegeben zu haben, die eine relativ zuverlässige Feststellung und Umgrenzung der Staubgefahr ermöglicht haben. Absolut unanfechtbare Versuche lassen sich nicht anstellen hier, wo soviel Zufälligkeiten beim Verkehr in den Klassen, beim Schulbetriebe, bei der augenblicklichen Witterung kaum zuverlässig in Rechnung gestellt werden können.

Was aber an Genauigkeit erreicht werden konnte, ist erreicht.

Vorweg geschickt mag werden, dass bei der Untersuchung der Zusammensetzung des Staubes im Verhältnis zu den sterilen Staubmengen die Anzahl der entwicklungsfähigen Bakterienkeime gering befunden worden ist, nur etwa $\frac{1}{60}$ bis $\frac{1}{100}$ der Staubteile. Dass aus diesem Befunde freilich noch kein Grund zu mangelhafter Reinigung der Schulräume hergeleitet werden darf, ist klar.

Das Ergebnis der Versuche, soweit sie sich auf die Staubmengen und deren Beseitigung ohne Unterschied bezogen haben, ist kurz folgendes:

Bei dem Vergleiche einer Schulreinigung

a) mittels zweimaligen wöchentlichen Kehrens der Klassenböden nach Wegrücken der Schultische, und täglichem trockenen Kehren unter Verwendung von feuchten Sagespähnen (sog. Hamburger Verfahren) mit einmaligem feuchten Wischen innerhalb 14 Tagen.

b) mittels täglichen nassen Wischens nach vorherigem trockenen Kehren, sogar unter täglichem Wegrücken der Schultische, (sogenantes Kopenhagener Verfahren).

c) mittel Vacuumentstaubers, hat sich herausgestellt, dass der schliessliche Effekt der vorgenommenen Reinigung bei allen drei, in ihren Kosten natürlich sehr verschiedenen Verfahren fast der gleiche ist, d. h. alle drei sind imstande, die Klassen wirklich zu säubern in einem solchen Masse, dass nach erfolgter Reinigung die Klasse als rein angesehen werden kann. Beim Vacuumreiniger konnte dieses Resultat nicht überraschen, beim täglichen nassen Wischen nach vorherigem Kehren (Kopenhagener Verfahren) ebensowenig. Erstaunlich ist nur, dass auch ein tägliches Kehren und einmaliges Wischen innerhalb von 14 Tagen Schon so gute Wirkungen hat. Es beweist das, dass das nasse Aufwischen in seiner Wirkung dem Staub gegenüber überschätzt wird, dass er mit trockenem Kehren unter Benutzung von Sägespähnen bei entsprechender Sorgfalt ebenso gut beseitigt werden kann. Dass auch die staubbindenden Öle, die in Deutschland lange Jahre als Allheilmittel angesehen wurden gegen den Staub, die Reinigungsfähigkeit der Klasse nicht wesntlich genug erhöhen, um ihre unangenehmen Seiten, die unerträgliche Glätte, und das hässliche Aussehen der mit ihnen behandelten Fussböden, die auf sie zurückzuführende Verschmutzung der Kleider vergessen zu machen, war ein interessantes Nebenergebnis, so sehr man geneigt sein möchte, dem Stauböl mindestens die Wirkung zuzuschreiben, dass es die Böden glatter, also reinigungsfähiger mache. Dass auch das Quantum des beseitigten Staubes genau gemessen, annähernd das gleiche bei der Reinigung nach den drei verschiedenen Verfahren ist und sogar unter Hinzurechnung des Umstandes, dass die Böden mit Stauböl behandelt sind, ist mit ein weiteres Beweismittel für die These, dass alle drei Verfahren gleich wirkungsvoll sind.

Die zweite Frage ist die: Wird die Staubentwicklung während der Unterrichtszeit von der Wahl des Reinigungsverfahrens wesentlich beeinflusst. Auch hier zeigt sich, dass alle drei Verfahren ziemlich gleich zu bewerten sind, was nach Feststellung der Tatsache, dass alle drei zu einer wirklichen und vollständigen Reinigung führen, eigentlich selbstverständlich ist. Über das Ergebnis hinaus, dass die Klasse bei Beginn des Unterrichts des Morgens rein ist, kann sich ein weiterer Einfluss des Verfahrens nur in ganz beschränktem Masse erwarten lassen, nämlich insoweit, als die Annahme nicht ganz ausgeschlossen war, dass durch die Art des Reinigungsverfahrens die gereinigten Flächen entweder mehr geglättet oder mehr aufgerauht würden und somit weiterem Reinigen weniger oder mehr Widerstand entgegensetzten. Auch in der Beziehung haben sich die drei Verfahren als gleichwertig erwiesen, was im Grunde auch durchaus einleuchtet, wenn man bedenkt, dass beim Vacuumverfahren überhaupt keine Reibung der gereinigten Flächen erfolgt und dass das Kehren bei den beiden anderen, dem Hamburger und dem Kopenhagener Verfahren, doch zu wenig geeignet ist, die gereinigten Flächen anzugreifen. Höchstens konnte man auf den Gedanken kommen, dass das feuchte Aufwischen, den Fussboden mehr aufrauhte, insofern es die angefeuchteten und später wieder getrockneten Teile von Holzfussböden quellen und damit rauher werden liesse, als das Verfahren sie vorgefunden hätte. Auch das aber ist nicht in irgendwie messbarer Weise beobachtet worden.

Ist somit ohne Einfluss auf eine wirklich gründliche Säuberung in ihrem Endresultat die Art der Reinigung der Klassen, kann also von ihrdie Staubentwicklung während des Unterrichtes nicht mehr beeinflusst werden, so bleibt nur noch die Frage übrig: Wovon hängt die Staubentwicklung während des Unterrichts ab.

Hier zeigt sich nun, dass das Mass der Staubentwicklung

a) selbstverständlich abhängig ist von dem Mass des in die Klassen eingeschleppten Schmutzes und

b) Von der Art des Schulbetriebes.

Um den letzeren Punkt zuerst zu erledigen, so hat sich gezeigt, dass in einer Klasse mit strenger Disziplin, wo die Schüler ruhig sitzen, bei den Fragen wenig aufstehen, sich überhaupt gesittet und ordentlich benehmen, wo der Lehrer selbst sich ruhig auf dem Katheder verhält, nicht in der Klasse hin- und hergeht, wie zu erwarten war, weniger

Staub aufgewirbelt wird, als in einer Klasse, in der es sehr lebhaft zugeht. Eine strenge Schuldisziplin wird also nicht nur in geistiger Beziehung auf die Schüler wohltätig einwirken, sondern auch in rein physischer Beziehung. Ihre Lungen werden unter Staubentwicklung weniger zu leiden haben.

Die erste Frage, wie lassen sich die Staubentwicklungen beschränken, so weit sie abhängig sind von dem Mass des eingeschleppten Schmutzes, eröffnet ein weites Untersuchungsfeld. Es ist klar, dass hier die mannigfachsten Konstruktionsfragen mitsprechen. Dass die Gestaltung der Decken eines Raumes vielleicht am wenigsten mitspricht, weil erfahrungsgemäss an horizontalen Flächen von unten der Staub am wenigsten haftet, ist auch durch besondere Versuche im Hamburger Institut noch einmal einwandfrei festgestellt worden. Weiterhin aber ist die Gestaltung der Wände, besonders des unteren Teiles derselben, zweifellos von Einfluss auf die Staubentwicklung. Eine glatte Wand, eine besonders geglättete oder mit glättendem Anstrich versehene, wird dem Staub weniger Gelegenheit geben, sich festzusetzen und damit ihn zwingen, auf die Erde zu fallen, um hier am schnellsten sich beseitigen zu lassen. Besondere desinfizierende Anstrichfarben, wie sie Delius neuerdings als erprobt bezeichnet, werden etwa noch an den Wänden hasstenden Staub unschädlich zu machen geeignet sein. Auch die Ausbildung aller Mobilien einschl. der beweglichen Türen und ihrer feststehenden Futter, die Ausbildung des Katheders, der Tafeln wird möglichst unter diesem Gesichtspunkte so erfolgen müssen, dass recht glatte, unprofilierte Flächen hergestellt werden, auf denen der Staub keine Gelegenheit findet, sich in Schlupfwinkeln festzusetzen. Horizontale Flächen wird man tunlichst beschränken, Fensterbretter wird man stark abschrägen, die Schränke möglichst in die Wände legen, damit auf jenen keine unkontrollierbaren Böden entstehen. Endlich wird die wichtigste Rolle innerhalb der Klasse der Fussboden selber spielen. Je leichter er federt, um so eher werden Staubentwicklungen entstehen. Er sollte also eine gewisse Härte haben, die allerdings auch nicht zu weit getrieben sein darf, aus Gründen der leichten Verletzlichkeit der Schüler bei gelegentlichem Fallen und weiter, um den Schall der sich bewegenden Menschen in der Klasse nicht so unangenehm hervortreten zu lassen. In der Richtung dieses Gedankenganges wird man unfehlbar dazu kommen, dem Linoleumbelag ganz besondere Werte beizumessen, die, wie bekannt, noch dadurch erheblich erhöht werden, dass die Fugenlosigkeit eines gut verlegten Linoleums die Ansammlung von Staubmassen in verborgenen Schlupfwinkeln von vorneherein unmöglich macht. Den Linoleumfussboden in seiner Vorzugsstellung vor dem Holzfussboden gerade für Schulklassen zu untersuchen, wäre eine weitere erspriessliche Aufgabe der exakten Forschung. Der Holzfussboden, ganz besonders der stark angegriffene fugenreiche, wird nach jeder Richtung hin als der ungünstigste in Bezug auf Staubansammlung und Staubaufwirbelung angesehen werden dürfen.

Weiterhin wird man innerhalb der Klassen noch alle diejenigen Massnahmen als förderlich gegen die Staubwirbelungen ansehen dürfen, welche geeignet sind, den an den Füssen der Schüler klebenden, eingeschleppten Staub von den Füssen abzustreifen und ihn dem Bereich der ihn wieder aufwirbelnden Gliedmassen der Kinder zu entziehen. Als solche Massnahme wird man die Fussroste unter den Sitzplätzen der Kinder begrüssen, an denen die Schüler den Staub abstreifen, ohne ihn, wenn er einmal in die Vertiefungen hinuntergefallen ist, wieder in Bewegung setzen zu können. Auch die feststehenden Pultflächen, die frei sind von allen beweglichen Teilen, wird man nunmehr wegen der geringeren gebotenen Gelegenheiten zur Staubansammlung und Staubaufwirbelung den Subsellien mit beweglichen Teilen vorziehen. Papierkörbe, Heizkörper usw. müssen weiterhin möglichst nur glatte und zwar vertikale Flächen haben, möglichst wenig horizontale Lagerflächen. Es werden also in der Richtung die Rippenheiz Körpen und die langen horizontalen Heizrohre unter den Fenstern für die Staubansammlung und Aufwirbelung ungünstiger sein, als die vertikal stehenden Heizregister und was fast selbstverständlich, jede Zentralheizung in Bezug auf die Staubfrage vorzuziehen den Ofenheizungen.

Am wichtigsten scheint es nunmehr aber den Schüler zu veranlassen, möglichst wenig Schmutz in die Klassen mit hineinzubringen, also Vorkehrungen zu treffen, die

a) auf dem Wege zum Schulhaus, mindestens aber auf der letzten Strecke desselben ihn möglichst wenig Schmutz an den Füssen mit forttragen lassen, den Weg also gut befestigt und stets gesäubert halten lassen.

Schulen, die inmitten einer grossen unbefestigten Hof- oder Spielfläche liegen, und deren Zuwege aus Sparsamkeitsgründen vielleicht längere Zeit ungepflastert gelassen werden, bieten ganz besonders Gelegenheit zur Staubeinschleppung und Staubaufwirbelung in ihren Räumen. Eine in dieser Richtung sich bewegende Sparsamkeit ist also sehr wenig am Platze. Dann muss noch ein grosses Augenmerk -wie—immer deutlicher in die Erscheinung tritt—arauf gerichtet werden, dass den Schülern ausgibige Gelegenheit gegeben wird, ihre Füsse vor Betreten des Schulgebäudes zu reinigen. Blosse Fusskratzeisen von geringen Ausmessungen sind ganz vom Übel. Grössere Gitter sind besser; am allerbesten werden solche sein, bei deren Überschreitung die Schüler mehrere Schritte zu machen haben, innerhalb deren sie also die Füsse von anhaftendem Schmutz gründlich zu reinigen gerade zu gezwungen sind selbst dann, wenn eigene Nachlässigkeit sie dazu nicht anspornt. Eine besondere Aufsicht am Schuleingang, welche die Kinder immer wieder anweist, die Füsse zu reinigen, selbst wenn sie es vergessen sollten, wird hier sehr segensreich wirken können. Aber hinter dem Fusskratzgitter werden noch weiche Matten auszulegen sein, über die hinwegschreitend die Schüler erneut ihr Schuhzeug säubern. Es ist jedem Bewohner eines eleganten Hauses bekannt, wie sehr er selbst ungewollt sein Schuhzeug reinigt beim Begehen einer mit Läufern belegten Treppe. Wenn es auch nicht möglich sein wird, die Schultreppen mit Läufern zu belegen, so wird doch auf andere Weise zunächst auf die angedeutete, auf möglichst ausgibige Säuberung des Schüler-schuhwerks hinzuwirken sein.

Endlich könnte die Beobachtung, dass die vom Eingange entfernter liegenden Klassen erfahrungsgemäss einen geringeren Schmutz aufweisen, eine Beobachtung, die der aus dem besseren Wohnhaus entnommen durchaus parallel läuft, dazu verführen, möglichst grossen Schulsystemen das Wort zu reden. Solche Schlüsse aber werden selbstverständlich fehl gehen. Denn wenn auch die vom Eingange entfernter liegenden Klassen in einer sehr grossen Schule geringere Schmutzmengen aufweisen werden, so werden dafür diejenigen, welche dem Eingang zunächst liegen und ganz besonders auch die entsprechenden Korridor- und Treppenteile, die von so vielen Schülern gemeinsam benutzt werden, um so mehr Schmutz zeigen. Die Beobachtung in den entfernter liegenden Klassen kann also nur die Notwendigkeit von Säuberungsvorrichtungen, die auf dem Wege bis zur Klasse liegen, in ein noch helleres Licht rücken. Es ist wohl denkbar, dass selbst grosse Aufwendungen an dieser Stelle sich durchaus bezahlt machen, einerseits was die geringern Reinigungs kosten der Klasse angeht, andererseits vor allem was die geringere Staubaufwirbelung und damit Beeinträchtigung der Atmungsorgane der Kinder anbelangt.

Alles Vorhergesagte trifft nun nicht nur auf die Klassen zu, es ist noch in viel höherem Masse zu beherzigen hinsichtlich der Turnhallen. Hier wo die lebhafte Bewegung der Schüler nicht nur nicht vermieden werden kann, sondern sogar eine Aufgabe des Unterrichts ist, muss die Einführung von Schmutz auf das Sorgfältigste hintan gehalten werden. Daneben wird hier aber eine erhöhte und häufigere Säuberung ganz besonders notwendig erscheinen. Die Einschleppung von Schmutz zu vermeiden, dient in den Turnhallen kaum ein anderes Mittel besser, als die Beschaffung von besonderen Turnschuhen für die Schüler. Ist man sich des Wertes dieser glatten, mit dem Schmutz der Strasse nie in Berührung kommenden Schuhe einmal bewusst, so wird man möglicherweise den an manchen Stellen schon begangenen Weg, der Beschaffung von Turnschuhen für die Schüler auf Kosten der Schulunterhaltungspflichtigen, weiter zu gehen sich nicht mehr scheuen dürfen. Daneben tritt aber hier noch eine andere Beobachtung des Hamburger Instituts bei seinen Reinigungsversuchen als wertvoll uns entgegen. Es ist die, dass alle Staubaufwirbelungen schon sehr kurze Zeit nach Eintritt völliger Ruhe im Raume zu Boden sinken und hier also zusammengekehrt und weggebracht werden können. Die Hamburger haben festgestellt, dass schon nach 10 bis 12 Minuten fast aller Staub zu Boden gesunken war, dass wenigstens erhebliche Staubmengen nach dieser Zeit von dem einmal gesäuberten Boden nicht mehr zusammen gekehrt werden konnten. Diese Beobachtung selbst konnte den nicht überraschen, der die Beobachtungen des letzten Jahrzehnts auf einem anderen verwandten Gebiet verfolgen musste, nämlich auf dem der Abwässerklärung. Wie bei diesem in dem leicht beweglichen Fluidum, dem Wasser, die aufgewirbelten Schmutzteile zum grossen Teil in ganz kurzer Zeit bereits zu Boden sinken—man hat hier gefunden, dass in 10 bis 20 Minuten der grösste Teil der Klärarbeit bereits vollendet ist—so konnte man annehmen, dass der Reinigungsvorgang in dem noch so viel leichter beweglichen Fluidum, der Luft, sich so viel schneller abspielen würde. Wenn auch nicht ganz allein der freie Fall im Wasser einerseits, in der Luft andererseits den Massstab für die Schnelligkeit der Wasser- bezw. Luftreinigung abgeben kann, weil auch die im Wasser mitgeführten Schmutzteile wesentlich voluminöser sind als die in der Luft mitgeführten, so werden doch sicherlich Beziehungen zwischen dem freien Fall im Wasser, der Abwässerklärzeit, und dem freien Fall in der Luft, der Luftklärzeit, bestehen, die genau zu untersuchen eine dankbare Aufgabe der Zukunft noch wäre. Jedenfalls werden das Ergebnis der Hamburger Versuche und die bisher in ihrer Exaktheit noch vereinzelt dastehende Feststellung, dass in 10 bis 12 Minuten die Luft bereits vom Staub gereinigt ist, durch die Beobachtung bei der Abwässerklärung in jeder Hinsicht bestätigt. Die Tatsache der schnellen Schulluftreinigung wird ein häufigeres Auskehren des Turnsaales zwischen je 2 Turnstunden, als ebenso erfolgreich wie notwendig erscheinen lassen. Auch hier wird die Frage der Fussbodengestaltung sehr mitsprechen, auch hier wird man zu der Überzeugung kommen, dass es kaum einen geeigneteren Bodenbelag als den des Linoleums geben kann, wenn man Staubaufwirbelungen vermeiden, ein schnelles Säubern des Raumes begünstigen will.

Um die Frage der Schulreinigung ganz erschöpfend zu behandeln, bedarf es noch einer Untersuchung der verschiedenen Reinigungsverfahren in ihrer Schädlichkeit auf das Reinigungspersonal. Ohne weiteres ist klar, dass ein Kehren mit dem Besen wesentlich mehr Staub aufwirbelt als eine Reinigung mit dem Vacuum-Apparat. Letzterer ist hygienisch für das Reinigungspersonal am günstigsten. Der Zusatz von feuchten Sägespähnen beim Reinigen mittels Kehren wird für das Personal als ebensowohl wertvoll bezeichnet werden dürfen.

Da das Reinigen mit dem Vacuum-Apparat in allen Schulen in nächster Zeit sicherlich noch nicht wird erreicht werden können, da also mit den Staubaufwirbelungen beim Kehren noch Jahrzehntelang wird gerechnet werden müssen, muss jedenfalls eins gefordert werden: Kinder selbst dürfen diese Reinigung unter keinen Umständen vornehmen. Ihr Ungeschick bei der Reinigungsarbeit einerseits wird die Gefahr der Staubaufwirbelung noch mehr erhöhen; ihre jungen Körper aber werden unter dieser selbst geschaffenen Gefahr noch mehr zu leiden haben, als die widerstandsfähigeren des erwachsenen Reinigungspersonals.

Den Stand unserer heutigen Erkenntnis auf diesem schulhygienischen Gebiet der Staubentwicklung und Staubbeseitigung in den Schulen wird man zusammenfassend also dahin kennzeichnen müssen:

1) Eine sorgfältige Reinigung der Schulräume, ganz besonders der Turnsäle, ist in jeder Beziehung notwendig, sie ist aber auch möglich mit den verschiedensten Reinigungsverfahren, auch dem altbewährten des blossen Kehrens in Verbindung mit feuchtem Abwischen aller Tisch- und Bankflächen pp., falls dabei die grösste Sorgfalt angewendet wird und häufiger durch Wegrücken, Umlegen der Subsellien oder durch geeignete Konstruktionen derselben Gelegenheit gegeben wird, auch die Flächen unter den Tischen und Bänken zu reinigen.

2) Ein gelegentliches einmaliges feuchtes Aufwischen der Schulräume wöchentlich zur Befreiung des Fussbodens und der Mobilien von festklebenden Schmutzteilen lässt sich nicht umgehen.

3) Die Staubaufwirbelung während des Unterrichts ist abhängig von der Schulzucht; sie ist nicht abhängig von dem vorher benutzten Reinigungsverfahren, wenn bei den verschiedenen Verfahren gleiche Vorsicht an den Tag gelegt wird. Am gründlichsten reinigend, für das Personal am wenigsten belästigend, allerdings auch am teuersten in der Anlage sowohl wie der Benutzung ist das Vacuum-Reinigungs-verfahren.

4) Die Staubaufwirbelung ist dagegen abhängig von der Staubeinschleppung; diese wird am besten vermieden durch gute Befestigung der Zuwege zur Schule, durch möglichst ausgibige Gelegenheit zur Säuberung des Schuhmaterials gleich am Eingange zum Schulgebäude.

5) Die Fussbodengestaltung in den Klassen und der Turnhalle ist von grossem Einfluss auf die Staubaufwirbelung. Zur Vermeidung derselben wird Linoleumbelag ein wertvolles Material sein.

SECTION TWO

The Hygiene of School Administration, Curriculum and Schedule

Room F. Monday, August 25th, 2:00 P.M.

SESSION FIVE

STATUS OF SCHOOL HYGIENE AND METHODS OF INSTRUCTION IN CITY, VILLAGE AND COUNTRY SCHOOLS (Part One)

EUGENE H. PORTER, M.A., M.D., D.P.H., *Chairman*

HENRY P. EMERSON, LL.D., Buffalo, N. Y., *Vice-Chairman*

Program of Session Five

EUGENE H. PORTER, M.A., M.D., D.P.H., Commissioner of Health of State of New York, Albany, N. Y. "What the State Shall Do in the Care and Supervision of School Children."

R. H. CROWLEY, M.D., Board of Education, Whitehall, England. "The Present Position of the School Hygiene Movement in England."

R. L. DIXON, M.D., A.B., Secretary and Executive Officer, Michigan State Board of Health, Lansing, Mich. "Relation of the State Board of Health to the Rural School." (Manuscript not supplied.)

GEORGE A. MIRICK, A.M., Assistant Commissioner of Education, Department of Public Instruction, Trenton, N. J. "State Program of Education in Hygiene in New Jersey."

WILLIAM HAMILTON, Ph.D., Acting Chief of the Alaska Division, U. S. Bureau of Education. "Hygienic Conditions Among the Native School Children of Alaska."

BURTON S. TEFFT, Commissioner of Schools, Saginaw, Mich. "Rural School Hygiene in Michigan."

FELIX MARTEL, General Inspector of Public Instruction, Paris, France. "Législation scolaire française; Dispositions légales et réglementaires relative aux mesures à prendre dans les écoles en cas d'épidémie."

Paper Presented in Absentia in Session Five (Read by Title)

W. H. HECK, M.A., Professor of Education, University of Virginia, Charlottesville, Va. "Parents' Part in School Hygiene."

WHAT THE STATE SHALL DO IN THE CARE AND SUPERVISION OF SCHOOL CHILDREN

BY

EUGENE HOFFMAN PORTER

The importance of this field of health work has long since been admitted by those familiar with the problems presented by the recent developments in sanitary science. We are fully persuaded that the best index of community health is the physical welfare of the school children in that community. So far there is agreement, but when we begin to consider methods of procedure differences of opinion appear. It would seem very probable that any diversity of view regarding plans to be adopted for the proper care and supervision of school children would arise either from a lack of a comprehensive and firm grasp of the question or a failure to clearly discern just what definite results are to be accomplished. It would seem that it ought to be very clear to everyone that if we effectively guard the physical well being of our school children, teach them the fundamental laws of health and train them in the observance of these laws, we have gone a very great ways indeed not only in protecting the health of the individual but in establishing and confirming the health of communities and indeed of the State.

Such an advance as that in health work would be one of the great foundation stones upon which might be successfully erected that ideal structure of public health protection which would actively and visibly promote and determine State and National efficiency and happiness.

But if we are to supervise and care for our school children we must not only know what kind of care we are to give and what kind of supervision we are to exercise, but we must know something definitely and accurately about the school children themselves.

There is only one way in which we can find out anything about the children in our schools and that is to examine them and this examination must be made by those who have had some training in the work, who understand the vital points at issue, and are competent to bring out the facts that such an examination is searching for. Many examinations of school children have been held and the results of such examinations have been duly recorded on thousands and thousands of cards and buried in as many forgotten reports. It is not the examinations that do any good nor the tabulated results that are of any value, but the use of these reports and their interpretation, and the intelligent work based upon them. The proper care and supervision of school children is preventive medicine in the highest sense of the term, and preventive medicine is the best and cheapest health insurance that a community can take out.

Some time ago was begun the formation of hygienic committees for universities.

These committees have employed an admirable scheme of investigation, have adopted wise measures for bettering the hygienic conditions of buildings and the health of the students. Such matters as Ventilation, Humidity, Water, Sweeping, Toilets, Gymnasium, Lodging House Inspection, Medical Adviser, Emergency Cases, Health Education, are given full consideration together with the various other subjects which have to do with the health and habits or life of students. Admirable as this scheme is and important as it is as an example of what can and should be done, yet its greatest value lies in the illustration given of the value and power of such close and critical examination of the surroundings and physical condition of the students concerned. Of necessity it reaches but an infinitesimal part of those attending the schools and colleges in the Union. But what can be done for college students should be done for every school child in the United States.

It is a curious fact, and by no means gratifying to our National pride, that when we wish to strongly illustrate the value of modern sanitary methods we draw our most striking illustrations from our island and provincial possessions. Modern sanitary science, for example, has abolished yellow fever in Cuba, discovered the cause and largely controlled the ravages of hookworm ænemia in Port Rico, barred yellow fever and Chagres fever from the Canal Zone, and isolated leprosy in Hawaii and the Philippines. Now this work has practically revolutionized conditions in our tropical possessions and enabled the President to say in the short 12 years that we have been responsible for our people in the tropics we have made more progress in the discovery of methods of prevention and cure of tropical diseases than all other countries have made in the past two centuries. Now this advance has been due to modern sanitary methods, backed up by intelligent and authoritative administration. And the results show what intelligence and authority can do when joined together. We have indeed intelligence in modern sanitary methods in these, our United States, but it is not always backed by authority, and we have in the same place authority that is notably lacking in intelligence.

Typhoid, pneumonia, tuberculosis, the black plague of venereal infection, are still ravaging the land. If they were tropical diseases how horrified we would be at their ravages and what active measures would we take to control and extirpate them. And yet I think it may be safely said that modern sanitation, if permitted, if we could unite authority and intelligence in health matters as they should be united, could effect as marvelous changes here as it has in the Canal Zone or in Havana.

Herbert Spencer said a long time ago that "to be a good animal is the first requisite to success in life, and to be a nation of good animals is the first condition of national prosperity."

It is true that we protect our cattle. The great State of New York, with nearly ten millions of people, spends many times more in looking after the health of the cattle of the State than it does for the health of its citizens. In 1909 the Health Department had $146,980, which was less then one-half of one per cent. of the total expense of the State Government. At the same time was spent for the protection of game, fish and forests, $568,595.80.

We are all familiar with the wastes of life in our country, going on day by day and year by year. Some of us know that much of this sickness and death is absolutely preventable. We are aware that we do not need to know more just now regarding the prevention of disease but we do need to apply the knowledge that we have immediately and without further delay. The attitude of the people is easily understandable. It is as Governor Hughes said a short time ago, "Only because we are accustomed to this waste of life and are prone to think of it as one of the dispensations of Providence that we go on about our business little thinking of the preventive measures that are possible."

The hog is fortunate in being an animal of commerce. If it were not the waste of hog life would doubtless exceed that of human life. We are a generous people. After every disaster money flows in to relieve distress. A great epidemic occurs—towns, cities, states and even the nation contribute liberally for the relief of the distressed community. Now if it is right and proper for the State and the nation to appropriate money for the relief of distress, it is certainly right and proper to contribute money for the prevention of distress, which means in most cases the prevention of disease.

Our system of philanthropy is essentially false. It has developed naturally and in its early growth, animated by noble motives, sustained by high ideals, it did a great and beneficent work. But increasing knowledge has shown the futility of much of the misdirected philanthropy of to-day. If a child is threatened with illiteracy millions are forthcoming for its education, but the child that is threatened with preventable disease is told that just now nothing can be done; wait until disease has attacked you and you are helpless. Then there is a hospital provided for you and you will be taken there and an attempt will be made to save your life. There are hospitals endowed for this very purpose.

And there you have the matter in a nut shell. It is not the curing of disease that is important; it is the prevention of disease. Where one life may be saved by appropriate treatment, a thousand lives may be saved by timely preventive measures.

Now the problems of health have to do principally with environment—home, street, school, business. And it is because this is so that it is worth trying to relate health instruction to industry and government, to preach health from the standpoint of industrial and national efficiency rather than of individual well-being. So that while the State cares for the child and undertakes his examination and his general health supervision, the real and important thing, the great result to be attained, is not so much the health and efficiency of the one child as it is the resulting increased efficiency in the community itself. The supervision and care of the school child, his instruction in hygiene, necessarily brings in all the persons in his home, takes in the groups made up of friends and acquaintances, reaching out and eventually embraces the entire community, and so lifts up and elevates the standards of living.

Now we must find some working program that will bring all these members of the groups mentioned together and make it easy for them to observe health standards, and we must remember that there is a great gap between health laws and health law enforcement. We are constantly making the mistake of concentrating our attentions upon the morals and pretentions of candidates and officials instead of judging government by what government does. It makes no particular difference just how our officials are exercising authority, but it makes a tremendous difference when what they do makes men freer in the enjoyment of health and earning power. In protecting health as in reforming government, as Allen says, "An ounce of efficient achievement is worth infinitely more than a moral explosion."

Undoubtedly some legislation will be necessary if we are to make the progress we desire in the care of the physical welfare of our school children. Such legislation should be as brief, as simple, and as fitted to the place and the time and the people as possible. And it must be remembered that the value and permanence of the results that are sought for in any reform movement or in any type of governmental action depend largely upon the adaptability of the movement undertaken and of the principles on which it is based and the special conditions of the time. If we wish, therefore, to improve the welfare of our schools we must study carefully the conditions of the State at this particular time and see to it that our movement in advance is adapted to these conditions.

An instructive illustration of the great advance made in another field is shown by a proposed Children's Code of the State of New York, compiled by Justice Deuel of the Court of Special Sessions of the City of New York. He proposes to attain, among other things, the following four purposes:

1. Indubitable protection of the child against all suggestion of crime; hence the elimination of all objectionable references to him in the penal law and the criminal code, and the specific definition of juvenile delinquency.

2. Extension of the Children's Court, without any increased expense, to every city, town and hamlet in the State, at the same time giving to each the home rule privilege of developing and utilizing to the utmost the resources of the court.

3. The institution of uniform procedure and the acquisition of uniform statistical data throughout the State.

4. The legal employment of scientific agencies in the detection of mental or physical causes of waywardness which, uncorrected, predisposingly lead to crime; and a procedure likewise legal compelling curative treatment.

I cite these provisions of this proposed code simply to show what progress the legal profession has made in dealing with what may be called the criminal or perhaps rather the moral side of the child's nature. Such a code as that proposed by Judge Deuel would have been impossible in this State ten years ago and unthinkable twenty-five years ago. It will be noted that the underlying purpose of the judge is evidently the prevention of crime rather than the punishment of crime.

In a paper so limited as this it is only possible to give a brief outline as to what should be the duty of the State in its care of the school child. I have already said that the best index to community health is the physical welfare of its school children. Now, if we can fix upon the test to be applied at school of home conditions affecting both the child's health and his progress at school, it will be possible in the name of the school to correct those conditions if necessary, just as it will be easy to read the index, because the child is under study control for the greater part of the year, from six to fourteen. This test should be the physical record of the child obtained by the examination and re-examination for the physical signs called for by the record card. This card, among other things, should register the weight, height, age and other measurements. It should take note of the nutrition, of enlarged glands, of cardiac or pulmonary diseases, of defective spine, chest or extremities, of defective vision or hearing, of the condition of the teeth, of the palate, of the tonsils, of post-nasal growths, of deficient and defective nasal breathing, and of the mentality.

Now when such a card as this is filled out for every child in a class in a school or city the story told points directly to physical health rights neglected. In the examination of school children in New York City, running from March, 1905, to January, 1908, 275,641 children were examined and 198,139, or 71.9 per cent., were found to be defective. If this percentage should obtain throughout the whole of the United States then the army of children would be 7 out of 10 or over 14,000,000. These figures have been vigorously attacked by those who do not believe that such a percentage of the children in our public schools have any serious defects. But it is really not material whether these figures are exact or not. If they overstate the truth or understate the truth the health authorities of the country should find out.

Now this record of physical examination is the only way in which the existence in a community of conditions prejudicial to health that particularly affect the child can be discovered. The card record will show whether the child sleeps in a dark, ill-ventilated and crowded room, if he has too little to eat or the wrong things to eat, and whether he has eye trouble or adenoids or enlarged tonsils; whether he has defective lung capacity, which may mean improper breathing or too little exercise or too little food. Let me say again that it is the use of information and not the measuring of information that improves the health. The mere examination of school children does little good. The examination tells what child should have special attention, what parents need to be warned against as to the condition of the child, and what home conditions need to be corrected.

Let us keep clearly in mind the distinction between medical school inspection and medical school examination. Medical inspection is simply the search for communicable diseases; medical examination is the search for physical defects, many of which furnish the soil for contagion. Among the important defects which demand correction if the health and efficiency of the child are to be protected and his value as a future citizen of the commonwealth is to be preserved are mouth breathing; diseased glands, which means adenoids and enlarged tonsils; ear troubles; eye strain; malnutrition; diseases of the teeth, and contagious diseases.

It will be impossible in a brief paper of this character to discuss separately each of these defects, to attempt to point out their seriousness, their frequently fatal results and the great importance of their correction. Those who have given this subject any considerable attention know full well that these conditions should be no longer neglected but should be promptly, energetically and wisely corrected.

For a working program for the supervision and care of school children, that suggested by Mr. Allen will serve at least as an excellent basis for discussion and future action.

First. A thorough physical examination of all candidates for teachers' positions.

Second. A thorough physical examination of every single child in every single school upon entering, and periodically during the school life.

Third. Supervision by physicians of hygienic practices in school rooms and upon playgrounds.

Fourth. Restrictions of study hours at school and at home to limits compatible with health.

Fifth. Establishment of follow-up plan to ensure action by parents to correct physical defects and to attend to physical needs.

Sixth. The teaching of hygiene so that children will cultivate habits of health and see clearly the relation of health and vitality to personal happiness and the future efficiency.

Seventh. Central supervision of school hygiene.

Eighth. Information gained at school regarding conditions prejudicial to community health should be published and made the basis of an aggressive campaign for the enforcement of sanitary laws.

This is by no means all that Mr. Allen suggested, or that has been suggested by others, but it will serve excellently as an outline to guide our advance in the betterment of conditions in our schools. I am thoroughly convinced that this work should be in the hands of the health authorities, and that all medical examinations of school children should be made by competent physicians.

This work of school inspection and examination gives us a clear view of some of the most important defects in the community health, and when to this picture is added that given by a sanitary survey of the same community, town or city, made by competent inspectors, which would take in the questions of water supply, sewage disposal, tenement conditions, clean streets, etc., we have a pretty definite and accurate picture of the essential health conditions existent. Now with such sources of information the annual report of the Board of Health should give as clear a picture of a community's health for any past week or past quarter as an accountant's books would give of the condition of any commercial business. Furthermore such a Board of Health should not only keep track of one community alone, but this community should be compared with other communities of similar size and each community compared with itself year by year. Such comparisons as these have not often been made and I do not know of a State where such records exist.

I believe thoroughly that it is the duty of health authorities to compel all citizens under their jurisdiction to cultivate habits of health and to punish all who persistently refuse to acquire those habits so far as the evils of neglect are in any sense a danger and a menace to the community. And one of the unlimited educational possibilities of health boards consists in their privilege to point out repeatedly and cumulatively the industrial and community benefits which result from habits of health, and the industrial and community losses which result from habits of unhealthy living. And should it be thought that this health program encroaches upon individual liberty we may recall what one of the greatest of modern biologists has recently said: "As we march onward toward the true goal of existence mankind will lose much of its liberty but in return will gain a high measure of solidarity. The more exact and precise a science becomes the less freedom we have to neglect its lessons." These new duties are before us and it is only by organized, enlightened and persistent effort that we may hope to accomplish our ends.

I thoroughly appreciate the fact that what I am proposing is more or less ideal, and yet I am as thoroughly convinced that within a few short years it will be realized that the plan proposed is absolutely practical and sane. A public official said a little while ago: "I am fully aware of how little I am doing and how little at best I shall have done when my time is up. Corrections and improvements in government, as in all things, may not be done at once, but only patiently and gradually and, may I say, charitably; explaining and teaching as you go, even as Isaiah says: 'Precept upon precept; line upon line; here a little and there a little.'"

I think we may show that these words—modest, patient and charitable—could be hung over the desk of every ranting, denouncing reformer who labors to make the people believe that he holds the remedy for the complete and sudden reform of every existing abuse, health or otherwise.

Realizing, then, the limitations of human power, the existence of honest differences of opinion, the dependence of all true and lasting education and reform on the people themselves, let us march steadily onward and let us remember that the truest measure of civilization and of intelligence in the government of a State is the support of its institutions of science and of health. For the science of our time in its truest sense is not the opinions or prejudice, the strength or weakness of its votaries, it is the sum of our knowledge of nature with its infinite applications to State welfare, to State health, to State progress, and to the distribution of human happiness.

THE PRESENT POSITION OF THE SCHOOL HYGIENE MOVEMENT IN ENGLAND

BY

RALPH H. CROWLEY

The rapidity of the growth of the school hygiene movement has been a remarkable phenomenon in nearly all countries. It is hardly too much to say that where its significance has been appreciated it has changed the center of gravity and profoundly affected the administration of the public health service. In England, some six years ago only, a considerable controversy took place as to whether the school medical service should be a separate *ad hoc* service or whether it should form a branch of the existing public health administration. In the event of the adoption of the latter course it was feared by some of the pioneers of the new movement that this new branch of medical work which opened out such great possibilities would tend to become side-tracked. It was feared, if placed in the hands of men intent upon the more general problems of public health and but little accustomed to deal with those of the character which the new movement was bringing to light, the development of school hygiene, and its peculiar problems would be seriously checked. The school medical service in England forms an integral part of the public health administration of the country and it is not too much to say that so far from this form of administration having led to the relegating of school hygiene to a subsidiary place, the event has shown that the new service, coupled with that dealing with the care of the infant, has become the pivot around which the administration of public health tends more and more to revolve.

Administration. The responsibility for carrying out the work of the school medical service is placed upon the 317 local education authorities of England and Wales. Upon each of these has been cast by Parliament in the Education (Administrative Provisions) Act 1907 the *duty*

"To provide for the medical inspection of children immediately before or at the time of, or as soon as possible after their admission to a public elementary school, and on such other occasion as the Board of Education direct," and the *power*

"To make such arrangements as may be sanctioned by the Board of Education for attending to the health and physical condition of the children educated in Public Elementary Schools."

Upon the passing of the Act a medical department was inaugurated at the Board of Education for England and Wales with Sir George

Newman as Chief Medical Officer, and through this department the general principles which should guide the local education authorities in doing the work and the lines along which these should find expression were laid down in a series of circulars. (1)

At the very output a broad and comprehensive view was taken of the scope of the school medical service and of its relation on the one hand to the existing general educational administration, and on the other to the existing general public health service. As at present carried out in England and Wales the work of the school medical service comprises the following branches, viz:

Medical inspection of the child.
Following up and supervision of children found defective.
Treatment of defective children.
Special schools for physically and mentally defective children.
Provision of school meals.
Physical exercises and games.
School baths and bathing.
Supervision of school buildings.
The control of infectious disease.
Medical inspection in secondary schools.
The teaching of hygiene to teachers and scholars.
Employment of children.
Schools for mothers.

For the purpose of carrying out the work of the school medical service a "school medical officer" has been appointed by the respective local education authorities in each of the 317 areas. In 252 areas the school medical officer is also the medical officer of health of the district. In the remaining areas in which the School Medical Officer is not the same officer as the Medical Officer of Health arrangements are made in almost all instances to ensure close linking up of the general public health and school medical services. There are throughout the country 597 assistant medical officers, 212 acting as whole-time and 385 as part-time officers. The total number of medical officers is 943, of whom 74 are women medical officers.

The fundamental characteristic of the organization of Medical Inspection in England and Wales is that it is compulsory and universal. The systematic medical inspection of children has been assured throughout the country, even in the most remote rural school, and while local education authorities differ in the degree to which they carry the

(1) *Circular* 576. Memorandum on Medical Inspection of children in public elementary schools, under section 13 of the Education (Administrative Provisions) Act, 1907.

Circular 582 including a Schedule of Medical Inspection.

Circular 596 dealing in particular with the treatment of school children.

Code of Regulations for Public Elementary Schools.

efficiency of the work a minimum, and by no means a low standard of minimum, is expected of and obtained from all local education authorities alike.

The Board keeps itself informed as to the extent, character and efficiency of the work in each area by the payment of visits of inspection by medical officers of the Board and also by means of the Annual Reports which the school medical officers present to their respective local education authorities and which are forwarded by them to the Board.

Upon these reports are based the Annual Reports of the Board's Chief Medical Officer, which will be found to contain full statements as to the position of the school hygiene movement in England and Wales from year to year.

Medical Inspection. Under the regulations of the Board of Education for England and Wales arrangements are required to be made by each local education authority for the medical examination of every child in the country on the occasion of the first admission to school and shortly before leaving school. From 1st April, 1915, a third and intermediate routine examination will be required at the age of eight years. Already over one-third of the local education authorities have arranged for this intermediate examination.

This routine examination includes a record of important points in the family and personal history of the child, and while not professing to be exhaustive is of a thorough character, involving an examination of the height and weight, the special sense organs, the lymphatic system, the heart and lungs, etc., and ensures that no pathological condition of importance shall escape detection. The findings are recorded upon a schedule prepared for each child. On the occasions of the visit of the doctor to the school to carry out these routine examinations, children of any age presented by the teacher as suffering from some particular defect, or picked out by the school medical officer while making a survey of the children in the classes, are also examined. The arrangements for medical inspection form an organic part of the general educational system. Medical Inspection is upon school premises and during school hours.

This systematic medical examination of the children forms the foundation upon which is built the whole superstructure of school hygiene.

Following Up and Supervision of Children Found Defective. It is generally recognized that the medical examination of children in itself would be of comparatively little value unless systematically followed up. This branch of the work, technically known as "following up," embraces a definite range of activities, the object of which is to ensure that the child shall receive appropriate treatment.

First and foremost among these agencies is the *school nurse*. In the majority of cases she attends on the occasion of medical inspection and subsequently visits in the home when necessary in order to encourage the parent to obtain treatment, to advise how it may be obtained or to show the parent how to apply such simple remedies as may have been prescribed.

Repeated examinations for uncleanliness are made also on the occasion of periodic visits to the schools when, in particular, the heads of the girls are examined and warning notes sent to the parents if necessary and the cases followed up till satisfactory action has been taken. At the present time 632 school nurses or health visitors have been appointed by 212 local education authorities.

The *school medical officer* himself, on the occasion of subsequent visits to the school, also "follows up" these children found defective, reexamines them and notes what action, if any, has been taken towards the relief or cure of the defect and what is the result of such action.

In some areas, particularly in country areas, a good deal of this work of following up is carried out by *voluntary workers* banded together to form what is known as a "School Care Committee." Children requiring attention are reported by the School Medical Officer to the Committee whose members undertake to visit the homes where necessary and endeavour to obtain on the part of the mother such attention as has been recommended by the medical officer. There are upwards of 1,000 such committees in London alone, and large numbers throughout the country.

And lastly use is made in some districts, for the purposes of following up, of the *school attendance officers*, but generally speaking their time is already sufficiently occupied with purely school attendance problems. Through the several agencies an endeavor is made to ensure that the school medical officer has cognizance of and supervision over all children of school age found defective whether in attendance or not in attendance at school.

Treatment. It has been the aim of the Board of Education for England and Wales, in their circulars to local education authorities relating to the school medical service, to emphasize the need for taking a broad view of the meaning of treatment. Thus they have urged that the adaptation of school conditions and the school curriculum, establishment of open-air recovery schools, the provision of school meals, arrangements for physical exercises and school baths require to be viewed in the light of treatment, as well as the more direct measures adopted for the cure or relief of some specific defect, as for example the removal of adenoids and enlarged tonsils by surgical operation, or the prescription of glasses for defective eyesight.

The agencies available for treatment in its more restricted sense may be summarized as follows:

1. The private practitioner.
2. The voluntary hospital and infirmary.
3. The poor law.
4. The school clinic.

Treatment under the English Poor Law, through the agency of the local Boards of Guardians, is speaking generally, and for reasons into which I need not enter, in practice not used.

For some children and for certain ailments the services of the private practitioner are available. Due, however, in part to the fact that many parents are unable to pay the cost of adequate treatment, in part too, owing to the circumstance that many practitioners do not undertake special forms of treatment, as for example the correction of defective vision, the X-ray treatment of ringworm or the operative treatment of adenoids, and in part again because associated with treatment by the private practitioner there are usually no systematic arrangements for obtaining the services of a nurse, it is found by experience that reliance cannot be placed upon obtaining treatment from this source in a large number, indeed in the majority, of cases.

Many children receive treatment through the agency of the voluntary hospital or infirmary. Speaking generally however these institutions are suitable for the more serious cases of illness and especially for cases requiring operative treatment.

Experience has shown, therefore, that in most areas there are difficulties in the way of many children receiving prompt systematic and adequate treatment for the ailments discovered, and the need has arisen for further provision more intimately associated with the education and school medical services. To meet this requirement the school clinic has been instituted in a considerable number of areas.

The School Clinic. In England the school clinic has developed on two lines. First it forms a centre for "following up" where the School Medical Officer may examine more fully children referred by himself for more detailed examination or sent by teachers, nurses, school attendance officers or members of Care Committees or brought by the parents themselves.

But the clinic is used for the purposes of *treatment* also and in particular for the treatment of one or another or all of the following conditions, viz:

1. Minor ailments, including the common and often contagious affections of the skin of all kinds, such as impetigo and eczema and pustular conditions generally, the lesions associated with pediculosis of the body and head, scabies and ringworm, the simpler forms of external eye disease such as blepharitis, hordoolum and conjunctivitis; otorrhœa.

2. Defective vision.

3. Defective hearing.

4. Ringworm by X-rays.

5. Adenoids and enlarged tonsils.

6. Dental defect and disease.

At the present time in a large number of education areas Inspection Clinics have been arranged. Ninety-five Authorities have established Treatment Clinics, 38 Authorities are treating ringworm by means of X-rays and in 58 areas dental clinics have been established. Speaking generally the operative treatment of adenoids and tonsils is carried out at existing hospitals and infirmaries but a few authorities have themselves established or are about to establish clinics for this work. In a few centres there is being added also provision for treatment by means of remedial exercises.

Experience has shown how great are the advantages if treatment is to be promptly secured and effectively carried through, that it should be, so far as possible, carried on as an integral part of the school medical service. The conception taken of treatment in the past as a single act with but little relation to subsequent action or to associated lines of treatment has led to inefficiency and to ineffectiveness of result. Thus the treatment of defective vision by means of glasses requires the services of an oculist who is fully acquainted with school circumstances and requirements. The prescription of glasses for a child who squints is of little value unless the interest and aid of the teacher is invoked, in order that the instructions given in connection with the care of the eye may be carefully carried out. The operation for the removal of adenoids and enlarged tonsils again may be rendered largely nugatory owing to failure to see that suitable breathing exercises are subsequently practised. Some children suffering in this way moreover require treatment along other lines, *e. g.* by the provision of meals or by attendance at an open-air school.

Special Schools for Physically and Mentally Defective Children. These schools have been established under the Elementary Education (Blind and Deaf Children) Act of 1893 and the Elementary Education (Defective and Epileptic Children) Act of 1899 and include schools for the following groups of children, viz: Blind, deaf, mentally defective, physically defective (principally cripples), epileptics, tuberculous children, delicate children of all types.

The Blind and Deaf Children Act makes it compulsory upon all education authorities to provide educational facilities for all blind and deaf children in their area. The larger local education authorities have established schools of their own; the smaller contribute for the maintenance of their children to Institutions and Homes established by the larger authorities or by private effort. There are in all 40 schools for blind and 51 for deaf children throughout England and Wales, providing accommodation for 2,400 and 4,300 children respectively.

As a result of medical inspection, more especially in the larger centres, attention is being drawn by the school medical officers to the presence in the schools of "partially-sighted" and "hard-of-hearing" children who, though not considered bad enough in the past to justify attendance at a special school are nevertheless unsuited for education given in an ordinary elementary school. Special classes are now being formed for these children in several centres or special provision is being made for their accommodation in the existing schools for the blind and deaf.

Mentally defective children are provided for in both Day and Residential schools. The Act regulating the establishment of such schools is, however, at present a permissive Act only and although action has been taken under it by most of the larger towns there remains a large number of children in the country for whom special provision is not at present available. 52 Local Education Authorities have established schools under the Act and 106 other Authorities contribute towards the maintenance of their defective children in the schools provided by the above-mentioned Authorities or in schools established by private enterprise. There are in all 8 residential schools providing accommodation for approximately 600 children and there is further accommodation for approximately 12,800 children in the 169 day schools.

The important group of children known as the dull and backward is now receiving special attention as the result of medical inspection. Children of this group, whether the cause of their retardation be in heredity or associated with poor physical development, respond to special training and to a curriculum adapted to their needs. Special classes for such children have been started in a few towns and moreover they form a considerable percentage of the children in attendance at the open-air Recovery Schools.

Special schools for crippled children have been established under the 1899 Act in several of the larger cities. There are at present in the country 11 residential schools and 56 day schools, providing accommodation for approximately 800 and 4,400 children respectively. The fact that so many of the children owe their condition to tuberculous disease and the clearer appreciation accordingly of their requirements, is leading to a modification of this type of school, which it is now recognized must take on, so far as possible, the form of the open-air school.

There are at present 11 day open-air Recovery Schools for delicate children. These comprise children of the pretubercular type, children suffering from debility associated with malnutrition, anaemia, lymphatic glandular enlargement, etc.; "nervous" children, including those suffering from milder forms of chorea; children with chronic bronchitis, heart disease, ricketts, etc.

Sanatorium schools for children suffering from pulmonary tuberculosis are being established in several parts of the country and in view of the special government grants now available for such schools their number is likely largely to increase in the near future.* A few local education authorities have established also Day Open-Air Schools exclusively for children in the early stages of pulmonary tuberculosis.

There are six Residential Schools reserved for the treatment of epileptic children. They provide accommodation for 488 children, most of whom suffer from epilepsy in its severer forms. The provision is at present inadequate. Experience shows that for large numbers of these children attendance at a special residential school, followed by colony life, is required in the interest both of themselves and of the community.

Provision of Meals. The Provision of Meals Act, authorizing the expenditure of public money on the provision of food to necessitous children, was passed in 1906. The general administration of the Act, as in the case of that regulating medical inspection, is entrusted to the Board of Education for England and Wales, acting through the medical department. The experience gained in the working of the Act has shown the need for associating the administration of the Act as closely as possible with the school medical service. An endeavour is being made to bring the school medical officer into intimate relation with the selection of the children, the dietary provided and the preparation and serving of the food.†

*A grant not exceeding £90 per bed or three-fifths of the cost, whichever is the less, is payable towards the erection of sanatoria for children and a grant not exceeding 50% of the cost per child towards maintenance.

†The total number of meals provided in 1911 (the returns for 1912 being not yet complete) was 16,100,000 at a cost of upwards of £157,000. Of this sum £151,000 was provided by Local Education Authorities and the remainder by voluntary and other means.

Physical Exercises. The administration of this branch of educational work is being steadily brought into closer connection with the school medical service. The official syllabus of physical exercises now in use throughout the country has been drawn up by the medical department of the Board of Education for England and Wales which possesses a staff of experts for purposes of inspection in schools and colleges of all grades.

School Baths and Bathing. This branch of the School Medical Service has not developed to such an extent as in several other countries. Excellent use is, however, made of existing public baths in many towns but the use of these baths is connected more particularly with the teaching of the art of swimming and their use is in considerable measure restricted to older children. It seems likely, however, that in the near future there will be a fuller recognition of the physical and educational value of school bathing.

In addition to the various towns in which use is made of the existing public swimming baths, special spray bath installations have been placed in schools by 20 local education authorities. Such baths form also a feature of the open-air schools in the country and special provision is made for bathing children in most of the schools for mentally and physically defective children.

School Buildings. The advent of the school medical service is having a considerable influence on the hygiene of the school building. The increased attention which has been drawn in particular to the need for adequate ventilation has led to a reconsideration of the planning of schools. The accepted type until recently has been the central hall with class rooms leading out of it. This had avdantages from the point of view of compactness and also in the case of a school heated and ventilated by some form of mechanical means. But such an arrangement does not permit of adequate thorough ventilation of the class room and moreover from the point of view of the use of the central hall for physical exercises or for combined lessons such as singing, or for the purposes of play and organized games the central hall is by no means as convenient as a hall detached from the class rooms. Accordingly the type of school building tends increasingly to the pavilion plan, the class room opening on to a fresh-air corridor or on to a verandah. There is no doubt but that the open-air school is reacting in many directions upon the ordinary Elementary School and the buildings are tending to become less formal and elaborate in structure.

Control of Infectious Disease. The School Medical Service is furnishing a more precise weapon for dealing with the complex questions arising out of the administration of infectious disease than has existed heretofore. Powers have, it is true, existed under the Public Health Acts, but the School Medical Service has provided further opportunity for dealing more directly with the individual child whether in the school or in the home. Accordingly earlier and more precise knowledge is coming to hand, any steps required can be taken with more prompitude and a fuller understanding of the part played by the School in the spread of infectious disease is resulting. The utility of the service is shown particularly in the case of measles, a disease for which apparently so little can be done to lessen the incidence, but for which much can be done through the agency of the school nurse and health visitor, by calling at the homes of the children, to encourage the parents to seek medical advice where necessary and to take ordinary hygienic precautions. Active measures of this kind are being taken now by many school medical officers and there is every prospect that the mortality and also the malign after-effects of measles will become materially reduced.

Medical Inspection of Secondary Schools. The Act of 1907 made medical inspection obligatory in primary or elementary schools only. Nevertheless a considerable number of Authorities responsible for the provision of secondary schools have made arrangements for the medical inspection of the scholars. In some instances all the children, unless any objection is raised by the parent, are examined on admission, those with defects being subsequently followed up. In others, scholars are examined who are presented by the head teacher as suffering from some apparent defect.

The Teaching of Hygiene to Teachers and Scholars. Special syllabuses of instruction in Hygiene, Temperance and Infant Care have been issued by the Board of Education for England and Wales and in 1908-9 Hygiene was introduced for the first time into the list of subjects which students in Training Colleges are required to take for the final examination.

In 1910 the Board issued a Memorandum on the teaching of Infant Care and Management for use in public elementary schools, and a number of local education authorities are making a special feature of this branch of hygiene training.

Employment of School Children. The compulsory medical examination of all children in the country shortly before the date upon which they are expected to leave school links up very closely the work of the school medical service with the problems of juvenile employment. Many school medical officers are now paying special attention to this problem in its different aspects. Thus in some areas employed school children are kept under supervision by the school medical officer, in others the certifying factory surgeon is working in association with the school medical officer and the findings of the latter are available for the use of the former. Many school medical officers deal in their reports with the extent to which children work out of school hours and with the effects of such work on the physical and mental condition.*

Schools for Mothers. The establishment of the school medical service has shown the need for further medical observation and care of children below the age of compulsory school attendance which in England and Wales is fixed at five years of age. The provision of schools for mothers is at present in its infancy and their establishment is beset with numerous practical difficulties. At the present time there are approximately 100 properly organised schools of this kind which include arrangements for infant consultations, home visiting and educational classes towards the expenses of which the Board are in a position to pay grant. In addition in a number of areas the nucleus of such arrangements exists.

A large number of children are brought under observation in the Babies' Department of the Infants' Schools, attendance in the Babies class being optional between the ages of three and five. Comparatively few children attend these classes at the age of three, but in the more industrial centers about one-half of the children between the ages of four and five attend. On the other hand much is being done in many towns by infant care organisation under the medical officer of health, to aid and guide parents during the first few months or year of the infant's life. What is needed is some method of effectually bridging the gap between infancy and the age of four and five. This matter is now receiving careful attention and is likely to find solution along existing lines by extending the period of infant care as at present carried out by Health Visitors under the Medical Officer of Health, by developing the schools for mothers and by the establishment, more particularly in the industrial centers, of suitable Nursery Schools.

Relation to Educational Methods. The establishment of the school medical service is already exercising a considerable influence on educational methods and practice. It has emphasized the need, so far as practicable, of suiting the curriculum to the child, and the process of differentiation begun by the Blind and Deaf Children Act of 1893 and the Defective and Epileptic Children Act of 1899 is being carried still further. The establishment of the open-air school of Recovery for deli-

*The Acts specially affecting juvenile employment are the Factory Acts, the Employment of Children Act, 1903, the Labor Exchanges Act, 1909, and the Education (Choice of Employment) Act, 1910.

cate children, of classes for the dull and backward, for the partially blind and the hard of hearing, for stammering children and children with defective speech are evidences of the recognition of the needs of certain well-defined groups of children. But further than this it is becoming recognized that much that is faulty in current educational method and practice is due to a lack of appreciation of the physiological processes involved in the child's physical and mental development. There is here an almost unlimited field for research, and for reform well considered and wisely applied based on the results of such research. A broad foundation is now laid, school medical officers in every part of the country are becoming acquainted at first hand with the facts bearing on the position. Special attention has necessarily and rightly been concentrated on the problems of the physical condition and hygiene of the child and its surroundings. All the time however the School Doctor is becoming trained in the more subtle and the more purely educational problems, and there can be but little doubt that the School Medical Service, already bearing fruit in this direction, will in an important degree influence and modify existing educational practice.

Cost of the School Medical Service. The cost of the School Medical Service has, up to approximately the last two years, been borne entirely by the Local Education Authority for the County, Borough or Urban District as the case may be. For the year ended 31st July, 1912, a grant was paid by the Board of Education for England and Wales out of Imperial funds to Local Education Authorities in aid of expenditure incurred upon following up and medical treatment. This grant has now been further increased and for the year ended 31st July, 1913, a grant will be paid by the Board to all local education authorities, amounting approximately to one-half of the cost incurred in both medical inspection and medical treatment. In the case of some of the Special Schools an additional grant in aid of treatment has recently been made by the Board, and at the present time approximately one-half of the cost of educating a child in a Day Open-air School and approximately one-third of the cost of maintaining a child in a Residential Open-air School is borne by the Imperial exchequer.

The foregoing sketch of the present position of the School Medical Service in this country will show that an endeavour has been made to lay broad the foundations. It has become evident that around the child, from infancy upwards, must revolve the machinery for the administration of public health. With the adaptation of the conditions of life and the environment generally to the healthful upbringing of the child will be solved simultaneously many of the present-day problems affecting the adult.

Discussion of R. H. Crowley's Paper

by

Herbert F. True, M. D.

Mr. Chairman:—By the way of comparison and since there has been expressed a desire to learn of the methods used in Los Angeles City, and as Professor Leslie, who is down for a paper at this session is not here, I take this opportunity under the discussion of this most interesting paper by Dr. Crowley, to briefly outline the methods followed in our western city.

Under the California law, local boards of education may employ persons who hold a certificate from the state board of education to do health and development work; and the state board grants such certificates only to educators holding a California life diploma or to physicians holding a California certificate to practice, and only to such persons when additional evidence as to their particular fitness for this class of work is produced. In the city of Los Angeles, the Board of Education has employed ten such certified examiners—nine physicians and one educator. In addition they have also employed one dentist and nine nurses.

Our plan of work is as follows: Each physician has a given district and one of the nurses assigned to him. Preliminary notices are sent to the home notifying the parents of the date of the examination so that that they may be present if they so desire. When the parent is not present the nurse or a teacher is always present during the examination. Some parents desire their children excused from our examination on account of religious belief or preferring that their own physician do the examining; blanks are provided for these which they sign and file with the principal at any date prior to the examination. The examination itself is essentially the same as elsewhere; record cards are kept, and notices sent to the parents of any unusual condition that might require attention. It then becomes the nurse's duty to see how much of this attention is given and to record the same. A second notice may be sent out by the nurse or she may make a visit to the home, where she explains the condition to the parents and requests that the family practitioner be consulted and his decision be followed. Special attention is given the cases in families unable to pay the ordinary fees. If the parents are unable to employ a medical practitioner, purchase glasses, etc., and wish the work done or glasses supplied by our clinic, which is supported by the Board of Education and voluntary subscriptions and is under the control and management of the City Parent-Teachers' Association, then such parents must sign a request for such work and the principal must certify to their inability to pay the fees. The work at the clinic is carried out by paid dentists, volunteer physicians and the nurses of our department. The sum total of the work done by the family physicians and the clinic bring a large percentage of results, and the results are what we are working for.

The schools of Los Angeles are of the highest standard in the United States, and Superintendent J. H. Francis was one of the first to put into operation the intermediate schools. In these schools, as in the high schools, gymnastics are given especial attention; so in the intermediate and high schools the examiner, assisted by the gymnasium instructors takes many physical measurements and prescribes special forms of corrective work for selected cases. In addition, Los Angeles is one of the few cities having a clinical-psychologist. Professor George L. Leslie, who was to have read the paper this morning, holds this office. Thus it may be seen that we have ample provision for the examination into the physical and mental condition of the children, and means for associating the two; and for providing the proper amount of work for the supra-normal, the normal and the sub-normal child; and for improving the condition of the physically and mentally sub-normal child whenever possible.

STATE PROGRAM OF EDUCATION IN HYGIENE IN NEW JERSEY

BY

GEORGE A. MIRICK

In presenting this condensed statement of the State plan for education in hygiene, I wish to say that I am not speaking for myself but am representing the State Board of Education, whose chairman, Dr. William G. Schauffler, is a positive force in promoting hygiene education in the State, and the Commissioner of Education, Dr. C. N. Kendall, whose assistant it is my privilege to be. Two other members of the Board of Education have rendered signal service to the State in the field of school hygiene. To John P. Murray, Esq., is due the law for the school segregation of mental defectives, a law which in a practical, positive way is effecting the betterment of mental school conditions. To Mr. Melvin A. Rice is due the demonstration of the practicability of a free oral clinic for all children in a semi-rural school district.

The need of a plan of education in hygiene that would comprehend all the adult population of the State and not simply the school children has been made evident in several ways.

1st. The efforts of the State Board of Education and of the Commissioner to improve the sanitary conditions of school life met and are still meeting with popular indifference in many quarters.

2nd. The school medical inspection in the State as a whole is very unsatisfactory. In cities, like Newark, Jersey City and Camden, the Department of Medical Inspection is a model of efficiency. In some smaller places also, like Leonardo, fine dental care is given; and in Cranford the attendance supervision has been socialized, but it cannot as yet be said that the law requiring medical inspection in every school in the State has universal approval, or is generally effective in its working. The people are too generally uninformed and too many physicians accept the pay for school inspections without accepting the professional responsibilities that should go with it.

3rd. The Department of Public Instruction is now at work on a pamphlet on the Teaching of Hygiene for the elementary schools.

The plan covers the entire field of hygiene—personal and community; physical and mental; preservation of health and prevention of disease and disability—and involves not only the giving of information but the formation of habits of conduct, including social conduct, in the hope that life itself may be bettered.

Public opinion and conviction are factors that cannot be ignored in dealing with this subject in school, and at present, in many places where the hygiene need is greatest, public opinion and conviction are at variance with the teachings and practices that will be proposed for the schools.

4th. It appears also that there is a growing conviction that the time has come for the State Department of Education to assume responsibility for the systematic education of those not connected with schools, who cannot therefore be reached directly through the schools. The theory that the conduct of adults cannot be affected by education is not sound and should not blind us to our educational duty and opportunity.

What this view of the larger educational responsibility of the State Department of Education may in the future develop is not now evident but it seems to be clear that, to accomplish the desired purposes of education in hygiene in the schools, there must be a systematic dissemination of information regarding health matters and a systematic development of public conviction and approval of hygiene practices.

These are the reasons for the formulation of a plan of education in matters pertaining to health that shall reach not only the most remote school but also every community consciousness no matter how remotely located.

The question at once arises, "What agencies are available for carrying out any such State program of education?"

The following table will indicate these agencies. They are surprisingly numerous and powerful in their possible influence.

Tabulated Statement of the Agencies and Means Available in the State for Purposes of Education in Hygiene

*State Organization for the Control and Promotion of Public Education.

State Board of Education—Department of Public Instruction:

- Commissioner of Education
- Assistant Commissioners of Education
- State Inspector of School Buildings
- County Superintendents
- State Normal Schools
- State Summer Schools
- *Extension Normal School Courses

State School Agencies:

- State Home for Boys (delinquents) Under Special Board
- State Home for Girls (delinquents) Under Special Board
- State School for the Deaf (Under State Board of Education)
- State Industrial School for Colored Boys and Girls (Under State Board of Education)

NOTE—*These items are contemplated or are in process of making.

County School Agencies:

County Schools of Detention

Local School Agencies:

Boards of Education
City Superintendents
School Supervisors
Teachers
School Medical Inspectors and Nurses
Teachers of Mentally Defective Children

Agencies in the State Interested in the Promotion of Health:

State Board of Health
State Lecturer on Hygiene
State Lecturer on Tuberculosis
State Medical Society
State Sanitary Association
State Dental Association
State Board of Architects
Commissioner of Charities and Corrections
State Granges
New Jersey Congress of Mothers
Woman's Christian Temperance Union
New Jersey State Federation of Women's Clubs
New Jersey Sons of Temperance
Local Boards of Health
Local Playground Associations
Local Civic Organizations
State Agricultural Experiment Station
Princeton University—Department of Hygiene
State Hospitals for the Insane
State Sanatorium for Tuberculosis Diseases
State Home for Epileptics
Training School at Vineland (Feeble-Minded Children)
United Junior Order of American Mechanics
Patriotic Order Sons of America

State Agencies That Should Be Created to Direct Educational Effort in Hygiene:

*State Director of Medical Inspection and Educational Hygiene
*State Director of School Attendance

Means for Education in Hygiene in the Public Schools:

*State Courses of Study in Hygiene
*Special State Bulletins on Hygiene
Newspaper and Magazine Articles
*Traveling Educational Exhibits

NOTE—*These items are contemplated or are in process of making.

Before discussing the plans, still tentative, for utilizing these various agencies and means in a systematic way for general education in hygiene, it may not be out of place to refer briefly to three laws that have recently been put in force in the State:

I. Medical Inspection is required in every school in the State, and its regulation is in the control of the State Board of Education.

II. Children mentally unfit are by law required to be removed from the regular school and placed in classes of not more than fifteen pupils in charge of a teacher specially trained for work with these children. Under this law about 150 classes of this character have been formed, affecting from 1,500 to 2,000 children. The reports for last year are not yet compiled and these figures are conservatively estimated.

III. No school house can be built or repaired in the State except on approval of the State Department and in conformity with a State Building Code. Modifications in existing buildings must be made to bring them to the standard of this Code.

The State, it will thus be seen, has already adopted in its legislation a liberal and enlightened policy in regard to the physical and mental well-being of the school children. I have not the time here, nor is this the place, to discuss the health policy of the State in other fields.

The definite problems of the Department of Education are to make effective those laws relating to hygiene that are already in its hands to administer, and to recommend such other legislation as may appear necessary. Perhaps the most important phase of the general problem relates to the medical inspection of schools. "How shall it be made worth while in every school district in the State?"

I believe the suggestion of Dr. Joseph E. Raycroft, head of the Department of Hygiene, Princeton University, will lead in the right direction. He proposes that the various medical and hygiene State associations, the health departments of the two universities in the State, the State Board of Health and the Department of Public Education arrange a program of conferences with the school medical inspectors. For these conferences the State is to be divided into medical inspection districts. The conferences should result in the extension of better medical inspection practices, a more sensitive professional conscience in some of the inspectors, the general recognition of this as a legitimate specialized department of medical practice. These conferences may also have some value in forcing upon medical colleges the realization of the duty of giving some attention to this specialized form of medical practice which all now practically ignore, as revealed by correspondence with the leading medical schools of this country.

This problem of school medical inspection is peculiarly one for the medical and health organizations to work out. It may be said that the State Medical Society has a committee of ten working upon this problem.

The problems of personal, school and community hygiene, and the development of means for the special treatment of the physical defects of school children are problems that can be solved only by sound education in hygiene through the schools, an education that, both in its content and in its method, shall have the endorsement of the various branches of the medical and sanitary professions and also be supported and reinforced by an approving public sentiment.

To secure the support of the former it is proposed to submit to them the manuscript of the Course of Study in Hygiene for criticism and suggestions. They have shown themselves more than willing to coöperate in this.

To secure the approval of public sentiment it is proposed to follow the plan mentioned before, of dividing the State into districts, possibly using the same districts that are used for the medical inspection conferences. The various women's organizations and other civic associations will be affiliated with the Department of Education in some systematic way, so that through them in each district an enlightened, civic, hygienic conscience may be created. It is hoped by this plan to have in each school district a movement *from within* in support of desirable health practices.

It is evident that to carry out this State plan of education in hygiene there should be a "State Director of Medical Inspection and Education in Hygiene," whose duties would include the direction of the activities of the various civic forces referred to, as well as the direction of health education and training in the schools, and of medical inspection. Dr. Louis W. Rapeer, the well-known authority in this field, would name the one holding this position a "physician-physical-educator." It is agreed that such a position requires one who has had training and experience as a physician and as a teacher, who also is competent in the field of sanitation, physical training and mental hygiene. It is probable that the legislature will be asked to create this position.

There is also needed a better training opportunity for teachers. This the State should give free. In addition to the excellent work of the Normal Schools, and of the new State Summer Schools, extension courses should be offered during the year. It may be said that Rutgers College is seriously considering plans for such courses.

Moreover, the truant officer should be replaced by an attendance officer. Habitual unnecessary absence from school is a sign of social maladjustment. The difficulty is one in mental and social hygiene.

It should be so treated. It is being so treated in an increasing number of places, but there should be an immediate reorganization in New Jersey of the entire attendance business from the social viewpoint. There appears, however, to be no prospect that this reorganization will be made immediately.

In brief, the State Plan for Education in Hygiene consists in:

I. Increasing the efficiency of the education through the schools by the adoption of State Courses of Study and by the opening of additional opportunities for the training of teachers.

II. Increasing the efficiency of medical inspection by the appointment of a State Director of Medical Inspection and Education in Hygiene and by district conferences, in which medical and sanitary associations and boards of health will come together.

III. A union of all civic forces with the State Board of Health and the State Department of Education, for the promotion of intelligence and conviction in matters pertaining to health in every community in the State.

HYGIENIC CONDITIONS AMONG THE NATIVE SCHOOL CHILDREN OF ALASKA

BY

WILLIAM HAMILTON

Alaska is a continent. Its southern coast is washed by the mild waters of the North Pacific Ocean, ice-free the year round; its barren northern shores touch the eternally frozen Polar Sea; its eastern boundry faces the Dominion of Canada; its western-most extremity is within sight of Russia's remotest hinterland. Within its vast area there are continental varieties of climate and conditions. In July while the dwellers on the shores of the Arctic Ocean watch the whales spouting among the ice floes, in the gardens of Sitka the humming birds flit from flower to flower. During the summer the great rivers of Alaska are flowing highways for white men and natives, its forests are vocal with the song of birds, its plains are carpeted with flowers, and among its mountains is the sound of falling water. Throughout the long winter months Alaska, with the exception of its southern coast, is a mute land, locked in ice-bound silence. Those compelled to travel follow the snow-covered trails and frozen rivers.

In this unique land there are, approximately, 25,000 natives, belonging to 4 distinct races—the Eskimos on the shores of the Arctic Ocean and Bering Sea; the Aleuts on the Aleutian Islands, and on the adjacent peninsula the Athabascans in the valleys of the interior, and the Thlingets along the southern coast. The native villages, ranging from 30 or 40 up to 300 or 400 persons, are scattered, usually at long intervals, along thousands of miles of coast line and on the great rivers. Some of the villages on remote islands or on the frozen ocean are brought into touch with the outside world only once or twice a year when visited by the revenue cutter on its annual cruise, or by the supply vessel sent by the Bureau of Education.

In spite of the inherent difficulties of the problem, a United States Public School has been established in each of 76 villages; every school is a center from which proceed earnest efforts for the uplift of the native races, intellectually, morally, and physically.

The efforts of the Bureau of Education to safeguard the health of the Alaskan natives include (1) the maintenance of 4 small hospitals in important centers of native population, (2) contracts with 3 hospitals for the treatment of diseased natives, (3) the employment of traveling physicians who devote their entire time to the medical and sanitary work among the natives in their districts, (4) the employment of nurses who assist the physicians and do exceedingly valuable work for the children in the school rooms, and (5) the providing of medical supplies and textbooks to the teachers of the schools throughout Alaska to enable them to treat minor ailments, and intelligently to supervise hygienic measures. The entire medical and sanitary work of the Bureau of Education in Alaska is under the immediate supervision of an officer of the Public Health Service, on special detail. During the fiscal year ended June 30, 1913, the working force of the Bureau of Education in Alaska, including superintendents, physicians, nurses, and teachers, numbered 132, a force inadequate to accomplish the Augean task of cleaning up Alaska.

The Bureau of Education recognizes the vital importance of checking the diseases which prevail among the natives of Alaska to an alarming extent, and which are largely due to the unhygienic conditions prevailing in many of the native villages. Accordingly, without neglecting the scholastic work in the school rooms, special emphasis is given to medical and sanitary work in the villages and to hygienic work among the children.

In the native villages the teachers and nurses endeavor to establish proper sanitary conditions by inspecting the houses, by insisting upon the proper disposal of garbage, and by giving instruction in sanitary methods of living. Natives are encouraged to replace their filthy huts by neat, well-ventilated houses. Many of the school buildings contain bath tubs and facilities for the proper washing of clothing. In many schools sputum cups and individual drinking cups and towels are provided. The bathing and laundry facilities furnished are usually greatly appreciated. The teacher at Sitka thus describes this part of the work:

"On the first floor of our building we have a laundry which was used three days during the week, many women bringing their tubs and washboards to make use of the hot water. I consider this our best settlement wedge, for thus the mothers become co-workers with the children. I secured the services of an experienced laundress to give us instruction in starching and ironing the different kinds of garments. The class was popular, so much so that some of the white ladies suggested that they might come too. The baths have grown in popularity ever since their opening last year. The young men of my evening class were the first to try it frequently, but a few times we had a whole household come. Conservative, older women were slow to adopt the plan, but now we have a number who come regularly. It is now quite the fashion when guests arrive from another town to bring them to the school house for a bath. Thursdays are bathing days for the men, Friday for the women and small children, Saturday mornings for the school girls, Saturday afternoons for the school boys."

In some of the native villages the results of the efforts of the teachers and missionaries are evident in the orderly streets and well-built houses containing all the necessary articles of furniture, pictures, and books. The natives in places such as these are self-respecting, thrifty people, and their children are as clean as those in the average village in the States.

In other settlements not reached by civilizing influences the conditions are such as to appall the most enthusiastic social worker. The houses are wretched hovels constructed of driftwood, crowded together on an ill-smelling beach covered with garbage of all kinds, including discarded articles of clothing, old tin cans, and putrefying offal polluting the air with its horrible odors. In such a village the houses contain but a single room, very dirty and without ventilation, into which men, women, and children are herded, a stove and a bed being the only articles of furniture. The bed is usually used as a "catch-all" for a great assortment of articles, the natives preferring to sit, eat, and sleep on the floor.

The establishing of a United States Public School in such a village and the advent of a teacher mark the inauguration of a crusade against filth and conditions which foster disease. The methods used in order to establish hygienic conditions among the school children coming from homes such as those just described can best be told in the words of one of the enthusiastic workers:

"The clinic work of the school usually commenced with a talk on parasites and the necessity for cleanliness, and this was followed by an inspection of the entire class. Two and sometimes three of the older pupils were selected as assistants. The boys were taken to the clinic room, and after I had clipped each boy's hair my assistants gave him a shampoo with antiseptic soap, dressed his hair with a fine comb and anointed it with coal oil. Talks upon hygiene were given each day and the worst cases used as illustrations. After the talk, my assistants examined the heads of all the children and when necessary gave the above-described treatment. The assistants soon learned to do their work quickly and well and seemed much interested in it.

"My principal rules were: Keep clean. Wash your face. Wash your hands. Wash your neck. Wash your ears. Wash your teeth every day. Bathe your whole body with soap and warm water at least once a week. After these rules were well understood any child who came to school with a dirty face was brought before the class for consideration. The usual verdict was 'Scrub 'em good with soap and warm water.' After the assistants were through with him, the subject was usually a shining example of cleanliness. It was most encouraging to see the results of a little teaching, for after four or five weeks it was a rare occurrence to have a child come to school with dirty hands or face. They soon developed pride in their personal appearance and would strive to have their few torn clothes at least clean.

"The crusade was extended to the homes, and the father or older brother sometimes brought to the schoolhouse and clipped. With the mothers it was a different proposition, for they would not allow anyone to look at their hair, but kept it well covered with a cap or handkerchief, saying that they would comb their own hair.

"It takes time to change their old customs for new ones, and I cannot say that the root of this evil has been destroyed, but much has been accomplished, for the school children have learned that it is indecent to be filthy."

Especially do the native mothers require instruction in the care of infants. The teacher of the school at Wainwright, among the Eskimos dwelling beside the frozen ocean, far beyond Bering Strait, thus tells how he made one baby an object lesson to the entire village:

"A baby suffering from some form of skin disease proved a useful object lesson. The baby came from a dirty home of the old type, and its mother was of the old regime that knew not the virtues of soap and water. It is difficult to imagine a more distressing object than that baby was when its mother brought it to me for treatment. Its arms, legs, and body were covered with immense scabs, and when the mother removed its little fur bonnet, its head was seen to be in a similar condition. It was given a thorough bath in warm water and hydrogen peroxide. The mother thought the hydrogen peroxide was 'plenty strong medicine' when she saw the white fuzz spout up wherever it touched the child's body. We impressed very strongly upon the mother that the filthy rags that clothed the baby must not be put on again. As the mother could not provide suitable clothing, my wife made some underclothes and a bonnet, while the baby's older sister made the dress for it in the sewing period in the school. This baby was inspected thoroughly and washed every day, and we saw to it that the clothes were kept clean. After repeated applications of hydrogen peroxide, blue ointment, and soap and water, the baby became well. Whereas formerly she had been a sickly, crying baby, to-day the child is well, strong, and happy, and, above all, clean. That the mother was sufficiently impressed with the importance of cleanliness was shown in the fact that her only subsequent request was for soap to keep the baby and its clothes clean, so it would be 'no sick.' This case made quite a stir in the village, and mothers kept the babies much cleaner than they had done before.

The children would come to me with cuts and ask for the 'clean medicine.'"

It is by radical, effective measures such as those described that the self-denying force of workers in the native villages throughout Alaska is striving to build up a healthy race of young Alaskans.

Tuberculosis, syphilis, and diseases of the eye are rife among the natives of Alaska. According to the investigations of the Public Health Service, 15 per cent. of the native population is infected with tuberculosis. If the native races of Alaska are to survive, the children must be saved.

RURAL SCHOOL HYGIENE IN MICHIGAN

BY

BURTON S. TEFFT

It is said that in one of the campaigns of the Revolutionary war an important victory for the Americans was gained by a clever strategem on the part of the general in command. A half-witted Tory boy who had been taken prisoner was promised his freedom, if he would go into the enemy's camp and declare that a very large body of American soldiers was close at hand. He did this and more, for he cut holes in his clothes to represent bullet holes and pointed upward to the leaves on the trees, when asked the number of men. The British fled in confusion. I am not here as the main body of the American Rural Schools with its 17,000,000 soldiers, but to point upward to the leaves on the trees.

I am not a pessimist, but, on the contrary, I have the profoundest faith in mankind and their desire to do the best and to provide the best for those depending upon them. These depend upon knowledge, judgment and ability. I shall give my experiences and observations only. My interest and my effort are for the rural schools. I was born and raised in a rural community, all of my preliminary education was acquired in a one-room country school; I taught in this kind of schools and in village schools, and my work as commissioner and superintendent has been among this class of schools only. I have had every opportunity to become familiar with rural school conditions and needs, and if I do not know them it is very largely my own fault. I shall give some specific cases that have come under my observation as types of conditions to be found in not a few communities in my own county and state, as well as in other counties and states. These are bona fide cases, not imaginary ones.

My home is in a city having schools that rank second to none in the state; and I say this with pride, not with boasting. In one portion of the city is a splendid Manual Training School, equipped for the best service and highest efficiency. The teachers in this school, as well as the teachers in the high school and grade schools, are the best a splendidly trained superintendent can procure. Nearly all the school buildings are modern and constructed on the most recent scientific plans. Heating, lighting, ventilating, interior decoration, blackboards, etc., are well nigh perfect. Many rooms have adjustable single seats and desks. Windows are provided with proper shades. There are drinking fountains or individual drinking cups and filtration plants to insure pure drinking water. Warm breakfasts and noon lunches in some parts of the city for needy pupils. Well kept and closely observed toilet rooms and lavatories. Sanitary towels or well laundered ones, etc., etc., through the long list of needed and convenient apparatus and appendages, besides school gardens and recreation grounds, splendidly supervised.

Another portion of the city has in course of construction and nearly completed a magnificent Trade School and has all the other accessories just named, excepting the recreation grounds with their supervised games. But roomy, well kept parks containing swings, slides, teeters, etc., are available to the children of that district. In fact, almost everything that the human mind can conceive, and the human hand can make and money can buy is placed at the command of the proper school authorities to be used in the education of the children of these districts.

I contend the greatest problem which the American people have to solve in the school system of our country is not the city school problem, but the question of the rural and small village school, the question of properly educating the rural child, academically, vocationally, socially and religiously. The fact that many children of rural communities achieve success in the world is not because of the little "red school," but in spite of it; and by the training in industry, economy and responsibility which their environment gave to them.

In one rural school in which I taught there were four brothers attending. Their ages at that time were six, eight, ten and twelve years respectively, or thereabout. They brought their dinners, or lunches, in one basket. But the older brothers made complaint that the younger ones ate all the food before the noon hour and left them with nothing to eat, when the proper time came for eating. I sent word to the mother, a stepmother, to put the boys' dinners into separate baskets, thinking it would prevent them from eating one another's lunches and getting into trouble over their noon meal. The mother did as I suggested, but the complaints did not cease coming in from the larger brothers and from other pupils, too. I investigated further and I found that each boy had in his pail for his dinner; dinner for a hungry, growing, poorly clothed boy, one single biscuit, a cross between poor bread and hardtack. This was divided into two pieces and had some meat grease or some meat between the pieces, and that was all they did have. Do you wonder that other pupils missed food from their lunch baskets?

A teacher made this report to me: She had a pupil, a boy ten or twelve years of age, who went home from school at noon for his dinners. On several occasions he failed to appear in the afternoon sessions of the school. The teacher told him he must not stay out of school in that way or she would be compelled to refuse him the privilege of going home at noon. He promised to do better, but almost the very next day he was absent from school in the afternoon. The following morning he appeared with no dinner and was allowed to go home only after he had agreed to come back as soon as he had eaten his dinner. The afternoon came, but no boy appeared according to the terms of the agreement. Can you imagine the thoughts that invaded the mind of that teacher at this stage of the game? The next morning the boy was at school again as usual, and you may be assured that the teacher met him when he came in, too. She reminded him of his promise and demanded of him the reason he had for not living up to his part of the agreement, and the demand had some force behind it I want to say to you. The answer came; for the boy, half ashamed, half frightened and half sobbing confessed, "I didn't have no dinner, teacher, and so I couldn't come," and the worst part of the answer was he told the truth.

I have had several cases in schools where I taught, and several cases reported to me by my teachers, of pupils coming to school actually filthy, and repulsive from this cause. Cases of children having comparatively good clothing and shoes on entering school in the fall, but who apparently did not change clothes till they were completely worn out and unwearable, and who showed no evidence of any kind of having had a bath from summer to summer. I recall the story of two boys who went on an outing to a lake, given by the philanthropic people of the city to children unable to take an outing by any other means. The boys hurried down to the lake and made preparation to take a plunge at once. When they began to divest themselves of their scanty clothing, one of the boys eyed his companion quite closely and exclaimed, "Gee, Jim, but you are awful dirty." His chum replied, "Yes, I know, but you see, last year I missed the train."

I visited one of the schools of my county several years ago and found this condition: On observing the personal appearance of pupils I noticed that nearly every pupil, if not every one, was sitting with eyes somewhat closed and squinting. I noticed, also that many seemed to have some trouble with their eyes. They were wiping them frequently and their eyes looked inflamed and bad. I went into the rear of the room and sat down, wondering what could cause such a generally bad condition of the pupils' eyes. I think the causes were evident; for the pupils sat facing two large, unshaded windows and were compelled to look in that direction most of the day during school hours. The blackboards were fully three feet from the floor and had a poor but reflecting surface. The windows where on the right-hand side and in the front of the room. The walls had been a shade of pink, but were very dark at that time. The teacher's desk was on a platform by the two front windows, which compelled the children to look upward when in the class as well as to look directly into the light. I believe it was the worst condition I have ever met in school room lighting. The heating and ventilating were about the same. I asked the Board to change the seating in order to change the light effect, and they did as I suggested. There is but little eye trouble to be found in the school now. There were other factors that contributed to the bad eye condition, no doubt, but I am certain the elements I have just named did a large part in making this condition.

I found in another school room that had been recently redecorated by order of the district voters and board that the colors used were cream color and bright red. The body of the walls and ceiling was tinted with the cream color and the trimming was of the red. I felt as though a thousand spears had been thrust into my eyes, when I first entered the room. The contrast was too sharp. Of course one would get accustomed to the colors, after being in the room for a time. But the point I wish to make is the utter disregard of harmony and appropriateness in colors, when the matter of decorating the interior of a school room is being considered. This is a prime factor in school room conditions, I am sure.

We still have in my county school buildings with windows on four sides, or three sides, instead of on but one side or two at the most; and having no provision for any kind of ventilation except doors and windows. School rooms that receive a thorough cleaning but once in a year, and some that "miss the train" occasionally. Not all are like these, for we have some buildings which are the reverse, being modern buildings and well kept and furnished. Practically up-to-date school buildings in every respect. But these extreme cases are the ones first to attest our attention. The pupils in the unfavorable districts are entitled to as good school opportunities as any other children, if they are to become a part of the state and nation and intelligently perform their duty to them. It was the needs of the poor and oppressed in Europe that contributed largely to the settlements in America and the founding of a free government. It was the needs of the poor and unfortunate in America that developed our free school system, and I contend we must administer still further to the needs of our less fortunate children, our rural pupils and pupils of the small villages.

The curse of many schools is found in their outbuildings. Absolutely unfit for use and so situated they are an actual menace to morals and to health. Another source of danger is the disregard of the danger of disease and the means of dissemination of diseases. The following case was reported to me by an observing teacher: A boy "came down" with measles in her school and was sent home. He was taken care of according to instructions of the family physician and his woolen jacket removed and hung away until he might need it again. When school began in the fall, the boy entered for work and wearing the same jacket he had worn at the time he was taken ill with measles. Have you any doubt that any cases of measles appeared in that school again? Well, they surely did, and within two weeks from the time the jacket entered school in the fall. That teacher told me she had every reason to believe the source of the new outbreak was traceable to the infected jacket, for it never had been disinfected. I have had numerous cases of parents who refused to keep children out of school when they were ill with a communicable disease, because they did not think it necessary to protect the health of other pupils. "Children will get the diseases whether they are exposed or not," they said.

The most perplexing duty which the truant officer of my county is called upon to perform is that of compelling pupils to attend school, when they have poor shoes and poor clothing—and this duty comes often. It is a mighty embarrassing situation for a child to attend school, when his shoes are in shreds and his clothes are in rags. It is no less embarrassing for the truant officer when confronted by this situation, and told by the parents of the child that they will gladly send, if their children can be provided with suitable shoes or clothing or both; if he has no means at his command to provide these needs, but must enforce the compulsory education law instead.

The district board of education may furnish the child with food and clothing, if needed, but are not compelled to do so; which means the district board does not do it.

Another condition with which the county commissioner and truant officer have to contend is that of compelling attendance at all times of the year. I called at a school one morning in the spring of the year. On my way to the school I overtook and passed children going to school. The snow had melted and gone, leaving lakes and rivers of water and mud. Here and there were island, cape, isthmus and peninsula, and upon these latter the children were endeavoring to find a route to school. It was a good lesson in geography, but a mighty poor one in hygiene. I reached the landing ahead of them and watched them come in. Many of them had wet feet, in fact, nearly all of them had, and some of them were wet to the knees. In that condition those pupils sat in their seats all of that day; for there was no effort made to dry them, save the act of standing by the stove a few minutes before school "called." I inquired of the teacher what she did in such cases. She told me there was nothing she could do, for they came to school in that condition almost every morning during the wet weather. There were girls ten, eleven, twelve years of age and older; besides younger ones and boys of every school age, walking as far as two miles to school. This is not true everywhere nor of all children, but because these conditions do exist in some places is why I mention this one incident.

There are other conditions to be found in my county equally as unhygienic and equally as unnecessary, but I do not wish to make this paper over gloomy or morose. I should like as much to speak of the favorably hygienic conditions, of school room conditions which approach perfection in many respects. School houses which have basement playrooms, furnaces, warm and well ventilated rooms for wraps and lunches; correctly lighted and decorated study rooms with proper shades, usable blackboards, clean ventilation, etc., for we have them. But I will forbear speaking on this side of the question.

I wish to give some suggestions of remedies that may alleviate very largely, if not remove entirely, the unsanitary, unhygienic and undesirable conditions I have just recited. Michigan has a law, passed in 1911, which gives to district boards of education the right to supply needy pupils with necessary clothing and food in order to enable them to attend school as required by the compulsory education law. But this law does not compel these boards to give aid, only confers upon them the power to do so and leaves them free to take negative action in every case. I do not say that this is unwise, for in many cases aid is most needed where it is least available. I am sure that aid should be given and that a larger taxing unit should be called upon to give support to this class of indigent persons, say the county or state, and the law should be mandatory.

You will pardon me, I trust, for referring to my home city once more, but it is for the purpose of illustration and suggestion. The truant officer of one district of the city conceived a plan of giving relief to needy children, when out of school because of lack of clothing or shoes, or both. He has what he terms a "shoe fund" upon which he can draw in needy cases. This fund is made up by contributions from individuals and from fraternal bodies, cash and interest bearing securities, the latter serving as an endowment. When he finds a case of need and out of school, he immediately provides the necessary things, giving an order on his "shoe fund," and gets the child into school at once. The amount of money expended annually is not large, so the officer tells me, but the benefit is immeasurable.

There are buildings being constructed every year which have many of the defects known to architects and to sanitary engineers; defects which contribute to physical ailments and intellectual retardation of the pupils who will be compelled to occupy them. I firmly believe no building should be erected in my state, or in any state, unless the plan of the proposed structure shall have been approved by a board of competent engineers, to insure proper sanitary features as well as physical safety and hygienic properties. There should be a standard of floor space, air space, lighting area and relative position, ventilation, color scheme, seating, and many other factors which make up a perfect setting. I took a survey of seventy school rooms in my county during the past year to learn more specifically of the constituents just named and was astonished at the great variety to be found. Floor space per pupil, varying from 10 square feet to fifty-three square feet; air space, 136 cubic feet to 731 cubic feet; lighting area, 11% to 34% of the floor area, and coming from all directions. Defects of vision, teeth, breathing and vitality and mentality were everywhere found and reported. The picture was a revelation to me. There is absolutely no uniformity in the plans of rural school buildings, except the old style of school building. They should be uniform and meet the standard. For the privilege of requiring this to be done the state should pay a portion of the cost of construction, say ten per cent. or twenty-five per cent., or more. This plan would insure greater uniformity in school buildings, a higher standard and modern construction. It would not occasion so much opposition from school boards and voters of local communities, who might otherwise feel that their rights were being invaded by higher authority.

There is in my state a law, enacted in 1911, which gives to the truant officer the right, and makes it a part of his official duty, to inspect the outhouses of the schools of the county, and to require the district board to put them in order when found out of fit condition for use. He determines their fitness, also. Upon the failure of the board of education to perform this office when so directed, the truant officer shall cause it to be done and at the expense of the district. There have been but few cases in Saginaw County where the truant officer has been called upon to exercise the last named power and actually hire this work done. I fully believe there is an improvement of fifty per cent. in the actual condition of these buildings since the law went into operation.

Most cities now have free, or nearly free, medical inspection in schools. Defects of vision, of teeth, of hearing and other physical defects are carefully looked after and every precaution taken to preserve and conserve the child. The rural school pupil needs these services and should receive them.

In fact I believe the state should have more authority over the child, should contribute more to his welfare and development, should exercise a greater vigilance over him, and should give him more complete protection from his enemies; whether they be parent, teacher, school board, employer, neighbor or associate. Will not a greater service to the child warrant the demand from the state of greater efficiency from him as a citizen? If we give him five talents, may we not expect ten in return?

In this age of our Republic, when every man and every woman may exercise the powers of a sovereign, can we fit them too well for this duty? My answer is no, if we incorporate into his training some of the philosophy of the Son of God. Teach him to be clean in body and mind; to respect the rights of others, and to earn honestly those things which he desires to possess.

When we have done all of these for him, may it not be possible, as he stands upon the threshold of life, young, hopeful, expectant, virile and zealous to achieve success, to say of his native state, cheerfully, honestly, gratefully, "I was naked and they clothed me; I was hungry and they gave me bread; I was thirsty and they gave me to drink of the waters of life." "And now, by virtue of these services, I am rich in possibilities; I have found that for which men in all ages have diligently sought; I am in possession of the Holy Grail."

LÉGISLATION SCOLAIRE FRANÇAISE

Dispositions légales et réglementaires relatives aux mesures à prendre dans les écoles en cas d'épidémie

PAR

FELIX MARTEL

(1) Quand une épidémie se déclare dans un établissement d'instruction, c'est le maire de la commune et le préfet du département qui ont qualité pour prendre les mesures nécessaires dans l'intérêt de la salubrité publique et de la santé des élèves.

(2) *Pouvoirs et attributions du maire.* C'est tout d'abord au maire qu'il appartient d'agir. La loi municipale du 5 avril 1884 lui confie "le soin de prévenir par des précautions convenables et celui de faire cesser les fléaux calamiteux, tels que les maladies épidémiques ou contagieuses, en provoquant, s'il y a lieu, l'intervention de l'administration supérieure."

Aux termes de la loi du 15 février 1902 sur la santé publique, il est tenu "de déterminer, après avis du conseil municipal et sous forme d'arrêtés municipaux portant réglement sanitaire...... les précautions destinées à assurer la salubrité des maisons, de leurs dépendances et des autres agglomérations, quelle qu'en soit la nature." Enfin lé maire tient, de la loi organique de l'enseignement primaire (loi du 30 octobre 1886, art. 9), le droit d'inspection dans les écoles, et cette inspection (Décret organique du 18 janvier 1887, art. 140), porte particulièrement sur l'hygiène. C'est en vertu de ce droit qu'il peut, en cas d'épidémie, prescrire, tant dans les écoles publiques que dans les écoles privées, les mesures reconnues nécessaires.

(3) *Pouvoirs et attributions du Préfet.* Il pourrait arriver que, par négligence ou pour toute autre cause, le maire d'une commune, une épidémie s'étant déclarée, n'usât point de ses pouvoirs et ne remplît pas son devoir. C'est alors au Préfet, représentant de l'administration supérieure, qu'il appartient d'intervenir. On lit dans la loi municipale, à l'article 99, que "les pouvoirs qui appartiennent au maire ne font pas obstacle au droit du Préfet de prendre, pour toutes les communes du département ou pour plusieurs d'entre elles, et dans tous les cas où il n'y aurait pas été pourvu par les autorités municipales toutes mesures relatives au maintien de la salubrité publique. Ce droit ne pourra être exercé par le Préfet à l'égard d'une seule commune qu'après une mise en demeure au maire restée sans résultats."

Le Préfet, informé de l'épidémie, doit dans telle ou telle commune déterminée, demander l'avis du maire, puis saisir, dans le plus bref délai, le conseil d'hygiène qui existe dans chaque département; puis il applique sans retard, pour les écoles privées comme pour les écoles publiques, les mesures sanitaires que ce conseil a proposées.

(4) Qu'arriverait-il, si un directeur d'école privée se refusait à se conformer aux prescriptions de l'autorité compétente? Le chef du service de l'Instruction publique dans le département, c'est-à-dire l'Inspecteur d'Académie, aurait alors le devoir de rappeler à cet instituteur quelles sont les dispositions de la loi (loi du 30 octobre 1886, art. 41), et de lui faire observer qu'après constatation de l'infraction aux réglements par lui commise, il s'expose, pour faute grave dans l'exercice de ses fonctions, à être déféré au conseil départemental qui prononcerait suivant la gravité de la faute, les peines ou de la censure ou de l'interdiction (id., art. 41).

(5) *Fermeture des écoles et licenciement des élèves.* L'autorité compétente pour prononcer la fermeture d'un établissement d'instruction, en cas d'épidémie, est l'autorité municipale ou l'autorité préfectorale, suivant la distinction ci-après. S'agit-il des écoles privées, c'est-à-dire fondées et entretenues par des particuliers ou des associations, le maire a le droit de faire fermer l'école contaminée, s'il le juge indispensable (circulaire ministérielle du 13 mars 1893). Pour les écoles publiques, c'est-à-dire fondées et entretenues par l'état, les départements ou les communes (loi du 30 octobre 1886, art. 2), le maire a pour devoir d'aviser le Préfet et il lui proposera, s'il croit devoir le faire, de fermer l'établissement où l'épidémie s'est déclarée. Le Préfet, sur la proposition de l'Inspecteur d'Académie, après avis du maire et du comité départemental d'hygiène, prononce, s'il y a lieu, la fermeture temporaire.

(6) Il importe de remarquer que la fermeture d'une école, en cas d'épidémie, est une mesure toute facultative. Il est même recommandé aux autorités compétentes de n'en user qu'avec une certaine prudence, car elle peut offrir plus d'inconvénients que d'avantages. Le Comité consultatif d'Hygiène publique de France s'est nettement prononcé sur le danger que le licenciement de l'école peut présenter dans certains cas. On lit à ce propos dans la circulaire précitée du 13 mars 1893: "En l'absence des parents retenus à leur travail, les enfants sont confiés aux soins et à la surveillance d'une voisine, laquelle sera souvent la mère d'un enfant malade, que cette circonstance seule oblige à garder le logis. Le licenciement de l'école peut donc favoriser la contagion, au lieu d'y remédier. Aussi serait-il preférable alors de recourir à la désinfection du local, toutes les fois que cette opération sera jugée possible."

(7) Ces indications générales sont complétées par les dispositions d'un règlement modèle, en date du 18 août 1893, "relatif aux prescriptions hygiéniques à prendre dans les écoles primaires pour prévenir et combattre les épidémies." Ces prescriptions pour les écoles publiques sont fixées dans tous les départements par arrêtés du Préfet. Aux termes des articles 7 et 74 de ce règlement, le licenciement ne doit avoir lieu que dans les deux cas ci-après: (*a*) en cas de scarlatine, si plusieurs cas se produisent en quelques jours malgré toutes les précautions prises; (*b*) en cas de rougeole: le licenciement n'est alors prescrit que pour les enfants au dessous de six ans, et même alors on devra auparavant recourir aux évictions successives des élèves atteints par la maladie et employer les moyens de désinfection.

(8) Dans le cas où le licenciement est reconnu nécessaire, il est envoyé à chaque famille, au moment du licenciement, un exemplaire d'une instruction officielle relative à la maladie épidémique qui l'aura nécessité (Règlement modèle précité, art. 13).

(9) Lorsqu'une école recevant des élèves pensionnaires doit être fermée, notamment en cas d'épidémie, le Préfet, l'Inspecteur d'Académie, et le Procureur de la République doivent se concerter pour que les parents ou tuteurs des élèves soient avertis sans retard et pour que les élèves pensionnaires, dont les parents ne résident pas dans la localité, soient provisoirement recueillis dans une maison convenable, jusqu'à ce qu'il ait été possible de les rendre à leurs familles.

(10) Les prescriptions règlementaires édictées pour les écoles publiques sont également applicables aux écoles privées, et il ne saurait en être autrement sans que la santé publique soit sérieusement menacée. Comme le remarque le Ministre, dans la circulaire du 13 mars 1893, "l'expérience," en effet, "a demontré que trop souvent l'école privée recueillait les enfants renvoyés momentanément de l'école publique licenciée et que, par suite, le danger que courait la santé publique avait été simplement déplacé."

PARENTS' PART IN SCHOOL HYGIENE

BY

W. H. Heck

For several years the author of this paper has been making an effort in the State of Virginia to increase the interest of school officials, teachers, and parents in the school child's health. During the session 1912-'13 the movement was systematized into a State School Hygiene Campaign, which will be continued through the session 1913-'14. The campaign included inspection of schools, health conferences with parents and teachers, round-table discussions at teachers' institutes, hygiene talks to older pupils, and lectures at the State Normal Schools. This experience is the basis of the following suggestions, a brief discussion of which will not give time for description of similar work that is being done elsewhere.

The main purpose of this campaign fuses into the larger purpose of bringing the home directly into relation with school problems. The natural evolution of the school out of the home has resulted in an evolution out of relation to the home, both school and home suffering greatly thereby in not understanding, learning from and coöperating with each other. The school needs, far more than teachers realize, such a view of the individual results of school management and methods as the home, sometimes even an uneducated home, can give. On the other hand, the home needs, far more than parents realize, such an interpretation of child development as the school, sometimes even an uneducated school, can give. The deficiencies of home and school cannot be overcome by mutual isolation, criticism, or defensiveness but by considerate consultation, where each can help the other. Such a give-and-take consultation is seldom seen. The usual school reports, notices, and functions may inform parents but are too one-sided and formal. Most patrons' meetings include entirely too few of those that ought to be concerned and consulted, and they are not really conferences where parents and teachers can frequently question each other and give suggestions.

In the health conferences of parents and teachers in Virginia, the leader would begin the discussion of each subject and then ask for opinions, questions, etc., from both the home and the school, emphasizing the value of "getting together and talking things out." The attendance and the response varied with the community leadership of the school and the intelligent interest in education. The local newspapers gave accounts of the conferences and this increased the demand for further discussions.

School hygiene is decidedly the most serviceable phase of education for consultation between home and school. It is of basic importance; almost all parents can be interested in some of it; all teachers should be forced to study it; it can never be considered properly out of its relation to home hygiene; its principles can be concretely explained, pro and con, by reference to the equipment and management of the homes and the school concerned; its practical application can be put within reach of ordinary intelligence and finances; and, above all, *the home has a legal and moral right to know under what hygienic advantages and disadvantages its children are being schooled by the state and local government.* Coöperation is here not only an opportunity but also a necessity, because a child cannot be made healthy by life and instruction during a few hours at school if the many hours at home do not coöperate, or vice versa. The unhygienic influence of either one may obstruct the hygienic influence of the other. You cannot create health in fractions of a day. Furthermore, the school can never get an all-round view of a child's health without the more inclusive view of the home.

The following are some of the subjects in which coöperation is now being sought in Virginia, those for a single conference being chosen to meet local interest and need.

Parents and teachers must be taught the meaning of vitality. A great many of them consider health simply the absence of illness; therefore, as long as the child is not ill, they classify it as well and then let the matter drop. Until this laissez-faire notion of health is eradicated, most of the aims of the school hygienist will be regarded as doctrinaire and secondary. Without, and even with, medical inspection for diseases and defects, interest is difficult to awaken in regard to the less evident but very important phases of school hygiene, such as the proper use of window shades, the minus distance between seats and desks, the prevention of the common cold, the postures of children, the care of the teeth, the open-air sleeping rooms, and a score of other problems. "If the child is not made ill by present conditions, why worry?" This attitude is the worst foe of school hygiene.

Vitality must be preached as the aim of growth, the basis of happiness, the secret of success. School hygiene works for the buoyant, complete child, for physical force expressing itself in mental and moral force, for physical power trained to efficiency. Diseases are treated and defects corrected as obstructions to vitality; school equipment and management are reorganized so as to avoid limitations to vitality. But these considerations are negative and preliminary, and hygiene is more positive than negative. The main emphasis should be upon hygienic activity as the means of developing vital efficiency. If parents can be made hungry for their children's vitality, the battle of school hygiene is half won, only the proper information being needed to effect the desired changes. Without this hunger the information will be little heeded.

Illustrations can be given by a summary of typical stages of growth in childhood and youth, showing that the child organism is not an adult in miniature, simply enlarging year by year, but a different organism with varying rates of growth in different organs. Emphasis should be put upon the disharmonies due to these variations. The danger of not meeting the vital demands of the growing organism at any stage, through unhygienic action or environment, arises from the probability of limiting for life the vitality of those organs growing most at that time. This danger is greater during the prepubertal increase in height and weight and the pubertal development of primary and secondary sex characters, when the coöperation of home and school ought to be very close in protecting boys and especially girls from overstrain. At every stage school demands are secondary to growth demands, and any strain is harmful if it limits the nutrition, physical activity, and rest required for growth.

The value of medical inspection is an attractive subject for meeting of parents and teachers. If such inspection does not exist in a school or exists only in part, the need for it can be well discussed in relation to many problems of home and school. If such inspection does exist the opportunities thus offered can be emphasized in such a way as to make their good results far more extensive. For instance, a brief account of the injury caused by adenoids or eye strain will often open the eyes of parents and teachers to the serious significance of defects which they have been disregarding. The best influence, however, that medical inspection can make upon the home is by inviting, even requiring, as in some German cities, the attendance of one parent or guardian at the inspection of every child. The meaning of each phase of the inspection can then be explained, the parent can give the child's past history in so far as it bears upon the inspection, and the advice concerning each defect noted can be discussed immediately. This education of the parent will take time and money, but it will well pay the school and the community. The usual notices to parents regarding the results of medical inspection are too brief for proper explanation, and the very valuable visits of trained nurses can include only a small portion of the homes represented by the school and can ordinarily deal with only a small part of the inspection. It is becoming more and more evident that the home must be brought into closer and more inclusive knowledge of the aims, methods, and results of medical inspection.

Parents should be informed of the hygienic condition and care of the building and equipment used by their children. They cannot be expected to learn standards from printed discussions or lectures on general principles; they must be shown the actual school plant and have principles interpreted in relation thereto. Their questions should be frankly answered and their reports as to the effect of the school upon their children should be carefully considered, although most buildings, even new ones, will not meet all standard requirements, and school officials may be sensitive about criticism. Principals and teachers are not really equipped for their positions unless they understand and can explain to parents the hygienic merits and demerits of their school plant and the daily use of it.

The same right of parents must be recognized in regard to the hygiene of school management and methods. Unfortunately, there are few principles to guide us here, as these matters are closely connected with the elusive problems of fatigue and interest. In most schools tradition regulates the length of the school day, the amount and use of recess periods, the requirements for home-study, the number of recitations per day, the nature of examinations, the forms of discipline, etc. Nevertheless, an intelligent conference between parents and teachers is the best way at present to improve conditions.

The prevalent practice of keeping-in at recess has nothing to justify it. If the recess has any significance, that significance is its effect upon health; therefore, to keep a child in at recess is to punish him at the expense of his health. A few such punishments may not injure one individual, but a school that practices such a form of discipline is to that extent an inconsiderate and unhealthy school. Furthermore, the windows of most classrooms ought to be opened at recess so that the rooms can be flushed with pure air; and, if the children are kept or even allowed in the rooms, this needed flushing cannot be thoroughly done. Thus the punishment of one individual may not only injure his health but also that of the entire class.

Home-study is first and foremost a home problem. It is surprising that parents have so long submitted to this intrusion of school requirements into home management without claiming the right to be consulted. Of all conference subjects I have found home-study the most interesting to parents and teachers. This fall a detailed plan for coöperative study of this problem will be worked out in several communities.

Parents can easily be interested in school instruction and training in hygiene. The formation of health habits, rightly the chief aim of hygiene instruction, can only be successful when both school and home insist together on the desired habits. It is strange that schools have blundered along without seeking the coöperation of those responsible for the health conditions of most of the pupils' time and environment. The home is the most important teacher of hygiene, for good or ill; and the school that fails to learn from and give advice to this teacher as a co-partner is failing through its own indifference or foolishness.

This subject naturally includes that of sex instruction. The public schools certainly ought to undertake this responsibility, if the home cannot be made to do so. The many difficulties involved in mass instruction, selection of teachers, gradation of subject-matter, combination of scientific fact with proper emotion, etc. will have to be solved by extended trials, cost what they may. But have the parents refused to bear this responsibility? It is one thing to say that the home is not now doing its duty; it is a far different thing to say that the home cannot or will not do its duty. Wait until the parents have been shown by educational and medical experts, as is now being done in a few places through the schools, just what that duty is, the serious results of neglecting it, and the proper methods of fulfilling it. Parents will welcome and make good use of such instruction, mock modesty here being a sign of pruriency. If, however, they show no inclination or success in meeting this problem, then the school must grapple with it. But let the school work through the parents first, especially in regard to elementary children, assisting the home, if necessary, in some of the instruction of high-school students.

Other subjects for discussion at these conferences have been the length of the school day by grades, the midday meal of school children, the afternoon play and social life, the systematic regulation of the time and environment of sleep, etc. The subjects briefly outlined in this paper and the methods of treatment given in these conferences may not be just those most suitable for other states and educational needs. They are mentioned here to emphasize the ideal of bringing school and home together in consultation regarding the health problems in education.

SESSION SIX

Room F. **Tuesday, August 26th, 9:00 A.M.**

STATUS OF SCHOOL HYGIENE AND METHODS OF INSTRUCTION IN CITY, VILLAGE AND COUNTRY SCHOOLS (Part Two)

SAMUEL G. DIXON, M.D., LL.D., *Chairman*

DR. FRANCIS E. FRONCZAK, Buffalo, N. Y., *Vice-Chairman*

Program of Session Six

ALLEN W. FREEMAN, M.D., Assistant Commissioner and Director of Rural Sanitation, Richmond, Va. "A Study of Sanitary Conditions in the Rural Schools of Virginia." (Manuscript not supplied).

GEORGE STARR LASHER, A.B., Department of Public Instruction, Lansing, Mich. "Safe-Guarding Rural Children."

WALTER E. LARSON, State Rural School Inspector, Madison, Wis. "Improvements in the Sanitary Conditions of the Rural Schools of Wisconsin."

N. K. FOSTER, M.D., Director of Department of Health and Sanitation, Oakland, Cal. "Oakland System of Health Inspection."

OTIS B. NESBIT, M.D., Ph.G., School Physician, Valparaiso, Ind. "Medical Inspection in Valparaiso, Indiana, Public Schools."

Papers Presented in Absentia in Session Six (Read by Title)

SAMUEL G. DIXON, M.D., LL.D., Commissioner of Health, State of Pennsylvania. "Sanitary Inspection of the Rural Schools of Pennsylvania."

SAMUEL G. DIXON, M.D., LL.D., Commissioner of Health, State of Pennsylvania. "School Medical Inspection in Rural Districts of Pennsylvania."

A. J. McLAUGHLIN, M.D., Surgeon, U.S.P.H.S. "Hygiene in the Philippine Schools."

DR. CLEMENTE FERRIERA, São Paulo, Brazil. "L'Organisation de l'inspection médicale des écoles au Brésil."

SAFEGUARDING RURAL CHILDREN

BY

G. S. Lasher

The rural one-room school is here; it has persisted despite all its limitations for years; it will remain for many years to come. It is well enough to hold the ideal of the consolidated school with its splendid possibilities but why not face the issue squarely, recognize that the ideal belongs to the future as far as the majority of rural districts are concerned and bend our energies toward making the present country school as healthful, as attractive, as efficient as possible?

Michigan is one of the richest states in the nation, its natural resources are superb, its population ranks high in intelligence and culture. There is no reason why its schools should not be among the very best yet the Russell Sage Foundation investigation resulted in a ranking of seventeenth. Even this indicates that the state is considerably above the average so there is a basis for the belief that the conditions to be found in Michigan among the rural schools are better than in many states that have equal advantages, still a survey of the situation reveals the appalling fact that the vast majority of boys and girls in rural districts are spending from four to six hours every school day in buildings which are a menace to their health.

In 82 of the 83 counties in Michigan, there are 7,234 rural one and two room schools. Of this number, 2,075 possess heating and ventilating systems; 499, basement furnaces and 888, jacketed stoves. The children in 3,772 schools or more than fifty per cent. suffer from stove-heated rooms which are inadequately ventilated. Only 1,260 or approximately eighteen per cent. have drinking fountains, while but 3,606 or less than one-half even boast the makeshift individual cups. But 151 safeguard the children from the dangers of the common roller towel by the use of paper towels and 140 by the use of individual towels.

Comparatively little attention is paid to correct seating of children. In only 435 schools or less than six per cent are found adjustable seats and desks. But 1709 schools or about twenty-three per cent. have the seats and desks properly arranged, the same sized seats and desks in the same rows from front to back. In 3,959 schools there are not a sufficient number of small-sized seats and desks so that thousands of youngsters have to sit all day with their feet swinging in the air and must distort their backs in order to write or figure because the desks are too high. Small chairs and tables are provided for the little ones in only 782 schools.

The lighting of the schoolrooms is causing children and teachers to become spectacle wearers by the hundred. In 887 rooms children are forced to face open windows while a similar fate falls to the teachers in 2,575 schools. The eyesight of the vast majority of children and teachers is impaired by cross lights because in 6,457 schools, or eighty-nine per cent., there are windows on both sides of the room. Schools, which have the lighting entirely from the left side, are limited to 242, while 360 light from the left and rear.

These injurious lighting conditions are modified in only 993 schools by the hanging of window shades at the bottom so that they can be pulled up rather than down. Correct decoration of the walls is found in 2,072 schools.

That the outhouse problem is serious is shown by the fact that but 4,052 schools have well-built, widely separated outhouses, while only 123 have inside toilets. Ample playgrounds are scarce. School grounds containing at least two acres are found in only 170 districts, while those possessing at least one acre number 2,526. No fewer than 4,060, or over fifty per cent., have one-half an acre or less. The schools possessing satisfactory water supply total 4,463. The information for this survey was furnished by the county commissioners and while not minutely accurate, is conservatively true. At least the conditions are not exaggerated. I am not inclined to be pessimistic, despite this adverse showing, as practically all the improvements noted have been made in the past few years and the number of progressive districts is growing.

So much for the actual situation; now what is to be done about it? Fortunately, manufacturers with foresight have been studying the problems so that it is to-day possible to make the country schoolhouse as healthful, sanitary and comfortable as the city schoolroom at a decidedly moderate cost. There is not a one-room building in the state but that can be remodeled and improved to meet the demands for health and comfort at a cost of less than $500, while the great majority can be brought up to standard for much smaller amounts. Districts that cannot afford to give their children decent and healthful conditions are so few that consideration is not necessary.

Systems, which thoroughly ventilate the schoolroom and warm it evenly without the direct rays striking any child, can be purchased for from $95 to $125 or be made for less. Sanitary bubbling drinking fountains for districts where there is no water system do away entirely with the use of cups and cost from $13.25 to $20. Indoor chemical closets, which are sanitary and odorless and require neither sewerage nor water under pressure, solve the outdoor outhouse problem at a cost of from $20 to $40 each. Adjustable seats and desks that can be made to fit the individual boy or girl vary from $2.10 to $3.50. Paper towels, costing about 10 cents a hundred, eliminate the source of nearly every skin disease epidemic, the common roller towel. Proper window shades, correctly installed so that they may be pulled up rather than down, are not expensive, neither are floor brushes and dustless cloths to replace brooms and feather dusters. The cost of remodeling the building to permit adequate and correct lighting would probably vary from $25 to $75, while the expense of decorating the interior to aid in the lighting is trivial. It is not necessary to argue that such an expenditure by a school district would be the best possible investment, as it would be insurance against doctors' bills and epidemics; would permit the teacher and the children to do efficient work every hour of the school day; would be the most effective advertising a community could present to farm purchasers.

No one can question that rural districts need improved conditions while the cost is not so excessive as to be prohibitive for any district or a heavy burden for the majority. The situation now resolves itself into the question, what can be done to bring about the desired changes. The answer, in my judgment, lies in the general education of the people as to existing conditions and needs; in the intensive education of teachers and county superintendents; in legislation regulating the construction of new buildings and the remodeling and equipping of old structures.

In Michigan we have begun the work of general education through the department of public instruction. Press sheets are sent out every few weeks to each newspaper in the state. They are prepared by an experienced newspaper man so editors use the articles freely as they are written in a concise, direct style and, varying from the short paragraph to a half column, make most desirable "time copy." No more effective way has been used to bring about a general understanding of school laws, conditions and needs throughout the state.

Michigan has adopted a system of standardization which is arousing wide interest in the state. A certain minimum standard is fixed and any school reaching that requirement will be given a framed diploma designating it as a "Standard School" while a metal plate, bearing the same inscription, will be placed on the school building. When district No. 4 is so honored, it can well be anticipated that the residents of District No. 5 will wonder why their school is not also recognized.

The qualifications which concern the health of the children are: ample school grounds of at least one acre; two well kept, widely separated outhouses or inside toilets; schoolhouse well built and in good repair, lighted with some attention to correct lighting; good blackboards, some suitable for small children; heating and ventilating system; sanitary bubbling drinking fountain; hardwood floor; seats and desks properly placed so that the same sized are in the same rows from front to back, and a sufficient number of small sized seats provided.

The department of public instruction has in preparation a manual of schoolhouse construction and improvement which will give a number of detailed plans for the erection and improvement of one and two room buildings. The plans will be accompanied by complete specifications and estimates and adapted to varying needs. Illustrations or proper equipment with prices charged will be given, together with many helpful suggestions. In addition, the department is requesting all districts that are planning to build to submit their plans for expert criticism as to heating, ventilating, lighting arrangement, toilet accommodations, etc. In this way, it is expected many mistakes due to unwise architects will be avoided.

That visual impression is most effective was strongly emphasized upon my mind during the past few weeks while making a tour of Michigan with the state health train. I had charge of an exhibit of sanitary school equipment, which was a feature of the train, arousing great interest among general visitors as well as school officers and teachers. Comparatively few had ever seen an adjustable seat and desk, an indoor chemical closet, window shades hung at the bottom of the window instead of at the top or a sanitary drinking fountain for rural schools. Many had never seen paper towels or heard that a schoolroom could be properly heated and ventilated by a room furnace, while to still more, lighting entirely from the left side of the pupil was a new idea.

Included in the exhibit was a display of jaw casts showing the result of lack of attention to children's teeth and the effect of adenoids. The interest in this was noteworthy as it seemed new to the majority of parents, many of whom realized for the first time the cause of their children's mouth-breathing, deafness, and associated afflictions. The number of children in the crowds visiting the cars who were obviously affected by the throat growths was surprisingly large and their presence emphasized my statements.

The exhibit train will reach probably fifty thousand people before the tour is completed and will undoubtedly prove a great missionary agency for better school conditions. The thing that impressed me deeply was the seeming ignorance of the general public in regard to the needs of school children and the possibility of meeting those needs. To most live educators all that is somewhat of an old story but to the general public it is new gospel and thoroughly appreciated.

Another great agency for this wider enlightenment is the annual school officers' meeting held in every county in Michigan. A representative of each school board is expected to attend and as he or she is entitled to two dollars a day and traveling expenses for such attendance, most boards are represented. Some member of the department conducts the sessions. These meetings were started six years ago and at first school law absorbed the interest and the entire time, but more recently, general educational problems have predominated and the questions of school hygiene and sanitation are most strongly emphasized. The Michigan law gives the district officers almost complete taxing power, making the board of education the court of last resort in the proper remodeling and furnishing of the school buildings. The result of the agitation in the officers' meetings for better conditions is shown by the decided advancement in the state during the past two years.

No more powerful stimulus toward this same end can be given than by intelligent and efficient teachers and county superintendents, but both are in need of an intensive education along these lines. In visiting schools, the thing that has impressed me most decidedly is the pathetic ignorance of the great number of teachers in the most common sense principles of hygiene and sanitation, and that statement applies to city and village superintendents and teachers as well as to those in rural districts, to so-called trained teachers as well as untrained.

It is a curious paradox that the university, state normal schools and colleges require a somewhat extensive course in history of education, yet none of them demand a knowledge of school hygiene and sanitation. There is no question but that an individual can become a splendid teacher without knowing who devised the kindergarten or how the various theories of education originated, but no one can do his duty by the boys and girls under his supervision unless he understands that children must be seated so that they can rest their feet firmly on the floor and use the desk in front of them without distorting their backs.

Comfort is essential to good work and the first thing that a really successful teacher must do in order to develop efficiency among his pupils is to see that the schoolroom conditions make for comfort and health. The superintendent who does not thoroughly understand the heating and ventilating system of his school so that he can be sure that the janitor is not saving coal at a sacrifice of children's health, is not fit to be a superintendent. The sooner the dry rot in so many courses in higher institutions of learning is replaced by live subjects that will make it possible for the teachers to teach correctly the fundamentals of right living, the more hope there will be for the coming generation of men and women. The institution which does not train its product in the principles of school hygiene and sanitation and how to apply those principles cannot but fail in its real object, the development of the right kind of teachers.

The most effective way to do away with the dangers of the common drinking cup, the common roller towel and other insanitary articles of use is to teach children the actual dangers of those things. People have at last discovered that it is possible to know how to live correctly without knowing the anatomy of the human body. It is vastly more important that the child shall know how to clean his teeth than to know just how those teeth are constructed. Teachers must be trained in health knowledge and be made to appreciate that the health of the child is of much greater importance than the elements of arithmetic, geography and all other academic subjects combined.

The course of study, which under the present law must be followed in all Michigan schools, except city districts, outlines work in everyday hygiene. This is supplemented by helpful bulletins on various health questions issued by the department of public instruction and the state board of health. Last year eye-testing charts were sent out for use in every school room and the number of children found to be suffering from defective eyesight was overwhelmingly large. Teachers were urged to report the condition to the parents and in many cases dull children were transformed into bright students because with the aid of glasses they could see with some degree of correctness. The devoting of eight out of ten physiology questions to hygiene and sanitation in the state teachers' examinations is also proving effective in training teachers.

Education of the general public and of the teachers is a somewhat slow process, so if any sweeping reform is brought about in school conditions, it must come through mandatory legislation. If the state demands compulsory education, as practically every progressive state does, it most emphatically should demand compulsory health conditions in every school district. It is an absolute injustice to force parents to send children to school during the formative years when conditions are a menace to the health of the children. Neither is it fair to coop children up from four to six hours a day in a room that is uncomfortable, unattractive and unhealthful.

In order to prevent districts from reproducing the same mistakes in new buildings that are so glaringly conspicuous in the vast majority of old buildings, laws should be enacted to require boards of education to submit their plans to competent state authorities so that the details of lighting, heating, ventilating, arrangement, toilet accommodations might be corrected. No district should be permitted to expend any money unless the requirements of such board are complied with.

The state officials should also have authority to condemn buildings that are insanitary or unsafe and to require certain improvements and equipment that make for health. Unless the board of education acts under the instructions of the officials, then the latter should have authority to make such changes as are necessary in their judgment and assess the cost of the same against the district. Michigan has a law that makes it possible for the truant officer under direction of the county commissioner to require districts to meet any qualifications in regard to outhouses that he demands and, for the first time, many districts are getting outhouses that are decent, healthful and free from moral filth. The law works exceptionally well in this one respect and would do the same in regard to general conditions of the school.

Too long have law makers, educators and people in general entertained the silly fallacy of "ruddy cheek and glowing health" of the country lad and lass. As a matter of statistics, the death rate among children of the country is as great as that in congested cities. If many rural children are healthy youngsters it is in spite of the conditions under which they live in school and often at home, rather than because of them.

The country school children need proper health conditions as much as their city cousins; it is possible to secure such conditions at moderate expense. The members of the communities and the teachers must be brought to an appreciation of these facts. Even with that, mandatory legislation will be essential to safeguard the rural children in every community. If this country is to possess the quality of citizenship which will guarantee its supremacy intellectually, commercially, artistically, physically and morally, it must require not only compulsory education but compulsory health conditions under which to gain such education.

IMPROVEMENTS IN THE SANITARY CONDITIONS OF THE RURAL SCHOOLS OF WISCONSIN

BY

WALTER E. LARSON

In 1905 two important laws were enacted. The first provided for annual school board conventions to be held in every county of the state, and the second provided for the appointment of a rural school inspector, one of whose duties is to attend, and with the county superintendent direct, these conventions. As a result of these laws school board conventions have been held for the past eight years. The school officers of the various counties have met from year to year and learned about the best methods of school management. A considerable portion of the discussions have related to school sanitation.

These two laws have brought about a close relationship and coöperation between the state department of education and the local school boards, that has resulted in much improvement in the country schools. From seventy-five to ninety meetings have been held each year and the aggregate attendance during the last few years has been approximately 10,000 school officers each year, or nearly one-half of the total number of school officers in the state. At these school board conventions certain definite topics have been taken up each year and discussed by the representative of the state department. The first year the special topic was sanitation and the special feature of this topic was schoolhouse ventilation.

In 1907 a law was enacted, grouping the country one-room schools into two classes—first and second. Certain standards were prescribed for schools of the first class. Among the requirements made were first, that the school room should be kept in good condition and free from any unsanitary features; second, that it should have an adequate system of heating and ventilation; third, that the desks should be arranged properly; and fourth, that the outbuildings conform to the law. Schools that came up to this standard were to receive a special state aid of fifty dollars per year for three years. As a result of this law about four-fifths of the country schools in Wisconsin have installed heating and ventilating systems and provided the other equipment required to meet that standard prescribed by the state superintendent. Many of the first heating systems, it is true, were of a somewhat inferior kind and were not always properly installed. The result, however, has been exceedingly beneficial, as the people have been brought to see the necessity of having schoolhouses ventilated. It is the exception now to enter one of the rural schools and not find a ventilation system installed. The practice has even had a wholesome effect upon many of the village schools, which did not have the best of ventilation before.

The question of outbuildings has always been a difficult one in connection with the country school. In order to remedy this matter a law was enacted in 1907, providing that it shall be "the duty of each school board to provide at least two suitable and convenient outhouses for each of the schoolhouses under its control. Said outhouses shall be entirely separated each from the other and shall have separate means of access." Some other specifications are also made in the law. As a result of this law the outbuildings have been largely improved, although they are not yet what they should be in some places, but in counties where the campaign for better outbuildings has been taken up in a systematic way almost perfect conditions prevail. The problem of securing proper outbuildings and keeping them in proper condition is one that cannot be solved by mere enactment of a law. There must be developed in the children themselves and even in the people of the community a right attitude toward public property, and one of the difficulties in securing this is that many of our teachers are young and inexperienced and do not look after this matter in the proper way. We have been impressing upon school boards and teachers alike that they are in duty bound to

The Old Schoolhouse in District No. 2, Beetown, Grant County see that these buildings are kept in good condition, inasmuch as a filthy outbuilding is not only detrimental to the children's health, but it is also detrimental to their morals.

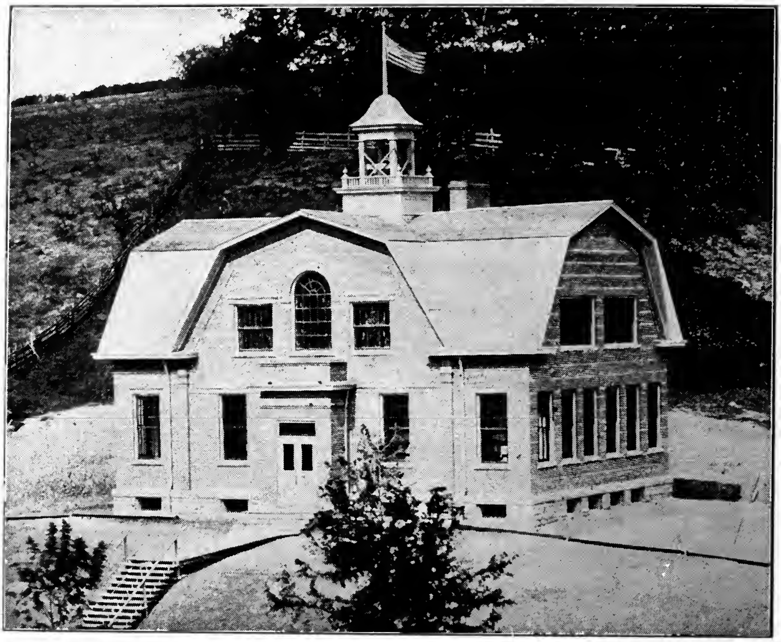
Another law that has had good effect upon the sanitary condition of school buildings was passed in 1907, authorizing the state superintendent to procure plans and specifications for rural schools and loan these plans to school districts. This law also provides that "Where the plans and specifications prepared by the state superintendent are not used, in order that the health, sight and comfort of pupils may be properly protected,

The Old Schoolhouse in District No. 1, Beetown, Grant County

all schools board of districts in which new schoolhouses of not to exceed four rooms are to be erected shall make suitable provision for the heating, lighting and ventilating, and hygienic conditions of such buildings, and all plans and specifications for any such proposed school building shall be submitted to and approved by the county superintendent of schools in whose jurisdiction the building is located, before it shall be accepted by the school district board of the district in which it is proposed to erect such building."

In accordance with this law the state superintendent has secured plans for five different one-room school buildings. In these plans the sanitary features, such as proper heating and ventilation, proper lighting, proper arrangement, etc., are kept clearly in mind. One of these plans was used in the construction of a model rural school building which is found on the state fair gounds at Milwaukee.

In order to enable the people to get rid of old schoolhouses in bad condition, a law was passed in 1909 providing a means whereby they could be readily condemned. A condemnation law that had been on the statute books for some time was a dead letter, inasmuch as it required the *joint* action of the town chairman *and* the county superintendent. The law of 1909 provides that any *voter* in the school district, any county or city superintendent, or any school officer may make application to the



Consolidated School, Beetown, District No. 11, Grant County
(Formed by the Union of Districts 1 and 2)

state superintendent to have the schoolhouse inspected, with the view of condemnation or securing order for repair. Four of the inspectors of the department are authorized to examine school buildings with the view of condemnation. If the schoolhouse is found to be unsatisfactory it may be ordered repaired or remodeled. If it is in such condition that it is unfit to be repaired the inspector may order it discontinued and that a new one be built by a specified time. Under this law over two hundred buildings have been inspected and in every case improvements have resulted. In the majority of cases new school buildings have been erected while in others the old buildings have been remodeled or repaired. This

One of the Buildings Condemned

Another Schoolhouse That Has Been Condemned law has also had an indirect effect upon conditions throughout the state in that many districts have improved their school properties knowing that the state inspector might be sent into the community to condemn the school.

Many of the new buildings that have been erected in rural communities are first class in every way. One county especially has done much in this respect. During the last ten years fifty-three departments have had new school rooms provided and nine others have been remodeled. Every county has now some good, up-to-date school buildings and these serve as an ideal and a stimulus for other districts that contemplate building. Whenever a district builds a schoolhouse now the officers or the building committee usually inspect some of the newly-constructed, up-to-date buildings.

Some reference has already been made to the ventilation of the one-room school building. Although perfect ventilation has not been secured, yet the progress made has been great. The attitude of the people has in general been changed and school officers especially are now convinced of the need of ventilation and it is becoming simply a question of the best method. Many of the new buildings have basements with furnaces and these are all constructed so that fresh air is provided for the school room. The principal drawbacks to the proper ventilation of the schools are the following:

First, some of our teachers are untrained and unfamiliar with the method of properly running the plants. In such cases the results obtained are not what they should be.

Second, in some instances the school buildings are poor. The hot air agent succeeded in getting the district to buy the outfit notwithstanding the unsatisfactory condition of the building.

Third, in some instances the chimneys are not adequate to handle the system.

Every year, however, we find better conditions. The school officers are taking greater interest in school affairs and they are becoming more intelligent in the discharge of their duties. The teachers are learning more and more about the operation of the plants, the regulation of heat and fresh air supply, the regulation of light and the need of proper physical exercise and direction. The plants themselves are also much improved over those that were first placed upon the market.

About four years ago the state board of health made a ruling that the common drinking cup should be no longer used on trains and in other public places, including schools. As a result of this ruling, the water pails have almost entirely disappeared from the schoolhouses of the state. Some years ago it was common to find the water pail and general dipper;

now it is the exception. A covered jar or a covered tank is now used and as a rule children have their individual cups. In some cases these cups are not used in the best way possible, but still the improvement is great. The attitude of the children themselves has also greatly changed. In many instances the pupils are able to tell why this order was made, and they are rather proud of the fact that they have their own individual cups. In some of the schoolhouses sanitary cabinets have been installed so that each child has a place for his cup.

In many instances the old schoolhouses are inadequately lighted. In our investigations we find the window surface to be from one-twelfth to one-sixth that of the floor space; the usual ratio being about one-ninth or one-tenth. The arrangement of the windows is also on the old style, three or four windows being placed on each side of the school room. In the new buildings the lighting is according to the approved methods. In the new school buildings not only is the lighting surface adequate, but the windows are properly arranged. I think there will be little trouble after this in having the proper kind of schoolhouses built. Not only does the law require the approval of the plans by the county superintendent, but the people themselves, after seeing the new schoolhouses readily note their superiority over the old.

One of the subjects required to be taught in the schools of the state is physiology and hygiene with special reference to the effect of stimulants and narcotics upon the human body. Some stringent laws relating to the use of tobacco in any form have also been placed on our statutes. This subject was introduced into the schools many years ago, but during the last few years special effort has been made to make this subject of practical value to the people. Instead of giving the major portion of the time to the teaching of anatomy and physiology, as was the custom following the early text books, we now are emphasizing the hygienic side of the subject. The last revised common school course of study lays special stress upon the health phase of the subject. The following are some of the topics that are given special emphasis: The care of the teeth, prevention of tuberculosis, the danger from flies and mosquitoes, quarantine and disinfection. The course of study also emphasizes the importance of right living in the school room as well as in the home. In fact, the teacher is given to understand that the proper observation of hygienic principles in the school room is really the most important part of the course of study. On this subject the course of study says "We teach by precept and by example. The first amounts to but little unless it is reinforced by the second. The best way to make teaching *practical* is to put the facts taught into actual practice. The first thing to consider in the teaching of physiology and hygiene is the sanitary condition of the school room and surroundings. Teaching the children a few facts in the *physiology* class is time wasted unless these facts are *made real* in the daily conduct of the school."

It may also be mentioned in this connection that there is in every country school in the state of Wisconsin a library containing on the average one hundred books. In most of these libraries are some recent books on hygiene and sanitation. The influence that reading these books has upon the health of these children cannot be over-emphasized. An excellent pamphlet on "The Great White Plague" was prepared last year for the department by Prof. W. D. Frost and Prof. M. V. O'Shea, of the University of Wisconsin, and published and distributed by the state superintendent. A copy of this pamphlet has been placed in every school to be used by the teachers in connection with the teaching of hygiene.

In one of the counties a unique campaign was carried on during the past year. It was a campaign for clean teeth. Under the leadership of the county superintendent the teachers took this matter up and made a special effort to have the children realize the importance of preserving their teeth. Another county superintendent has made a special campaign during the past year against the house fly. At the school board convention a year ago he announced his policy to have every schoolhouse properly screened, and to wage a campaign against the fly in every possible way.

Much of the success in the improvement of rural school sanitation is due to the county training schools in which the young people are trained for their country school work. In these schools a special effort is made to emphasize the hygienic side of physiology teaching and as a result the work done is much more effective. The training of the teacher is shown in the way she teaches hygiene as well as in the teaching of the other subjects. County superintendents also make special efforts to secure from their teachers more efficient work in hygiene instruction.

Time and space prevent us from discussing some other phases of the work, and all that can be done is to refer to them. An effort has been made to increase the educational value of the playground activities by having the teachers supervise them to some extent. The state department has published and widely distributed a bulletin entitled "Plays and Games," to aid the teachers in this work. Special effort has also been made to secure desks of proper size for the children and to have the children properly seated. As a rule the desks are fairly well arranged, although in many instances this matter can be improved upon, as some little children still sit in desks that are too large for them. We hope, however, to quickly remedy this condition. The law now requires the schoolhouse to be cleaned at least three times during the year. In many of the schools it is done every month. A law recently enacted makes it compulsory to teach prevention of accidents one hour each month and the state superintendent is required to prepare a booklet containing information for instruction on this subject. Some of the teachers have introduced the practice of giving school credit for home work, and in this way they have included the care of the teeth, sleeping with open windows, etc. As a rule, greater precautions are taken when an epidemic breaks out in the community. The law requires that the schoolhouse be fumigated by the local health officer immediately after the prevalence of an epidemic disease. In some of the schools the teachers have introduced the practice of preparing warm lunches for the children. The introduction of the oil stove makes this feasible. This is by no means a general practice, however.

It is impossible in this short article to include all the phases of the subject under discussion. There has been notable progress in Wisconsin during the last eight years in particular. The cause of this improvement is largely due to the laws mentioned at the beginning of the article. These laws provided machinery by which the people could come together and get ideas. When the people are once convinced that a certain policy is right, the policy will be carried out. Like all great movements, this movement is slow but it gains momentum each year. The most gratifying factor is the attitude of the people. As a rule, the people want to have the best living conditions possible not only in the schools but in the home, and these conditions when secured are mutually helpful, but in many instances they do not know what these conditions are. It is the duty of those of us who are leaders in the educational movements to bring these ideas to the people and show them in a business-like way their importance. Wisconsin now allows the teachers to attend the school board conventions. During the coming season it is our plan to have the teachers attend these conventions and in this way the state plans to give suggestions and helps to both the school officers and teachers in such a way that better results will be secured because of better mutual understanding.

DISCUSSION OF
WALTER E. LARSON'S PAPER
BY

J. GEORGE BECHT

It is scarcely possible to add anything illuminating to the very clear, discriminating and comprehensive survey of rural school conditions as presented in the papers of the representatives of Michigan and Wisconsin. It may not be unprofitable, however, to speak briefly of what Pennsylvania has done during the past two years to secure better schoolhouse conditions.

The School Code, enacted in 1911, provided that thereafter the plans and specifications for every new construction and every reconstruction of schoolhouse should be submitted to the State Board of Education for examination. Expert architects are employed to examine these plans, and, if the plans conform to the standard requirements for light, air space, floor area, heating and ventilating appliances, they are approved, and the Boards of Directors may proceed to give contracts. No contract can be entered into by any Board of School Directors unless the plans for construction or reconstruction have been first submitted to the State Board of Education, and its suggestions, if any are made, considered. During the past two years more than 600 plans have been passed upon and approved by authority of the State Board of Education. A study of these plans by the architects and other officers of the Board has given opportunity for helpful service in the suggestions that were made relative to the planning of buildings. Frequently architects and builders who draw the plans are not familiar with the varied schoolhouse conditions. Structurally and architecturally the building may be well conceived but lacking in adaptability and adjustability to school activities. To bring about the best results, the architect must study special schoolhouse conditions.

The State Board of Education has been able to give help to the rural districts where one-room school buildings are the prevalent type. Standard plans for one, two, and three-room buildings have been prepared for free distribution. Detailed drawings and specifications from which any builder may build are sent to districts making application. These plans may be adjusted to meet particular needs.

The State Board of Education is insistent that every one-room building shall have as its minimum requirements:

15 square feet of floor space.
200 cubic feet of air space.
20% net of floor space in lighting area.
A heating and ventilating stove.
Cloak rooms for boys and for girls.
A vestibule.

It also insists that more attention shall be paid to the construction of outside sanitaries and to the proper care of the same.

OAKLAND SYSTEM OF HEALTH INSPECTION

BY

N. K. Foster

Medical, or as I prefer to say health inspection, is among the youngest offsprings of our school department. It was small at birth and in its early infancy gave no promise of the rapid strides it made in early childhood. Its present lusty youth is evidence that it has come to stay and that it will be a mighty force in the upbuilding of a strong man and womanhood.

Like every other advance step in civilization, experiments have been tried and failures made. It could not be otherwise, and that the work has grown despite discouragements is proof that it has a strong hold on the public. It is only by comparing our failures and successes and winnowing out the chaff that we can build up the most effective system, and this is the excuse I have for speaking of Oakland's system of health inspection. I designate it Oakland's system because at the time it was instituted, July, 1909, there was, as far as I could learn no other city working along the same lines nor do I know at present of any other large city that has adopted it. It is an entirely paid and whole time department. No volunteer work and no one with divided interests, everyone connected with the department giving full time to the work. At present the department consists of a Director, who is a physician and seven graduate nurses. The work attempted by the department in common with all systems is educational, reparative, attention to sanitation of school buildings and grounds and the eradication of infectious diseases.

The distinctive feature of this system is that the work is largely done by nurses. They are trained to the work and receive a gradually increasing salary, beginning at $75.00 per month and increasing $5.00 per month each year until $100.00 per month is reached. They are also paid $2.50 per month for extra car fare. The Director is the man of all work and upon his tact and ability to handle people will depend, as in all systems, its success. He must train his nurses, be ever ready to answer questions of any and all kind, meet irate parents and convince them that the work is for their good, enlist the active support of physicians, see to the sanitary conditions of schools and be at all times ready to answer the call of teachers, even if it is sometimes useless. Only in a slightly less degree does success depend upon the nurse. They are constantly with the children and the parents, and their personality and ability to meet and kindly conquer is a strong factor of success.

Method of Work. Our schools are divided among the nurses, each one keeping as nearly as possible the same schools year after year. She visits them at least every two weeks to look after any particular case or give any aid or advice that may be needed. Once each year she examines systematically each child in her schools and carefully records results. The child is taken into the room set aside for this purpose and examined for vision, hearing, throat or mouth trouble, condition of breathing, general nutrition, etc. The child is not disrobed, but any malformation that can be detected is noted. An effort is made to get the confidence of the child and excite an interest in health. For this purpose a mental picture of the ideal man or woman is kept before the child and the means of attaining that ideal, rather than the defects found are dwelt upon. The defects are, however, carefully noted and after school hours the nurse sends to the parent, in a sealed envelope, the result of the examination, if anything needing care is found. This notice will have some effect, a small percentage will respond at once and this percentage is increasing each year. While the parent may forget or neglect, the nurse does not, but she visits the home and explains the need of attention, and these visits are repeated as needs demand. Our notice to the parents does not state a definite diagnosis, but says the examinations "seems to show" a given condition and asks that the family physician or specialist be consulted. The reasons for this are apparent: First, we do not think it well for the nurse to try to make a diagnosis, although in a large majority of cases she could do so. Second, the loss of time required to make a careful diagnosis and frequently the impossibility of making one with the appliances at hand. Third, there are still some doctors who feel that it raises them in the estimation of a patron if they dispute another's diagnosis.

The nurse after a few days follows the notice to the house and shows the mother the needs of the case and the benefits to be expected if the proper work is done. No compulsion, but strong persuasion is used. Conditions at the home are studied and whenever it will be received, advice as to proper food, bathing, ventilation, etc., are given. Among a very large class, inattention to these things are responsible for much physical and mental weakness and their correction will wonderfully improve conditions. In every city there are many who cannot pay the price for proper medical or surgical attention and it is among this class that our work is most needed. Frequently we find whole families having physical defects that are slowly and surely sapping their vitality. A few dollars expended on each member in remedying these defects would make the difference between success and failure in life, but the few dollars is not theirs and unless the city comes to their aid it will later have to support many of them as indigents or criminals. No city can afford not to have facilities for the repair of physical defects of the children of the poor.

Practically the only criticism that I meet to this system comes from those who think that a nurse cannot or should not examine the children. They seem to think that a nurse cannot tell trouble when she sees it. A moment's reflection will answer this criticism. They can certainly tell a decayed tooth, a mouth breather, defective vision, impaired posture or malnutrition. They may not be able always to tell the cause, but what of it, neither can any of us always, and some of us not at all. It makes no difference, the defect is there and the family doctor or specialist is anxious to find the exact condition and cause. If treatment is to be given he would examine for himself and arrive at his own conclusion and the time given by the school examiner to make an exact diagnosis would be wasted and if it did not agree with the conclusions of the latter examiner, discredit would be cast on the department.

The nurse is patient, painstaking and diplomatic. She can get nearer to the children than a man and excite more interest in themselves and her "seems to show" is for all practical purposes as good as a careful diagnosis. A divided interest is not conducive to the best work and it is difficult to get a doctor to give his full time to routine examinations of school children, unless he is a failure in his profession, in which case we do not want him. Young physicians or old ones who have lost their grip can be secured for part time, both making the school work secondary to their private. It is seldom that one of this class will do the best public work, for it is nearly impossible for one not to have an eye on their private business. Even if the position is not used to get private practice, work is liable to come to them during hours that should be devoted to the schools, and the private work gets the preference. While the doctor may work honestly and faithfully for the public, the public, or some of it, will accuse him of using his position for private gains. It is as important to avoid the appearance of evil as the evil itself. For the whisperings of wrong will wreck the harmonious workings of a department as quickly as it will a private character.

Results. There is no absolute standard of results by which we can measure our work, it is not spectacular and results will frequently develop only after months of waiting and one should not be discouraged if a child, after operative work has been done, does not immediately improve. The removal of diseased tonsils, for instance, is generally in a child followed quickly by good results, but sometimes the patient fails to show improvement for a long time, and it is the same with other operations. There are so many complicated conditions entering into our cases that no one can tell exactly from whence the good comes or why results are not what we hoped. Again we have to depend upon whoever the parents select to do the work; the selection is often bad and poor results follow. We will never be independent of this drawback until the city has a hospital of its own where the best skill is employed and where the poor and those in moderate circumstances can have the work done free or at a moderate expense.

The usual way to measure results is the number who attempt to follow suggestions. While this does not give the final result in units of improved physical or mental force, it does show the effectiveness of the department. Until we can control the reparative work some of it will be unsatisfactory and we will get the minimum of good results. In the Oakland Department we do not try to get reports from parents or teachers as to whether or not our requests for treatment have been followed. We tried it the first year and the results were useless. We mark as corrected one year those who do not show the same defect as was recorded against them the year before, and seek the cause of cure. This is the basis of our report of results. A mere visit to a doctor or dentist is not accepted, actual improvement in conditions or the removal of the defect must be in evidence. Statistics of results for comparison based upon physical or mental improvement must always be unsatisfactory until we have a standard of examination and results. One city will mark every decayed, decidious tooth as a defect, thereby increasing the percentage of defects. Another will mark none of this class and have a small percentage. The small defect did no particular harm to the health of the child nor will its repair increase its vitality; looking forward the benefit is great, but for classification on a basis of immediate physical or mental improvement it cannot compare with a city which records only more serious defects. We have made no classification as to benefit except the general one that almost all cases, at least 98% of tonsilar and adenoid cases have been decidedly beneficial. An equal percentage have been benefited by glasses. For dental work the percentage is much less, this is what would be expected, as very many of the dental cases show no ill effects on health. The danger is for the future.

The other defects vary in benefits received. Just as in all medical and surgical practice, the removal of a defect or diseased condition will prevent more extensive trouble while always not immediately improving the general health.

The 6 per cent. decrease of retarded children in our schools during the school year of 1911-12 is, no doubt, largely the result of our health inspection.

We examined, in the school year of 1911-12, 17,326 pupils. Of these 12,343 or 71% were more or less defective. In the examination in 1912-13, we found 8,666 of the defective children still in school. The others having passed to higher schools or left school entirely. Of these 8,666, 4,271 or 49.4% had received beneficial attention. We have recorded 508 cases as receiving hygienic treatment. These are cases which were influenced to better methods of life by the school nurses and the defects were thereby removed. If these be taken from the 4,271 receiving beneficial treatment there would be 43.6% receiving professional treatment. As these 508 are marked defective and charged as such, I see no reason why they should not be credited to the other side of the account since they received benefit by following special directions of the nurse by sleeping out of doors, giving up drinking of wine, coffee and tea, breathing properly and bathing frequently.

Among the parents there is almost no complaint and frequently they send for the school nurse to get advice on questions pertaining to health matters. The principals and teachers are coming to rely on the department and refer to it questions of the relation of health to work. Infectious diseases have materially lessened, and the appearance and cleanliness of the children has very much improved.

Grand Total, Term of 1911-12

Age	10 Yrs., 6 Mos.	
Grade		
Defect of Vision	3,572	20.6 %
Defect of Hearing	1,198	6.6 "
Defect of Nasal Br.	1,815	10.4 "
Defect of Tonsils	5,189	29.9 "
Adenoids	1,112	6.6 "
Enlarged Glands	1,312	7.5 "
Decayed Teeth	7,343	42.3 "
Disease of Nerves	40	.2 "
Disease of Skin	61	.3 "
Disease of Lungs	2	.01 "
Disease of Heart	14	.08 "
Defect Orthopedic	75	.4 "
Defect of Palate	29	.1 "
Malnutrition	540	3.1 "

Pupils with 1 defect	6,104
" " 2 "	3,670
" " 3 "	1,716
" " 4 "	634
" " 5 "	168
" " 6 "	45
" " 7 "	6
	12,343

Pupils defective	12,343	71%
" non-defective	4,983	29 "
" examined	17,326	

CORRECTIONS OF DEFECTS, TERM OF 1911-12

Pupils reported for one or more defects	8,666	.....	
No response	4,395	.....	50.6%
Responded	4,271	.....	49.4%
Glasses fitted		385	
Eyes treated		127	
Throat or nose operation		572	
Throat or nose treatment		245	
Other operations		51	
Skin treatment		137	
Medical treatment		525	
Hygienic treatment		508	
Dental work		1,691	
Christian Science treatment		30	
Total		4,271	

DISCUSSION OF

N. K. FOSTER'S PAPER

BY

B. FRANKLIN ROYER

I am not inclined to agree with the preceding speakers concerning the advisability of doing the work of medical inspection by means of nurses. It seems to me to be very much better to use the physician for this work and the nurse or, better still, the sociological worker to follow up cases requiring treatment where the teacher fails to secure the coöperation of the parents. We have not reached the ideal in medical inspection; it is only when we include many things not now included in the inspection that we can hope to approach the ideal and to do the things the nurse's training does not fit her to do. Further medical inspection is very much more likely to meet with the approval of the medical profession and with school authorities, largely influenced by the profession, if done by medical men; and the opinion given the parents relative to defects in the child, probably remediable, is very much more apt to be heeded when based upon a physician's opinion than when based upon the opinion of nurse or teacher.

There should be no question of conflict of authority concerning the sanitary procedure incident to the presence of communicable disease in the school room. In these matters the authority of the health officials always takes precedence, so that in schools, as in this building, if infectious disease developed the health officer's order must be obeyed. For example, in this particular room, if smallpox, scarlet fever or diphtheria were present, Dr. Fronczak, the health officer of the city, would order the room closed until disinfected and no matter what other authority might disagree with him his order would always be respected and obeyed, and so with school work, the supreme authority is always the health authority and must necessarily remain so. With inspection under health authorities no conflict arises; with inspection under school authorities occasional friction may occur.

MEDICAL INSPECTION IN VALPARAISO (INDIANA) PUBLIC SCHOOLS

BY

Otis B. Nesbit

School inspection in Valparaiso, Indiana, was established in March, 1910, to assist in controlling an epidemic of scarlet fever which had persisted in the city for two and one-half years. Two physicians without compensation carried on the work with the essayist, the balance of the school year, there being three school buildings known as the Central, the Columbia, and the Gardner Schools. The last case of scarlet fever in 1911 occurred in June. The city went until April, 1912, when three cases appeared about the same time, two being school children, telling us some mild case was at large. It was not found in school.

Our schools opened September 3rd, 1912, and the inspection failed to find a case of quarantinable disease. No case of scarlet fever was known to exist in the city. The second week of school passed with no cases. On Sept. 24th a girl in the Fourth Grade, Central Building, was taken sick with scarlet fever. The case was not diagnosed until Friday. On Friday night another case developed from this room. Monday all pupils were in attendance except these two. An inspection failed to reveal any pupil with the disease but a pupil was found with a muco-purulent discharge from the nose, with enlarged tonsils, several decaying teeth, and adenoids, who was the last known case of scarlet fever in the city, having taken sick June 1, 1912, and released from quarantine July 15th. This pupil was regarded as a probable carrier and was excluded from school until her nose was dry. She was re-admitted. After eight weeks the two cases returned and no further trouble occurred in that building during that semester. January 20th the new semester opened, the probable carrier was promoted to Room Five. On January 22nd and 23rd she was out of school with a cold, returned the 24th, and on the 27th a pupil in the room was stricken with scarlet fever. On this date the inspection failed to find any one in the room or school except this probable carrier, whose nose and throat presented about the same appearance as before. She was again excluded and after re-entering no further trouble occurred in the room or building until a boy who had been ill was permitted to re-enter school without seeing the physician. He was in one day and was found the next morning, with a profuse skin desquamation and a history of illness that made the diagnosis of scarlet fever easy. His brother had come home from an adjoining city sick with quinsy and his sickness, with that of a brother under school age, followed. This pupil was in the Sixth Grade. When found the nose and throat were free from abnormal discharges, he being one of the type that do not freely distribute discharges and infections. He was excluded from school and the home quarantined. An inspection of all pupils found no suspects. The inspector explained the situation to the pupils and told them how scarlet fever was spread, advised all to return at every session of the school unless ill and to stay from school and see a physician for any mild case of sore throat or ill feeling and explained its importance. The method of school room cleaning was explained to them. The pupils were excused until the afternoon session. The room was disinfected. The pupils' books were disinfected by the Beebe Method. School resumed at 1 P.M., all pupils were back except two, both returning the next morning. The pupils were inspected every day for four days and not a case developed nor did any other case occur in pupils attending the building during the school year.

In the Columbia building we had only two cases of the disease, one source not being determined except that it certainly did not occur from a school exposure. The other case went to Chicago to spend Christmas with a bachelor lady physician. The physician had a dear friend who had two children. One had scarlet fever. The physician took the other child to her home to keep until after the quarantine was lifted. On Monday following the Valparaiso girl went to visit the doctor. She played with the doctor's other guest, returned home Friday, developing scarlet fever that night. This occurs so frequently and so little notice taken of it, is why I recite it. The Chicago doctor was afraid the child she took home with her was coming down with scarlet fever but decided it was not, being as she said a very mild sore throat. Children taken from where scarlet fever is known to exist, with red throats, nasal discharge and the mildest symptoms are frequent carriers and distributors.

Scarlet fever did not occur in the Gardner School until in the second semester, when three cases from three different rooms developed the same day. Nothing was found in school but all gave a history of having been with a girl whose sister had the disease and this girl had not been quarantined and was living away from home. She gave a history of having had a sore throat, and was probably the source of these cases as well as three cases outside of school.

A teacher in this building developed the disease on Thursday who had been visited by a young man from a near-by city on Sunday. The young man had suffered from a very severe sore throat ten days before. He came from a city which had much scarlet fever. This teacher was released from quarantine on the 42nd day and returned to school on the 43rd day after the beginning of illness without the permission of the school physician and remained that day. She was excluded the following morning under the rule of two weeks' exclusion from school after release from quarantine. The following Sunday a case developed in one of her pupils.

The week following the release of the three cases occurring the same day a boy in the neighborhood developed the disease. The children had not returned to school.

In 1910 there were 51 cases of scarlet fever among pupils who lost 1,526 days in attendance. In 1911 only two cases losing 80 days. In 1912, 10 cases compelling them to be absent 272 days.

The number of cases attributed to school exposure in 1910 was 31; in 1911, 0; in 1912, 3.

In nearly every case of scarlet fever in this city since September, 1910, we have been able to trace an exposure of the patient within four days. *First*, to some person known to have the disease. *Second*, a person who had previously, even months before, had scarlet fever and having a diseased condition of the nose, throat or teeth ever since. *Third*, to persons who had recently been with known cases and gave history or evidence of a mild infection.

We have had no cases that pointed to infection from things.

Some of the other infections in the schools in 1912 were:

Diphtheria Carriers. Four diphtheria carriers were found in the school during this year but no cases developed.

Septic Sore Throat. We had at the opening of school thirty cases. None in acute stages. All were admitted with only six cases developing after, among the pupils, and all these had intimate playmates or members of the family at home with the disease, which leads us to regard the disease as but mildly contagious in school.

Measles. Thirty-seven cases of measles occurred during this year. In view of the disease starting outside of school and being well distributed, this was considered not bad. The plan proposed by E. C. Levy, Richmond, Va., of closing the room from nine to fourteen days, was considered but was not practical in all cases. It is a splendid observation and would be useful at times. The inspection of the pupils in a room where measles has developed from the ninth to the fourteenth day and exclusion of all cases with slightest catarrhal symptoms was probably of some service in lessening the spread.

We do not disinfect for measles as a rule. Would do so if the first case in a city was a school case.

Chicken-pox. Occurred in only three families and were easily controlled.

Impetigo, Itch and Vermin. Caused a much greater loss than would have been necessary had a school nurse been employed. 26 cases lost 126 days.

Mumps. Mumps occurred in 35 pupils from 25 families and was spread through inability to recognize a probable carrier which produced 10 cases, and possibly other carriers, and too short an exclusion of the first case—three weeks.

Whooping Cough. Only four cases of this disease was found. This disease will be easier controlled in the future in places where laboratories are accessible, as the taking of cultures will enable the authorities to recognize this as easily as diphtheria. It has been the unrecognized case that has been the principle distributor.

Oral Hygiene. Mouth conditions attracted the attention of the Medical Department of the school in 1910 when 190 examinations were made by the local dentists without expense to the school. In 1911-1912 records were made of 976 mouths which included practically the entire school membership from the kindergarten up—public school pupils and three country schools. In 1912-1913 records were made of 1,013 in the Public Schools, 24 in the German, and 86 in the Parochial. A decrease of one cavity per pupil and the increase of the number with no cavities in permanent teeth from 22% to 36%, the saving of 186 permanent molars, and 50% receiving fair dental attention are some of the things shown by the following table that seems encouraging:

Comparison of Mouth Examinations Valparaiso Schools	Public Schools May 1910	Public Schools Sept. 1911	Public Schools Jan. 1913	German School 1913	St. Paul School 1913	Three Rural Schools 1912
Total No. Examined.......	190	976	1013	24	86	59
Total No. Cavities..........	937	4796	3996	75	582	403
Total No. Cavities in Temp. Teeth..................	482	2197	1905	38	205	148
Total No. Cavities in Perm. Teeth..................	454	2599	2091	37	277	275
Total No. Pupils with No Cavities................	15	116	179	4	6	3
Total No. Pupils with None in Perm. Teeth..........	42	246	369	12	19	11
Total No. Perm. Teeth Extracted................		178	84	0	4	
Total No. Pupils Having Lost Perm. Teeth........		116	58	0	2	

Comparison of Mouth Examinations Valparaiso Schools	Public Schools May 1910	Public Schools Sept. 1911	Public Schools Jan. 1913	German School 1913	St. Paul School 1913	Three Rural Schools 1912
Malocclusion			100	0	11	
Total No. with No Fillings and No Cavities			58	3	2	
No. Not Using Brush			238	11	9	
No. Not Having Brush			119		3	
No. Pupils' Teeth Need Cleaning			722	4	62	
Total No. Perm. Teeth to be Extracted			57	1	2	
No. Pupils Having Had Dental Attention			521	3	26	
Average No. Cavities	4.98	4.9	3.99	3.12	6.76	5.9
Average No. Cavities in Temp. Teeth	2.52	2.25	1.88	1.58	2.38	
Average No. Cavities in Perm. Teeth	2.38	2.2	2.06	1.54	3.22	3.6
Per Cent. of Pupils with None	7.8	11.8	16.6	16.	6.97	
Per Cent. of Pupils with None in Per	22.1	25.	36.	50.	22.	18.
Per Cent. of Pupils with Diseased Teeth	92.2	88.2	83.4	84.	93.03	96.
No. of First Molars Diseased		1389	1203	26	187	151

Disinfection. For disinfection material a mixture of the Cresols, the Phenal coefficient being known, is used.

The one used last year had a Phenal coefficiency of 3.92 and was used one part to 80 parts of water.

Method. A one to eighty solution was used daily on the banisters or stair hand railings. When scarlet fever occurred in a pupil while at school the books were removed from the sick pupil's desk and disinfected. The seats, wainscoting, lower window casings, the chalk troughs, door, including knob, and the interior of the clothes closets were washed with the disinfectant. The floors of the room and cloak room were mopped with the same. As soon as the floors and seats were dry school would resume if desired. Erasers are fumigated by putting in closed chamber using formalin.

Disinfection of Books. When books were fumigated the Beebe Method of immersing the books in a solution of 2% Phenal crystals in gas-machine gasoline for 20 minutes was used. Then allow the books to stand on ends for several days in the store room.

The mortality record during the school year of 1911-1912 was one pupil, age eight years, dying of acute dilation of the heart due to emphysema.

During the school year 1912-1913 it was three, one age 10 of tetanus, one age 11 of septicemia due to acute endocarditis, and one age 16 due to pneumonia. No deaths occurring during the vacations directly attributed to acute conditions arising during the school year. The school enumeration in the city in 1912 was 1,735 with two deaths of school age.

Other activities of the department has been the making of a physical record of the pupil, a limited study of some of the mentally deficient, and the establishing of a manual training class for them.

Free operations, dental and surgical, have been provided for some.

Ventilation and heating have been studied sufficiently to know our plants are inadequate and the opening of windows during exercise period is the rule.

The teaching of hygiene and sanitation has been emphasized by a School Health Exhibit. Talks have been carried on before the physiology classes in the grades and high school with microscopic demonstrations, and the cultivation of bacteria from water, milk, air, and from mouth discharges and fingers.

Public health lectures under the auspices of the County Medical Society have been well patronized and it will furnish two lectures a month during the coming winter.

SANITARY INSPECTION OF THE RURAL SCHOOLS OF PENNSYLVANIA

BY

Samuel G. Dixon

In making provision for sanitary inspection of the school grounds and buildings, the School Code continued a custom that had been in force in the rural districts of the Commonwealth since 1907, the specific provision in the Code reading as follows:

"The medical inspector shall, at least once each year, and as early in the school term as possible, make a careful examination of all privies, water-closets, urinals, cellars, the water supply, and drinking vessels and utensils, and shall make such additional examinations of the sanitary conditions of the school buildings and grounds as he deems necessary, or as the regulations of the State Department of Health, or the rules of the board of school directors or of the local board of health require. He shall see that the laws of the Commonwealth relating to the health and sanitation of the public schools and the requirements of the public schools and the requirements of the local board of health are complied with."

In compliance with this provision of the Code, a sanitary survey form was designed that combined the best features of former blanks, some features of forms used in other communities and some of the features of the Sanitary Index, designed by Dr. Hoag of Berkley, California. (The particular form in use at the present time in our schools is available at the Department's Exhibit.) The form in use at the present time requires the Inspectors to make particular notes in regard to the air space; floor space; lighting surface; cleanliness and methods of cleaning of all rooms in the building; special notes relative to the ventilating system, whether by mechanical apparatus or by means of windows; window shades; the heating and operating of the heating devices; condition of the basement; most careful inquiry into the water supply of the school, including the handling of the water in the room itself; use of drinking cups, fountains, etc.; the condition of the grounds in the vicinity of the school buildings; and careful examination of the school water closets and the disposition of waste from them.

A surprisingly large number of the schools of Pennsylvania, I regret to say, are not in a sanitary condition. In fact, only about one-half the country schools have a suitable amount of air space and floor surface. About 14 per cent. of these schools have deficient lighting surface; that

Form 61—A.

School, ____________________

Township, ____________________

Borough, ____________________

County, ____________________

COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF HEALTH.

SANITARY SURVEY OF SCHOOLS.

____________________ Principal or Teacher

____________________ P. O.

____________________ Sec. of Board.

____________________ P. O.

	Room 1.	Room 2.	Room 3.	Room 4.	Room 5.	Room 6.	Room 7	Room 8.	Room 9	Room 10.	Room 11.	Room 12.
I. SCHOOL BUILDING. No. of rooms in building?												
1. Number of square feet of floor surface in each room?												
2. Number cubic feet to each room?												
3. Number occupants in each room?												
4. Number square feet floor surface per pupil?												
5. Number cubic feet of air space per pupil?												
	Yes or No.	Yes or No.	Yes or No.	Yes or No.	Yes or No.	Yes or No.	Yes or No.	Yes or No.	Yes or No.	Yes or No.	Yes or No.	Yes or No.
6. Are rooms clean? Answer Yes or No, for each room												
7. Is saw dust or other substance used with a disinfectant before sweeping?												
8. Has dry dusting been absolutely abandoned?												
9. Does light enter in front of seated pupils?												
10. Does light surface equal 20 per cent. of floor surface?												
11. If pencils or pens are collected are they redistributed so as to insure each pupil getting his own?												

12. Is "Plenum" or other system of artificial ventilation used?		20. Is cold air admitted at the stove?	
13. Is it in good working order?		21. Are efforts made to keep air of room moist?	
14. Are some windows always open if the system is not in full operation?		22. Are dustless crayons used?	
15. If no artificial system of ventilation is used are some windows always open from top or bottom?		23. If modern heating device is used, is it a direct heating system?	
16. Are ventilation boards used under lower sash?		24. If indirect heating system is used, do cold air ducts receive air remote from lavatories and water closets?	
17. Are windows open during recess?		25. Are adjustable seats used?	
18. Are yellow or linen colored shades used?		26. If seats are not adjustable, are foot-stools provided for children whose feet will not touch floor?	
19. If room is heated with stove is stove jacketed?		27. Is a well ventilated, clean, dry cloak room provided?	

Note.—The School Code requires 15 square feet of floor space and 200 cubic feet of air space per pupil in modern buildings. Where no ventilating device is available, at least 300 cubic feet should be provided for each pupil. Dry cleaning, the use of the feather duster or of the common drinking cup, should always be condemned. Pencils must never be exchanged.

SANITARY SURVEY OF SCHOOLS

II. HALLS, ETC.	Yes or No.
1. Are the halls clean?	
2. Are they well lighted?	
3. Are they well ventilated?	
4. Has the roller towel been abolished?	
5. Do the exit doors open outward?	
6. Are stairs wide and straight?	
7. Are exits free from obstruction?	
8. Are iron fire escapes provided?	
9. Are fire drills conducted regularly?	
III. BASEMENT.	
1. Is the basement clean and dry?	
2. Is the plumbing modern?	
3. Is the basement well ventilated?	
IV. WATER SUPPLY (Answer 1, 2 or 9).	
1. Does the school have its own local water supply?	
2. Is water secured from nearby premises?	
3. Is it apparently pure?	
4. Is it protected from surface drainage	
5. Is it free from cesspool, privy vault or manure drainage?	
6. Is water stored in a covered container?	
7. Does container have spigot at bottom?	
8. Is the container scalded daily?	
9. Is a fresh supply secured each session?	
10. Is a public water supply used?	
11. Are sanitary drinking fountains provided?	
12. Have common drinking cups been abolished?	
13. Are individual drinking cups provided?	

V. GROUNDS.	Yes or No.
1. Are play-grounds adequate in size for number of pupils?	
2. Are they well drained?	
3. Is there evidence of ground pollution? (Is urine or feces deposited on the surface of the ground.)	
4. Is garbage properly destroyed?	
5. Are there accumulations of manure or other refuse in vicinity of school grounds?	
VI. SEWAGE DISPOSAL. (Answer 1 to 9 or 10 to 15 inclusive).	
1. Are separate privies provided for each sex?	
2. Are they in good repair?	
3. Are the approaches tightly screened?	
4. Are they clean?	
5. Are deep vaults provided?	
6. Are vaults water tight?	
7. Is surface drainage excluded from privy contents?	
8. Is lime or other disinfectant used?	
9. Are vaults or cesspools filled within one foot of the top?	
10. If modern flush closets are provided, do they discharge into a public sewerage system?	
11. Are they clean?	
12. Do they discharge into cesspools?	
13. Do they discharge into stream?	
14. Are fixtures properly trapped?	
15. Are soil pipes carried through roof?	
Remarks:	

____________________ M. D.

____________________ P. O.

____________________ 191

is, less than 20 per cent. of the floor space. The majority of them admit light from both sides of the room and in front of all pupils seated in the rear of the room. Sixty per cent. of these schools use no preparation on the floors to prevent dust arising while cleansing the rooms, the majority of them using dry sweeping and dry dusting. In about thirty per cent. of the schools heated by stoves the jackets are not in use. In about one-third of the rural schools without ventilating apparatus rational flushing was used during recess. In a majority of the single room buildings dark green shades were used to exclude the light, meaning of course too much exclusion or too much light. In not quite one-fourth of the rooms heated by stoves was the air admitted at or near the stove. In about one-half of the schools using towels the roller towel was found in use. One-half of the schools have their doors opening inward instead of outward. The majority of the schools have their own water supply, usually wells or springs, and in more than ninety per cent. of the schools a fair degree of protection of the source of supply is maintained, although in nearly half the cases a dangerous menace existed in the form of a neighboring privy or in the waste disposal from the school itself, the human filth accumulating in dry wall closets within less than a hundred feet of the source of water supply, either on the school premises or on neighboring premises. In from seventy-five to eighty per cent. of the rural schools drinking water was found in containers without covers and in a very large percentage of the schools the public drinking cup is still in use. In a vast majority of the schools of Pennsylvania separate privies are provided for both sexes, but in five per cent. of the schools these privies are in bad repair and in more than ten per cent. of the schools, are not kept in a clean and sanitary condition; that is, in a decent condition for the use of pupils.

Probably at times the fault lies with the teacher, at other times with the directors in not providing locks on the doors so that the public tramps, vagabonds or anyone may use the closets that the pupils are required to use at school. In less than twenty-five per cent. of the schools did we find lime or other antiseptic used to disinfect and deodorize the contents of privy vaults.

Some amusing things occurred in connection with the sanitary inspection of the rural schools. It may surprise you to know that in one district where the parents complained to us that no privies or outbuildings were provided, the secretary of the School Board admitted to us in writing that they had not provided such a building, explaining that the school house was new and as there were several acres of timber land nearby, they thought the children could get along very well by using the woods. I am sure this Congress would expect a pretty sharp reprimand from the health authorities when a school director showed such little decency as to allow his own child, along with his neighbors to expose themselves in the woods with perhaps other pupils gaping at him while attending to nature's needs. We not only reprimanded the Director, but urged the parents to seek a remedy at law by appealing to the Court and proceeding against the Board for malfeasance in office.

Some of the school boards felt that our standards were too high and objected to medical inspection because of standards implied in the survey form and made mandatory by the School Code. In the Act, provision is made for the light area to equal 20 per cent. of the floor area, and for each pupil to have 15 sq. ft. of floor surface and 200 cu. ft. of air space, the provision of course referring to new buildings or those that are about to be remodeled. In our communication to the Board after the inspection was made we forwarded a letter calling particular attention to all unsanitary conditions found, pointing out the specific defects in groups and sent a complete copy of the sanitary inspection with the letter, the letter reading as follows and bearing on the back of it the particular extracts from the school law:

DEPARTMENT OF HEALTH
HARRISBURG, PA.

........................191..

MR....................................
Secretary School Board,
....................................District.

Dear Sir: The water supply, the lighting facilities, the methods of cleaning, the methods of heating and ventilating in school buildings and the conditions of the water-closets, privies and the grounds, are made the subject of sanitary inspection by the State Department of Health.

The water supply for your schools should be free from any possible surface pollution, and from menaces located on a higher level, such as privies and barnyards. In........ of your schools a safer supply should be provided. Individual drinking cups should be provided for the pupils in all schools not having a public water supply and the drinking supply should be kept in a covered vessel, preferably with spigot at the bottom, and the vessel should be scalded every day and a fresh water supply secured for every session. These precautions are not being observed in..............of your schools. Where public water supplies are available bubbling fountains should be installed.

Dry cleaning should never be practiced in any school room. This custom is being followed in................of your schools.

Article VI, Section 618 of the new School Code provides that the lighting surface should be at least 20% of the floor surface, and that light shall not be admitted in front of the seated pupil. In..............of your schools the lighting surface is less than 20% of the floor space, and in..............of your schools light is admitted in front of the seated pupils.

Article VI, Section 619 of the School Code requires that where a common heating stove is used, it shall be incased with a shield or jacket. The stoves in use in........ of your schools are not so incased.

Article VI, Section 632 provides that not less than two water-closets shall be provided for each school building where both sexes are in attendance. Where such closets are detached from the school building, entrances shall be screened; if situated near each other the approaches shall be screened by a partition, wall or fence not less than 7 feet high. This section is being violated in..............of your schools.

Article VI, Section 633 provides that water-closets shall be kept in a clean and sanitary condition and dry slaked lime or other disinfectant shall be used. In....... of your schools the water-closets are not in a sanitary condition.

In..............of your schools the grounds show evidence of pollution from human waste. Your attention is called to this condition because of the opportunity for children to carry such filth into school rooms on their shoes.

Yours respectfully,

SAMUEL G. DIXON.

N.B.—Enclosure—Copy of Inspector's report of the schools in your district.

EXTRACTS FROM SCHOOL CODE.

Article VI. Section 601. The board of school directors of each district shall provide the necessary grounds and suitable school buildings to accommodate all the children between the ages of six and twenty-one years, in said district, who attend school. Such buildings shall be constructed, furnished, equipped, and maintained in a proper manner as herein provided, suitable provisions being made for the heating, ventilating, and sanitary conditions thereof, so that every pupil in any such building may have proper and healthful accommodations.

Article VI. Section 618. All school buildings hereafter built or rebuilt shall comply with the following conditions:

In every school room the total light area must be equal at least twenty per centum of the floor space, and the light shall not be admitted thereto from the front of seated pupils.

Every school room shall have not less than fifteen square feet of floor space, and not less than two hundred cubic feet of air space per pupil.

Article VI. Section 619. No board of school directors in this Commonwealth shall use a common heating stove for the purpose of heating any school room, unless such stove is in part enclosed within a shield or jacket made of galvanized iron, or other suitable material, and of sufficient height, and so placed, as to protect all pupils while seated at their desks from direct rays of heat.

Article VI. Section 620. No school room or recitation room shall be used in any public school which is not provided with ample means of ventilation, and whose windows, when they are the only means of ventilation, shall not admit of ready adjustment both at the top and bottom, and which does not have some device to protect pupils from currents of cold air. Every school room or recitation room shall be furnished with a thermometer.

Article VI. Section 621. Every school building hereafter erected or reconstructed, whose cost shall exceed four thousand dollars ($4,000.00), or which is more than one story high, shall be so heated and ventilated that each school room and recitation room shall be supplied with fresh air at the rate of not less than thirty cubic feet per minute for each pupil, and which air may be heated to an average temperature of seventy degrees Fahrenheit during zero weather.

ARTICLE VI. Section 622. All school buildings, two or more stories high, hereafter erected or leased in any school district of the first class in this Commonwealth shall be of fireproof construction; and in any school district of the second, third, or fourth class, every building more than two stories high, hereafter built or leased for school purposes, shall be of fireproof construction.

ARTICLE VI. Section 623. All doors of entrance into any building more than one story high, used for a public school building in this Commonwealth, shall be made to open outward, and the board of school directors of every district in this Commonwealth shall, before the opening of the school term next following the approval of this act, change the entrance doors of every such school building so that they shall all open outward.

ARTICLE VI. Section 624. In all school buildings more than one story high, hereafter erected, all entrance doors, as well as all doors from class rooms, school rooms, cloak rooms, or other rooms into halls, shall open outward.

ARTICLE VI. Section 625. Every school building shall be provided with necessary fire-escapes and safety-appliances as required by law.

ARTICLE VI. Section 626. The board of school directors in each school district shall put the grounds about every school building in a neat, proper, and sanitary condition, and so maintain the same, and shall provide and maintain a proper number of shade-trees.

ARTICLE VI. Section 632. The board of school directors in every district shall, with every building used for school purposes, provide and maintain in a proper manner, a suitable number of water-closets or outhouses, not less than two for each building, where both sexes are in attendance. Such water-closets or outhouses shall be suitably constructed for, and used separately by, the sexes. When any water-closets or outhouses are outside and detached from the school building, the entrances thereto shall be properly screened, and they shall, unless constructed at a remote distance from each other, have separate means of access thereto, and, if possible, for not less than twenty-five feet from such water-closets or outhouses, such means of access or walks leading thereto shall be separated by a closed partition, wall, or fence, not less than seven feet high.

ARTICLE VI. Section 633. The board of school directors shall keep all water-closets or outhouses, used in connection with any school building, in a clean and sanitary condition, and shall, not less than ten days prior to the opening of any term of school, and oftener if necessary, have them properly cleaned and disinfected by the use of fresh dry-slaked lime, or other proper disinfecting material.

It was encouraging in some districts to find that the school authorities agreed with the framers of the law that what is required for new buildings and reconstructed buildings is also good for old buildings so that in one district in Warren County our Inspector reported after his first examination and our letter that all buildings had been changed throughout the district, his letter to us reading as follows:

"*Dear Sir:*

As school inspector for Pine Grove Township (Warren County), I would like to make a special report in regard to the improvement made by the Pine Grove School Board since the inspection last year. These improvements are:

1. Use of 'no dust' sweeping,
2. Abolishment of dry dusting,
3. The placing of additional windows in each schoolhouse to comply with 20% law,
4. Window boards,
5. Jackets around stoves,
6. Pan water on each stove,
7. Placing stools in each room as necessary,
8. Two new ventilation stoves,
9. Paper towels in all rooms,
10. Changing doors to open outwards,
11. Installation of stand water-crocks with spigot at bottom—covered,
12. Individual drinking cups,
13. Screening and repairing closets,
14. Liming closets,
15. Cleaning closets and grounds,

Involving in all about $500 expenditure.

I believe that a good strong letter of recommendation to Mr. Chas. A. Clark, Secretary School Board, Pine Grove Township, Russell, Pa., would help much in showing the community just what has been done and the value thereof."

In another community the sanitary inspection was delayed a little while until the Directors could meet the modern requirements of the Code and make changes that were held under advisement for several years previously. A letter from the Examiner in this school district is also worth reproducing:

"*Sir:*

I am forwarding reports of the medical inspection of the (—————) Schools under separate cover. The delay in sending in these reports was occasioned by the request of the Board of Education desiring time to study them and meet the advanced requirements of modern hygiene.

Paper towels have this day been installed, dry dusting has been abolished, and contracts let for the sanitary drinking fountains.

These essentials it was impossible to get until confronted by this Sanitary Survey of the Schools.

Respectfully submitted.

November 22, 1912."

Even in some of our Normal schools were found lacking in certain sanitary particulars, one school, I will not mention it by name, made a hurry-up contract with a plumber and installed drinking fountains during the few days that the Inspector was examining the pupils so that in this requirement they might get a hundred per cent.

With results before us such as have been accumulated it is certainly encouraging to health authorities and school authorities to fix high sanitary standards and to make inspections from time to time to see that they are being carried out. It is just as essential that the country boy and country girl be given healthful sanitary surroundings in school as it is for the city boy and city girl. It is just as essential that they be taught obedience to law as that they should be taught to read and write and be given a knowledge of arithmetic, etc. In sanitary matters in rural schools we are greatly handicapped by the lack of sanitary information on the part of the School Directors and it is only by faithful attempts to educate the Directors and parents that we can hope to secure for the pupils all of that protection which the framers of the school laws of the country hope to secure for them.

SCHOOL MEDICAL INSPECTION IN RURAL DISTRICTS OF PENNSYLVANIA

BY

SAMUEL G. DIXON

Medical inspection of rural school children was first undertaken by the State Department of Health of Pennsylvania during the spring of 1910, trial inspection being made in 657 rural schools located in the second-class townships of Cumberland, Dauphin and Lancaster Counties reaching 14,434 students. State-wide inspection of rural school children was not undertaken, however, until the fall of 1911 and was done in compliance with Article 15 of the new School Code of Pennsylvania, adopted on the 18th of May of the same year.

The School Code provides for compulsory medical inspection of all pupils attending the public schools at least once each year, except in districts of the third and fourth-class where the School Directors may elect to have no such inspection. In third-class districts such resolution must be adopted before August 1st, and in fourth-class districts the resolution must be adopted and the Commissioner of Health notified prior to July 1st, in order to be effective for the ensuing year. Further, the expense of inspection in a first, second and third-class district is to be borne by the district itself and in a fourth-class district by the State Department of Health. I may say incidentally that first-class districts include cities having a population greater than 500,000. There are two such districts in the state. Second-class districts include municipalities having more than 30,000 and less than 500,000 population. There are fourteen such districts in the Commonwealth. The third-class districts include boroughs and cities of the third-class and densely populated townships having a population of from 5,000 to 30,000. There are 188 of these districts. Districts of the fourth-class include all townships and organized boroughs having a population less than 5,000. These districts total 2,366.

In the districts of the first and second-class where medical inspection is mandatory or in third-class districts where it is optional and resolutions are not passed against it prior to the time fixed by the Code—and an Inspector is not appointed within thirty days after the beginning of the school term—the Commissioner of Health is required after written notice to appoint qualified Inspectors, fix their compensation, the expense of which must be paid by the school district.

The School Code further provides that special attention be given to defective sight, to defective hearing and other disabilities to be determined by the Commissioner; and also provides that written reports shall be sent to the parents through the teacher concerning all pupils found to need medical or surgical attention. The Medical Inspector is also required by law to make a careful sanitary inspection of all privies, water closets, urinals, cellars, water supplies, drinking vessels and utensils, and to make any such additional examinations of the sanitary condition of the school buildings and grounds as he deems necessary or as the regulations of the State Department of Health or the rules of the Board of School Directors or of the local Board of Health require.

School Medical Inspectors are required by law to have had two years' experience in the practice of medicine.

In order to comply with the provisions of the School Code it was necessary to appoint a large staff of medical men (for the term of 1912-13, 871), to instruct them in the work, and to design special forms for use in noting their findings while examining pupils and in making the sanitary survey of the school grounds and school buildings. The whole scheme of work had to be planned with due regard to thoroughness and to the varying needs of school districts located entirely within small towns and to others located entirely in the country. We had also to keep in mind that in these districts the public were not yet fully educated concerning medical inspection and that we could go just a little way in advance of public education without meeting antagonism that might cripple the work. In our examinations for the sessions of 1911-12 and 1912-13, a blank form was used, which is here reproduced.

You will note that provision was made for certain identification records relating to the school itself, teacher, district, etc.; and for listing the name of the pupil, the name of the parent or guardian, the age, sex, color and the nativity of the pupil; and in columns space was provided for recording the vision of each eye separately after testing with Snellen's card; for noting any defects or scars on the cornea or inflammatory conditions about the lids; provision was made for recording the hearing of each ear after they were separately tested. In testing hearing we preferred to use a whisper at a distance of twenty feet. We purposely avoided the greater refinement of noting the tick of a watch or the sound from a tuning fork because we felt that the defective pupil who fails to appreciate what is said by the teacher or by the reciting pupil is the one that we first want to reach and correct and that this test is more certain in locating the defects noted by teacher and pupil than are the more refined tests. If any otorrhoea was present it was noted. A note was made as to the method of breathing, whether there was slight impairment of nasal breathing, serious impairment or whether mouth breathing was noted and if in addition to any obstruction to breathing a catarrhal

FORM 51.

COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF HEALTH,

MEDICAL INSPECTION OF SCHOOLS.

School.................................... Grade......... ....Borough ....Township...County...

Teacher...P. O..Enrollment.....................No. Examined...... ....

Sec. School Board ....P. O...No. Defective...... .... No. Normal....................

Name of Pupil	Name of Parent or Guardian	Age	Sex		Color		Nativity		Vision Tests				Hearing Tests				Breathing Tests	Teeth	Tonsils	Cerv. Glands	Tuberculosis				Nervous Dis.	Skin Disease	Head Lice	Deformities	Nutrition	Remarks
			M	F	B	W	US	F	R	CD	L	CD	R	OT	L	OT					Lungs	Glands	Bones	Joints						

Corneal Defects. Slight (1) Serious (2) Blindness (3)

Otorrhoea. Slight (1) Profuse (2) Offensive (3)

Breathing Tests. Slight Impairment (1) Serious Impairment (2) Mouth Breathing (3)

Teeth. Unclean (1) Decayed (2) Diseased gums (3)

Tonsils. Slightly Enlarged (1) Greatly Enlarged (2) Acutely Inflamed (3)

Nervous Disease. Chorea (1) Epilepsy (2)

Head Lice. Nits (1) Lice (2)

Nutrition. Fair (1) Poor (2)

discharge or adenoid facies was found a probable diagnosis of adenoids was given. The teeth were carefully examined and a note was made whether they were dirty, decayed or whether the gums were diseased. Tonsils were examined and if enlarged or inflamed a record was made of it, a similar record was made for the condition of the cervical glands and for any evidence of tuberculosis of the lungs, glands, bones or joints. In nervous diseases we only noted the presence of chorea or epilepsy, any one of the various skin diseases that are remedial or communicable were recorded and if communicable, provision was made for school exclusion. A careful examination was made of the hair of all pupils and if lice or nits were present those with infected heads were excluded until treatment was given, and finally notes were made concerning the presence of deformities and the general nutrition of the child.

It requires a great deal of tact on the part of an examiner to work successfully in many of the fourth-class districts, especially if the teacher is not thoroughly in accord with the work or if the pupils are a little nervous and excited and not quite willing to give hearty coöperation and to have the examiner succeed in locating all defects that should be noted. It is altogether probable that at times errors occurred.

As rapidly as these reports reached the Department letters were sent in duplicate to the teacher. The letters were for the most part printed in blank, worded about as follows:

"*Dear* ——————

You are hereby notified that the examination of ——————————, made by the Department of Health's Medical Inspector of Schools, apparently shows that——————has some affection of the —————— and we would advise you, for the good of the child, to consult your family doctor relative to treatment.

Yours very truly,

SAMUEL G. DIXON,
Commissioner of Health."

The letters relating to remedial defects were all in duplicate, the teacher's copy containing a note asking her to return it to us at the end of the session with a report of treatments if any were given and her impression of the results.

In sending letters to the parents we were careful to call attention to every defect found, even though it were not more serious than dirty teeth. Our object in going so far in communicating with parents was that we preferred to arouse just a little agitation in the school district and a good deal of discussion as to the reasons for cleansing the teeth and for attention to small matters in personal hygiene. We believed that if in each school district the children, as well as the parents were somewhat aroused by these letters that not only the parents and pupils, but the teachers themselves would be more likely to take an active interest in oral hygiene.

At the end of the session when the teachers forwarded their reports it was not an uncommon thing to find notes that every pupil in their school now used a tooth brush at least once a day, that a very large percentage of the pupils having defective vision were now wearing lenses, that a number of those having enlarged tonsils or adenoids had been improved by operation, that the general health of the pupils had improved and that infested heads were rapidly becoming a thing of the past.

The School Code was not in general circulation among the School Boards of Pennsylvania until the middle of the summer of 1911. A number of the fourth-class district Boards were not fully advised as to who would bear the burden of expense of inspection and unfortunately the League of Medical Freedom, an organization largely responsible for the optional clause in the Code giving third and fourth-class district boards the right to reject inspection, were very active so that out of the 2,366 districts some 1,500 elected the first year to have no inspection. In the 750 districts inspected in 1911, however, we reached a total of 3,572 school buildings and examined 145,500 pupils.

A year later when the school authorities were more fully acquainted with the provisions of the Code the same agitation on the part of the League of Medical Freedom having been kept up, twice this number of districts, about 1,500, were convinced that school inspection was worth having and passed no resolutions against it. More than 300,000 pupils were examined. For the coming school year 1,831 out of the 2,366 districts will receive medical inspection and in all of the remaining districts a sanitary inspection will be made by the Department's Health Officers.

To do this work in the rural districts of Pennsylvania will require one thousand doctors at an estimated cost of $100,000 a year. The entire organization is being handled by the Division of Medical Inspection of the Department and a corps of clerks.

The writing of letters to parents and the tabulation of the statistics of such a large piece of work is in itself a heavy task. In tabulating the statistics we adopted the United States Census office system of tabulation using a punch card together with the automatic counter and tabulator.

Some of you will be sufficiently interested in this method of tabulation to inspect the forms and see the tabulated data displayed in the Department's Exhibit. I may say in passing that this method of tabulation is the only one with which we are familiar that makes it practicable to show the relation or the association of defects in groups, as for instance the percentage of children having adenoids in association with defective hearing, the percentage having enlarged tonsils or decayed teeth with

Form of punch card (full size) used by the Department of Health in tabulating the results of the Medical Inspection of Schools in Pennsylvania

PHYSICAL INSPECTION

Cty.				Co.		Yr.	12 Mo 11	Age		SX	CL	NT	N D	VISION R	C D	L	C D	HEARING R	OT	L	OT	BR	TH	TL	CG	T. B. LG	GL	B	J	NV	SK	HL	DF	NU	Q D	E D								
0	0	0	0	0	0	20	10	0	0	0 M	0 W	0 US	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	21	1	1	1	1 F	1 B	1 FOR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	12	2	2	2	2	2 OT	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	14	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	15	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	16	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	17	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	18	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	19	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

enlarged cervical lymphatic glands or bad teeth with defective nutrition, etc.

We are so well pleased with the punch card system of tabulation that we have concluded to adopt triplicate punch cards to be used in the school room by the examiner. The object in trying to plan a triplicate card is that the one copy may become the permanent copy of the school, this card to follow the child from year to year through school life; the duplicate to remain in the possession of the teacher until the end of the year, when it is to be forwarded to the Department with her notes as to results of treatment; the third copy to come to this Department for our alphabetical files as soon as the inspection is made. Subsequent inspections would provide for the same system with a matching of the cards both in the hands of the teacher and in the Department. In this way we could follow each individual pupil throughout his school course At the present time, these cards are not completed, although we had hoped to have them here for your inspection. They are so nearly completed that with the consent of the Secretary of the Congress I will have them reproduced with this paper.

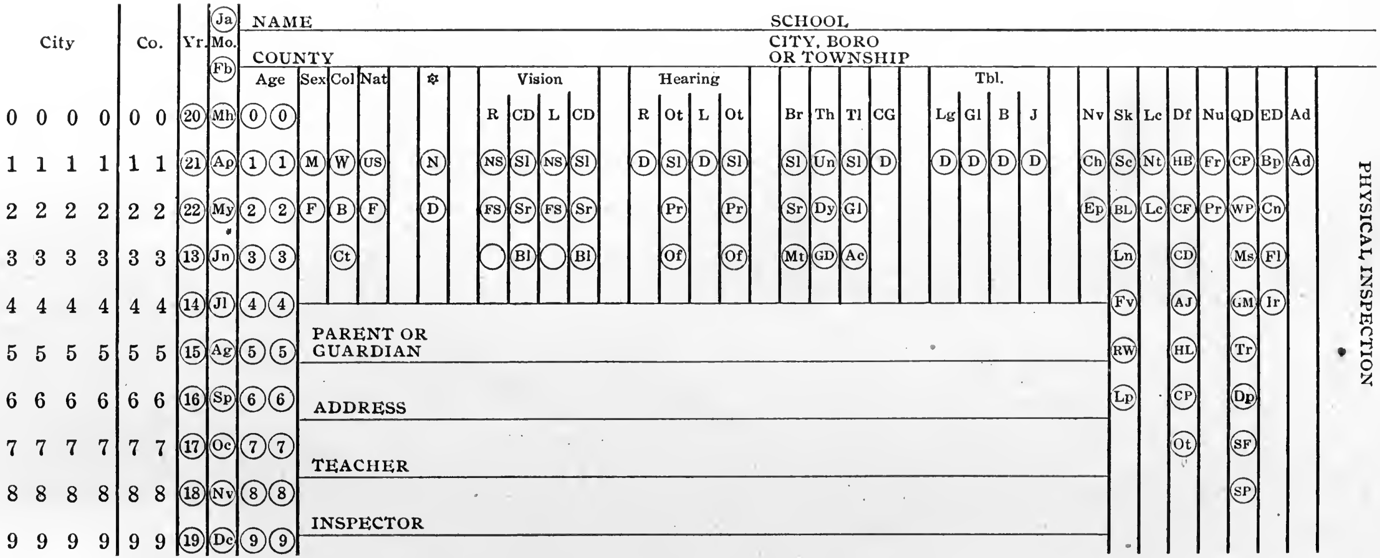
School medical inspection in the rural districts of Pennsylvania has not shown the rural children to be any freer of the weaknesses and frailties incident to school children than is noted in the larger cities. In fact, the percentage of visual defects, defects of hearing, defects noted about the nose and throat and cervical glands are just about as common in the country as in the city. A detailed study of the statistics of Pennsylvania's rural children will be presented in another session of this Congress, hence I need not dwell upon it here.

In addition to the routine Medical Inspection as outlined in this discussion and in the forms used, a complete sanitary survey was made of each school premises, a report of these sanitary investigations being the subject of another paper to be read by title only.

Section 1413 of the School Code, reading as follows:

"It shall be the duty of the county or district superintendent, attendance officer, or secretary of the board of school directors, in every school district in this Commonwealth, to report to the medical inspector of the school district every blind, deaf, or mentally deficient child in the district, between the ages of eight (8) and sixteen (16) years, who is not being properly educated and trained. The medical inspector of the school district shall examine such child, and report to the board of school directors whether it is a fit subject for education and training, If the child is reported to be a fit subject for education and training, but cannot be properly educated and trained in the public schools of the district, the board of school directors shall secure for it proper education and training: Provided, That when it is necessary to educate or train such children outside of the public schools, their parents or guardians shall, if able to do so, pay to the district the expense necessarily incurred by it in educating and training the

New form of punch card (full size) to be used by the Department of Health in collecting, recording, and tabulating the results of the Medical Inspection of Schools in Pennsylvania



same: And provided further, That any child who is reported by the medical inspector of the school district not to be a fit subject for education and training shall be exempt from the provisions of this act."

places upon the Department additional duties. We have not found it advisable at the present time to plan for expert opinion as to mental defect, being guided by the general family practitioner in his opinion as to the desirability of special education. In comparatively few instances has this provision of the Code been put in force; the school authorities seemingly overlooking its provision but we hope later to have valuable statistics, both as to number and location of the feeble-minded through its better enforcement.

We are not yet satisfied that we have reached the ideal Medical Inspection but from this beginning in a common-sense and practical way we hope gradually to convince the public of its usefulness and efficiency and lead on to a more complete system and to develop through the present Medical Inspector's corps a very much higher type of organized work than is now practicable or desirable.

A great deal more will eventually be done in the diagnosis of early deformities due to defective posture and advice will likely be given as to methods of correction. Much future work of the inspection will deal with mental and physical fatigue and methods of overcoming both by recreation and change of program.

The future inspector will eventually deal with the kinds and size of type used in text books; he will deal in a more extensive way with ventilation and scientific problems of lighting than is now done and, through his coöperation with the health authorities, deal more extensively with the contact infection and carrier cases in schools and through the assistance of school nurses will secure satisfactory follow-up reports.

Probably the present type of inspection will be received so kindly that at some future time the inspector will deal with all forms of school recreation and with the teaching of hygiene and preventive medicine in the school and in a supervisory way deal with the school lunch problem. These higher ideals in Medical Inspection of rural schools of course will not be reached until long after they have been adopted in large municipalities but they are bound to come at some time in the future.

DISCUSSION OF

SAMUEL G. DIXON'S PAPER

BY

ALEXANDER C. ABBOTT, M.D.

The system of medical inspection throughout the rural districts of Pennsylvania, as outlined in the paper we have just heard, is cause for pride on the part of the citizens of that State. It was made possible through a change in the administration of State health matters authorized by act of Assembly in 1905.

Previous to that time there was a State Board of Health and numerous town and borough Boards having no affiliation one with another, and no fixed responsibility to a central controlling and directing power. The result was as might have been expected: in some districts school inspection and other measures for safeguarding the public health were in satisfactory operation; in others such was not the case.

Systematic school inspection throughout the rural districts of the State developed as part of the regular functions of the newly created Health Department of the State Government.

That which has been accomplished in Pennsylvania we believe to be worth while. We also know that it could not have been done under the former methods of administering public health affairs.

I am of the opinion that it can be done in any other State that will centralize authority and responsibility and not depend upon the whims of loosely affiliated city, town and borough Boards of Health.

HYGIENE IN THE PHILIPPINE SCHOOLS

BY

Allan J. McLaughlin

Practical hygiene is taught in the Philippine schools even in the lower grades. In this country we are prone to overlook the enormous influence of school children upon the hygiene of the home. The children of poor, ill-educated parents are often the intermediary through which the simple gospel of hygiene and disease prevention reaches the parents. In the Philippines this is even more true, and in many instances it is only because of the children that the parents carry out the instructions of the health officer.

In combating cholera we were not slow to take advantage of the schools. A cholera circular containing the simple facts of the spread and prevention of cholera was used as a catechism even in the elementary grades. The children recited the answers daily, and in times of actual epidemic this teaching took precedence over all other studies and was supplemented by actual demonstration of hand cleansing and disinfection.

With an epidemic of contagious disease existing, there is a tendency in most communities to close the schools. In the Philippines on the contrary, it is the policy of the Bureau of Health to keep the schools open because of their extraordinary value in teaching the precepts of disease prevention. They were used in cholera epidemics as demonstrating stations where the children were taught how to protect themselves and their parents against cholera. The same principle is used in combating tuberculosis, hookworm, dysentery, and beri-beri. The children are taught how these diseases are contracted and how they may be prevented.

The modern Philippine school building is a model of construction, adapted to the tropics. There is no heating problem in the Philippines and as a consequence ventilation is very much simplified. Water supply and sewage disposal are directly under the control of the Bureau of Health. The pupils are specially trained in the necessity of thorough hand cleansing after using the toilet and before eating. The children have been used also to eliminate the time honored Filipino custom of eating with the fingers out of one common family dish.

The dense ignorance of sanitary principles and the Oriental fatalism of the older generation could not be successfully combated without the aid of the school children. With their aid a very great improvement has been effected.

There is now in Manila a very efficient medical inspection of schools. This is particularly effective because of the splendid facilities of the Bureau of Health for giving medical treatment. The city is divided into health districts with free dispensaries and hospitals where the school children are treated. In this country the health department can often do no more than recommend treatment. In Manila the child is reported to the Bureau of Health and the powers and organization are such that control is easily maintained until the child is returned to school cured. Special attention is paid to the teeth of children and these are treated in the free dental clinics of the Philippine General Hospital. During the school year ended March 29, 1912, in Manila over 2,400 children were referred to the hospitals and dispensaries of the Bureau of Health for treatment.

The effect of the teaching and practice of hygiene in the Philippine schools is not only manifest in the improved physical condition of the pupils but is a powerful instrument in the sanitary regeneration of the Filipino people.

L'ORGANISATION DE L'INSPECTION MÉDICALE DES ÉCOLES AU BRÉSIL

PAR

CLEMENTE FERREIRA

L'important service d'inspection médicale des écoles et des écoliers, qui fonctionne avec tant d'éclat dans la plupart des pays de haute civilisation, n'a commencé que tout récemment au Brésil.

Ce complement indispensable de l'appareil scolaire n'existe chez nous que dans les départements plus avancés de notre patrie—aux Etats de Sao Paulo et Minas Geraes et dans la capitale de l'Union—Rio Janeiro.

A Rio Janeiro remonte à la fin de 1909 la première étape dans l'organisation de l'inspection médicale des écoles, et c'est au Préfet municipal, M. le dr. Serzedello Correia, que l'on doit cette utile initiative. En Septembre 1909 il a envoyé au Conseil municipal un message dans lequel il accentuait l'avantage d'être inauguré le service d'inspection sanitaire scolaire, et le 6 Octobre de la même année il nommait une commission de médecins, pédiâtres, pédagogues et hygiénistes, en les chargeant d'étudier la question et de présenter un rapport complet et bien fait pour l'orienter dans l'organisation de l'important service.

Cette commission s'est réunie à plusieurs reprises et a élaboré un projet de loi, qui a été soumis à une large discussion au sein de ses membres. La rédaction finale a été la suivante:

Art. 1. Il est créé le service d'inspection sanitaire scolaire, subordonné à la direction générale d'hygiène et d'Assistance Publique.

Art. 2. L'inspection sanitaire scolaire a pour but:

a) la surveillance hygiénique des écoles et du mobilier scolaire;

b) la prophylaxie des maladies transmissibles et évitables;

c) l'inspection médicale des écoliers et du personnel;

d) l'éducation sanitaire des écoliers et des maîtres;

e) la systématisation et le contrôle de l'éducation physique scolaire.

Art. 3. La surveillance hygiénique des bâtiments et du mobilier scolaire sera faite au moyen de visites périodiques, portant sur les conditions hygiéniques des locaux et des bâtiments, dans le but de solliciter des autorités compétentes les mesures nécessaires.

Art. 4. L'inspection sanitaire des élèves et de tout le personnel scolaire sera faite au moyen de visites périodiques aux écoles, avec l'examen de l'état de santé général des écoliers et du personnel scolaire, en soumettant à l'exploration clinique ceux qui paraîtront suspects ou seront séparés comme tels par le directeur ou instituteur.

§1° Quand dans cet examen il sera vérifié un cas de maladie transmissible chez un écolier ou chez le personnel scolaire, on en défendra la permanence à l'école ou dans l'Institut et il ne lui sera permis de revenir avant qu'un nouvel examen aura démontré sa guérison complète.

§2° Lorsque cet examen décelera une maladie transmissible, l'administration de l'établissement en donnera avis aux parents, gardiens ou intéressés, afin que les écoliers atteints soient convenablement soignés.

§3° Le directeur de l'enseignement recevra toujours un avis préalable de ces visites.

Art. 5. La prophylaxie des maladies transmissibles et évitables aura lieu au moyen de l'inspection médicale des élèves suspects; on adoptera les mesures prophylactiques nécessaires d'accord avec les lois et réglements en vigueur.

Art. 6. Les providences auxquelles ont trait les articles 3, 4 et 5 s'étendent à toutes les personnes qui demeurent ou restent à l'établissement.

Art. 7. L'inspection sanitaire scolaire prendra les mesures qui deviendront nécessaires en vue de favoriser la divulgation des précepts et notions d'hygiène élémentaire, spécialement en ce qui concerne la prophylaxie des maladies transmissibles et évitables.

Art. 8. L'inspection sanitaire scolaire s'efforcera pour que dans les écoles et Instituts municipaux l'éducation physique soit effective et obéisse à une orientation scientifique, en la systématisant dans le sens de favoriser le développement physique et psychique des écoliers.

Art. 9. Il est créé le carnet sanitaire obligatoire pour les écoliers des écoles et instituts municipaux.

§1° La fiche de santé sera constituée par un livre où seront inscrits le nom, l'âge, filiation, naturalité, adresses, renseignements sur les vaccinations et revaccinations; mensurations anthropométriques, les résultats de l'examen physio-pathologiques et psychiques et d'autres données utiles, qui seront consignées dans le réglement.

§2° La fiche sanitaire constituera un document qui servira à que l'on juge du développement physique de l'écolier.

§3° Les renseignements de la fiche seront revus tous les six mois.

§4° Les notations générales de la fiche sanitaire seront faites par l'instituteur ou le directeur à l'occasion de l'immatriculation; on réservera au médecin scolaire celles d'ordre technique.

Art. 10. Sur la fiche sanitaire de chaque élève l'inspecteur sanitaire scolaire inscrira ce qu'il remarquera d'anormal toutes les fois que l'écolier sera examiné.

Art. 11. Les fiches sanitaires seront conservées dans l'école ou l'institut pour l'usage exclusif de l'Administration, elles devront suivre l'élève lorsqu'il sera transféré dans un autre établissement municipal.

Art. 12. Les directeurs des instituts d'enseignement et les instituteurs des écoles devront aider à l'inspection scolaire dans tout ce qui sera à leur portée.

Art. 13. Le service d'inspection sanitaire scolaire restera à la charge d'un inspecteur en chef, médecin d'évidente compétence et de libre choix du Préfet, aidé par dix médecins scolaires et plus 4 spécialistes, dont deux seront ophtalmologistes, l'oto-rhino-laryngologiste et 1 psychiatre, tous récrutés par vois de concours, et en outre par le personnel compris dans la table annexée.

Art. 14. Les écoliers déjà immatriculés seront soumis à l'inspection sanitaire et on dressera leurs fiches, dont s'agit la loi présente.

Art. 15. Aucun permis ne sera accordé pour l'ouverture d'écoles privées d'un genre quelconque sans l'avis préalable de l'inspection sanitaire.

Art. 16. Tous les bâtiments et les adaptations des bâtiments destinées à écoles ou asiles de mineurs ne seront pas autorisés sans l'avis préalable de l'inspection sanitaire.

Art. 17. Le Préfet démeure autorisé à expedier les règlements pour la mise en vigueur de la loi présente, lesquels en détailleront toutes les mesures nécessaires à la bonne éxecution et délimiteront les attributions des différents fonctionnaires.

Art. 18. Les appointements de personnel du service de l'inspection scolaire sont ceux consignés dans la table annexée.

Ce projet de loi fut envoyé au Préfet, qui à son tour l'adressa, en le faisant accompagner d'un message, au Conseil municipal du district fédéral, en date du 20 Octobre 1909.

Ayant expiré le mandat du Conseil municipal, un arrêté du Préfet, sous le numéro 778, en date du 9 Mai 1910, a créé le corps médical scolaire composé de 20 cliniciens et hygiénistes et de 4 spécialistes et a fait expédier le règlement du service d'inspection médicale des écoles, d'après les lignes principales du projet de loi élaboré par la commission, dont nous avons fait mention précedemment.

Le 16 Mai a été mis en vigueur le service, qui a recontré peu d'embarras de la part du public, déjà bien renseigné sur les avantages de cette importante pièce de l'appareil scolaire, grâce à la propagande bien conduite due à la grande presse et à quelques médecins très au courant de cette branche de l'hygiène infantile.

Malheureusement, avec le changement du préfet, ce service a cessé de fonctionner, le nouveau chef de l'administration municipale l'ayant suspendu sous le pretexte de manque de resources budgetaires.

Au commencement de cette année le Préfet, sous la sollicitation de la presse et de l'opinion de distingués hygiénistes, a décidé de rétablir cet important service. On va organiser incessamment le corps de médecins inspecteurs, qui seront au nombre de 28, ils seront recrutés par voie de concours.

A Sao Paulo la réorganisation des services sanitaires en 1911 a créé l'inspection médico-sanitaire des écoles, comme une section du departement d'hygiène. Voici le texte des articles du nouveau règlement sanitaire, qui ont trait à ce précieux service:

TITRE I.

Chapitre VII.

Inspection médico-sanitaire des écoles.

Art. 66. L'inspection médico-sanitaire des écoles sera exercéé dans la capitale par 4 inspecteurs sanitaires spécialement désignés par la Direction générale du service sanitaire.

Art. 67. Le service est organisé de façon à comprerendre les écoles publiques et privées d'enseignement primaire, secondaire et professionel, et il aura pour but:

1. L'indication des mesures hygiéniques et administratives concernant l'emplacement et la construction des bâtiments scolaires.

2. Le choix, d'accord avec la direction de l'Enseignement Public, du mobilier scolaire, des méthodes et procédés d'enseignement, des

attitudes des écoliers, aussi bien que la distribution des matières enseignées, la répartition des heures de travail, de repos et d'exercices physiques.

3. La prophylaxie des maladies transmissibles.

4. L'examen individuel du corps enseignant, des élèves et des employés.

5. La vaccination et la revaccination du personnel des écoles.

TITRE II

Chapitre VI.

Art. 135. Les bâtiments scolaires devront être construits sur des terrains assainis, d'après les regles qui sont en vigueur pour les habitations collectives.

Art. 136. Les bâtiments scolaires ne devront être assombris par d'autres édifices ou par des arbres, et seront à l'abri des vents nuisibles.

Art. 137. Toujours qu'il sera possible les écoles ne comprendront qu'un étage avec une cave haute d'un mètre au minimum, suffisamment exposé et aéré.

Art. 138. Les escaliers seront droits ou tournés en angle droit et les marches n'auront plus de 6 centimètres de hauteur.

Art. 139. Les salles des classes auront des dimensions en rapport avec le nombre d'écoliers, qui sera au maximum de 50, chaque élève disposera d'un mètre et 25 centimètres de superficie au minimum.

Art. 140. La hauteur des salles sera au minimum de 4 mètres demi.

Art. 141. La ventilation des salles devra être la plus parfaite possible, sans des courants d'air qui puissent nuire à la santé des écoliers.

Art. 142. L'éclairage des classes doit être unilateral avec lumière venant de la gauche, l'éclairage bilatéral sera toléré, une fois que la lumière provienne de surfaces non parallèles.

Art. 143. L'éclairage électrique est l'éclairage artificiel préférable. L'éclairage au gaz ou l'alcool sera toléré une fois qu'il soit convenablement établi.

Art. 144. Les fénêtres des classes devront commencer à 0^{m} 90–1 mètre du sol et se rapprocheront le plus possible du plafond.

Art. 145. La superficie utile des fénêtres des classes devra être au moins égale au cinquième de la superficie du plancher.

Art. 146. Les salles des classes revêtiront de préférence la forme rectangulaire et la largeur du rectangle sera calculée de façon que l'éclairage ramplisse les exigences hygiéniques.

Art. 147. Les classes auront les angles arrondis et la surface dépourvue de moulures et de saillances et dépressions.

Art. 148. Les murs des écoles seront revêtus de matériel aisement lavable, on préférera les couleurs grise, bleuâtre ou verdâtre.

Art. 149. Il y aura un water closet pour chaque groupe de 40 élèves dans les sections masculines et de 20 dans les sections féminines.

Art. 150. Le mobilier soclaire devra être soigneusement choisi si et aura la grandeur proportionnée à la grandeur des écoliers.

Art. 151. La gymnastique éducative sera obligatoire, d'après la methode plus avantageuse.

Art. 152. On interdira les exercices gymnastiques après les repas.

Art. 153. Les écoles disposeront de locaux abrités affectés aux jeux.

Art. 154. On interdira la fréquence scolaire aux écoliers atteints de maladies transmissibles.

Art. 155. Aux internats on observera les dispositions concernant les habitations collectives.

Art. 156. Les écoles publiques ou privées ne pourront fonctionner que dans des bâtiments considerés appropriés par les autorités sanitaires.

Art. 157. Les écoles superieures demeurent assujeties à ces prescriptions dans tout ce qui leur sera applicable.

A l'interieur de l'Etat de Sao Paulo l'inspection médico-sanitaire des écoles est réalisée par 16 médecins inspecteurs.

Le Dr. Vieira de Mello, qui a été chargé de l'organisation du service d'inspection médicale des écoles de la capitale, a adopté un cosier sanitaire des écoles calqué sur le modèle établi par le dr. Christiani, de Berne, a dressé une fiche sanitaire individuelle, d'après les modèles les plus modernes et trois modéles de bulletins sanitaires, l'un pour être remis aux parents ou tuteurs des élèves s'il s'agit d'une affection ou déformité, constatées lors de l'examen, et qui réclament des soins et des corrections, l'autre pour être adressé au directeur de l'école ou au professeur s'il s'agit d'une maladie qui exige l'éviction de l'ecolier et un troisième pour être rempli par le médecin traitant, une fois l'enfant guérí et n'offrant plus de danger de contagion.

Sous l'initiative de la Section d'inspection médicale des écoles de Sao Paulo, a été organisée une association privée ayant pour but la création de cliniques dentaires scolaires pour les soins des élèves des écoles publiques, très éprouvés par la carie dentaire; on a déjà installé 4 cabinets très bien outillés et dirigés par des dentistes compétents, où l'on procède à l'inspection systématique des bouches et des dents des enfants des écoles et on surveille l'hygiène buccale. Les services rendus par ces dispensaires d'assistance dentaire sont déjà des plus précieux et ce serait un inestimable avantage que d'élargir leur programme pour les soins des maladies de la gorge, des yeux, du nez et des oreilles, en constituant de véritables cliniques scolaires, pareilles à celles qui ont été établies en Angleterre et qui sont si prônées par l'éminent dr. Hogarth, qui affirme la nécessité de la création de ces centres de traitement et assistance pour certaines maladies et affections de l'âge scolaire chez les écoliers pauvres. "Without the school clinic the whole system of medical inspection becomes practically fruitless," dit Hogarth. Les cliniques scolaires municipales en Angleterre rendent de notoires services.

A l'Etat de Minas Geraes c'est tout récemment, le 10 Avril de l'année courante, qui l'on a commencé le service d'inspection médicale des écoles, on a l'intention de suivre les principes adoptés en Allemagne. Ce sont les médecins de la Ligue contre la tuberculose qui ont été chargés de remplir les fonctions de médecins inspecteurs.

SESSION SEVEN

Room F. **Wednesday, August 27th, 9:00 A.M.**

STATUS OF SCHOOL HYGIENE AND METHODS OF INSTRUCTION IN CITY, VILLAGE AND COUNTRY SCHOOLS (Part Three)

H. M. BRACKEN, M.D., *Chairman*

DR. H. U. WILLIAMS, Buffalo, N. Y., *Vice-Chairman*

Program of Session Seven

THOMAS E. FINEGAN, M.A., Pd.D., LL.D., Third Assistant Commissioner for Elementary Education, State of New York. "The Medical Inspection of Public Schools in New York State."

JAMES H. MORRISON, A.M., M.D., Health Commissioner, Hartsville, Ind. "The Evolution of Hawcreek Township."

JOHN T. CALHOUN, B.A., County Superintendent of Education, Collins, Miss. "Opportunity of County Superintendent in Fight Against Hookworms." (Manuscript not supplied.)

CLINTON P. MCCORD, M.D., Medical Inspector of Schools, Board of Education, Albany, N. Y. "Health Direction in the Public Schools."

MOSBY G. PERROW, A.M., Ph.D., Health Officer, Lynchburg, Va. "Two years' Work in the Schools of Lynchburg."

JAMES A. NYDEGGER, A.M., M.D., Sc.D., U. S. P. H. Service. "Hygiene of the Rural Schools."

B. FRANKLIN ROYER, M.D., Chief Medical Inspector, Department of Health, Commonwealth of Pennsylvania. "A Statistical Study of the Physical Defects of Three Hundred Thousand Rural School Children."

Papers Presented in Absentia in Session Seven (Read by Title)

J. L. LUDLOW, C.E., M.S., President Winston-Salem Board of Trade, Member and Consulting Engineer, State Board of Health, Winston-Salem, N. C. "A Practical Method of Promoting School Hygiene in Small Cities."

ALICE FLORER, County Superintendent of Schools, York County, Nebraska. "Status of Hygiene in the Schools of York County, Nebraska."

THE MEDICAL INSPECTION OF PUBLIC SCHOOLS IN NEW YORK STATE

BY

Thomas E. Finegan

For several years the local health laws of certain cities in the State of New York have been interpreted to confer upon municipal health officers the authority to make medical inspections in the public schools. Under this legal power, the health authorities of the city of New York organized a system of medical inspection in the public schools of that city in the year 1897. It was not, however, until the year 1910 that a provision relating to the medical inspection of public schools was incorporated into the education law of this State. In that year the school authorities of certain cities and of union free school districts—districts including villages which usually maintain high schools—were authorized, within certain limitations of expenditures, to provide for medical inspection of public schools. The provisions of these statutes, either the local health laws or the education law, were simply permissive and yet under them various cities in the State have from time to time, in response to public sentiment organized systems of medical inspection in their public schools until fifteen of the leading cities in the State are now conducting systems of medical school inspection. In addition to the work accomplished under these statutes, the State Education Department and the State Health Department have coöperated for several years in an effort to induce local school authorities to adopt a voluntary system of medical inspection in all the schools of the State.

The whole plan of medical inspection of public schools in New York State, up to the present time, has been not only under statutes which were simply permissive but which were even so inadequate and cumbersome in their provisions as to render satisfactory results impossible. The achievements attained, however, even under the unfavorable conditions under which medical inspection in the public schools of the State has been operated, were sufficient not only to show the results which might be accomplished under a law mandatory in its provisions, state-wide in its application and based upon sound principles of public school administration, but the results secured were a potent factor in developing public sentiment which sustained the enactment of a general statute on the subject, by the Legislature of 1913. The law of 1913 went into effect on the first day of this month. This paper therefore will not review what has been accomplished under previous statutes but will consider briefly the broad features of the new act and point out how it is expected to be administered and what may be accomplished under its proper enforcement. It is a comprehensive law and confers very broad powers upon those charged with its enforcement. It is also mandatory in its provisions and applies to the entire State except the cities of the first class. These cities are Rochester, Buffalo and New York. Frankly, these cities were exempted from the provisions of this law to insure its passage in the Legislature and for the further reason that these cities were maintaining reasonably effective systems under their local laws.

The enactment of this law was based upon the broad ground that, when the State makes the attendance of a child upon instruction compulsory, it is the duty of the State to protect the life and health of such child, not only by requiring sanitary buildings in which he receives such instruction, but by protecting such child from the liability of having a disease communicated to him by another pupil. Four fundamental principles which are vital to the most effective and satisfactory operation of a system of medical inspection in public schools were incorporated in this law. These principles are:

1. That the medical inspection of the children in a public school system is a purely school question and a law requiring such inspection should be administered by the school authorities.

2. That a parent possesses the legal right to have such examination of his children as the law may demand made by a physician whom such parent selects.

3. That local school authorities should possess the same power and obligations in relation to the employment of physicians, nurses, etc., in providing for the physical necessities of school children that they possess in relation to the employment of teachers, supervisors, superintendents, etc., in providing for the intellectual needs of such children.

4. That penalties should be imposed upon cities and school districts for failure to enforce a medical inspection law on the same bases that penalties for failure to enforce the compulsory attendance laws, fire laws or other statutes affecting the schools are imposed.

The status of the public school has undergone a marvelous change within a generation. It no longer stands as an institution whose sole function is to give instruction to children in the usual elementary and academic subjects found in the public school curricula. It is now universally recognized as an institution which is to so train and develop boys and girls that, when they enter into the activities of the social, commercial and industrial life of the nation, they shall possess the best equipment possible for efficient service in their own behalf and in behalf of society in general. One of the greatest assets which a girl or boy may possess when leaving school to become a worker and earner is a sound, healthy body. It is as much the function of the school to teach a boy how to care for his body and to see that proper treatment is provided for physical defects which interfere with his normal growth and development or with his progress in school work as it is to teach such boy how to read and to cultivate in him a desire for wholesome literature. The only agency for the accomplishment of this is a thorough system of medical inspection. Medical inspection is therefore a school question and the responsibility for the administration of any school proposition should be placed upon the school authorities. Experience has also demonstrated that the administration of a system of medical inspection by any other agency will result in a waste of funds, in the loss of time and energy on the part of the pupils and teachers, in the usual embarrassments and conflict of authority incident to a division of responsibility in the general direction of any one proposition and will therefore result in great inefficiency.

Compulsory attendance laws universally recognize the right of a parent to provide in his own way the minimum amount of instruction which the State decrees each child shall receive. A parent cannot be compelled to send his child to the public school. He may send him to a private school. He may employ a private teacher and educate his child at home. He may be required to send his child to a public school only when he fails to provide such child with instruction elsewhere which is equivalent to that given in the public schools. The same principle upon which such laws are based must be applied to the enactment of medical inspection laws. The State may properly require evidence of a child's freedom from disease and his physical fitness to attend school. Neither the authority nor the policy of the state to protect a child in his right to receive treatment for defects which are impediments to his proper physical and mental development will be questioned. The parent must first be given the opportunity to provide any required examination and treatment and willful negligence on the part of the parent to furnish the same affords sufficient ground for the State to supply it.

Under the law of 1913 the board of education of each city must appoint a medical inspector and as many additional inspectors and as many school nurses as may be required to properly inspect the pupils in attendance upon the schools of such city. The board of education in a union free school district possesses similar power except that in a district having a population of five thousand or less but one medical inspector may be appointed. Provision is also made for adequate inspection of the rural districts. The trustees of a rural district may employ a medical inspector and a school nurse and two or more of such districts may unite in the employment of the same inspector and the same nurse. The action of these several boards in the employment of medical inspectors and school nurses does not depend upon the direction or ratification of any other municipal board or body. The law confers upon these school boards the absolute power not only to appoint such inspectors and nurses but to determine the number to be appointed with the exception stated, and to fix their compensation. The education law further provides that, when the statutes make it the duty of school boards to perform specific functions, such boards shall have power to include in the school budgets and raise by tax upon the districts or to pay from unexpended moneys in the treasuries, without vote of the districts, the amounts necessary to meet the expenditure incurred in the performance of such duties. These local medical inspectors must be physicians licensed to practice in the State and must have had at least two years' experience. Although not required under the law, they should possess a thorough knowledge of physical training and of school hygiene and sanitation. The school nurses must be registered trained nurses. Neither inspectors nor nurses are employees of the municipal government but are employees of the public school system and are not therefore subject to local civil service requirements. The clear intent and purpose of this law is to create within the organization of the school system the necessary machinery to give intelligent, scientific direction to all the health agencies of the schools, to correlate all of this work and to coöperate with all school forces to the end that all the health needs of a great school system, giving instruction to one and one-half million children shall be wisely, economically and scientifically supplied. For the accomplishment of this purpose, local school authorities possess the same independent powers to organize, manage and direct this special work which they possess in the organization and direction of the teaching and supervisory forces of their schools. One of the medical inspectors should be designated as the chief Medical Inspector or Director of Hygiene or some similar title and the other inspectors as assistant inspectors and these and the school nurses should be under the general direction of this principal officer. The principal officer and nurses should be employed for full time but assistant inspectors may sometimes be employed to good advantage on part time.

Each pupil is required on entering a public school at its opening in the beginning of each year to present a health certificate signed by a physician licensed to practice medicine in this State. The Commissioner of Education prescribes the form of the certificate after consultation with the State Commissioner of Health. This certificate must set forth in such detail as may be required the physical condition of the pupil. The examination on which such certificate is based must have been within thirty days prior to the application of the holder thereof for admission to school. Parents are allowed thirty days within which to furnish such certificate. Notice is then forwarded to those parents whose children have not furnished the required certificates, that if such certificates are not presented within the next thirty days, examinations will be made by the school inspectors. Parents may waive their right to furnish such certificates and request the school inspectors to make the examination at any time. The school inspectors may take up for immediate consideration at their discretion such emergency cases as appear, from their observation or from information obtained through teachers, to demand prompt attention. School inspectors must make separate and individual examinations and tests of each pupil who has not furnished a health certificate, to ascertain if any of such pupils are suffering from physical disabilities tending to interfere with their normal development or with the progress of their school work. In cases where such disability exists, full notice thereof must be given the parent. If the parent is unable or if he refuses to provide the necessary relief and treatment, it then becomes the duty of the school authorities to provide it. These cases are to be followed up by inspectors from time to time as their necessities demand. Whenever a case of contagious disease is discovered, the affected pupil must be excluded from the school and the health authorities notified. Such pupil may not be admitted to school again until the health officer of the city or district, the family physician who treated him or the medical inspector shall certify to his physical fitness to associate with other pupils. Medical inspectors are also required to inspect the school building to see that they are properly lighted, heated, ventilated and cleaned. They are also required to make medical examinations of all teachers and janitors.

The State Commissioner of Education is charged with the duty of supervising the enforcement of this law. Such officer may, after consultation with the State Commissioner of Health, prescribe regulations to supplement the provisions of the law for its better enforcement. The Commissioner of Education is also authorized to appoint a State Medical Inspector of Schools, who will have the immediate supervision of the enforcement of this law. This inspector must be a licensed physician and must have had at least five years' experience in the actual practice of his profession. Other qualifications are quite as essential as this professional training and experience. He should also possess a thorough knowledge of physical education and of educational hygiene and sanitation. The statutes place in the hands of the Commissioner of Education an effective power for the proper enforcement of this law. The law authorizes him in his discretion to withold from a city or district its share of the public moneys appropriated by the State for the support of schools, whenever such city or district has willfully refused or failed to enforce this law. The education law further provides that when a city or district is subjected to the penalty of a loss of its funds through the willful failure or refusal of a school officer to perform any duty imposed upon him, such officer shall be personally liable to the city or district for the amount of such loss. This wholesome provision of the law is generally a sufficient stimulus to induce school officers to perform their duties.

The proper enforcement of this law will result in the segregation of all pupils afflicted with infectious or contagious diseases, in showing the necessity of making special provision for the education of the mentally defective, in the establishment of open-air schools for the treatment and training of thousands of anemic children and for those having a predisposition to tubercular troubles, ten thousand of whom now in attendance upon the schools of this State will die before they become eighteen years of age if this treatment is not provided for them, in the correction of physical defects in thousands of children who would otherwise become permanently disabled or diseased, in providing cleaner and more sanitary school buildings and surroundings, in teaching the future generations how to take proper care of their bodies and thus make them better citizens, in providing more effective instruction in the schools, and in changing the schoolroom from a place which often breeds and disseminates disease and immorality to an institution which will be the most powerful and effective agency of modern times in promoting the health interests of the Empire State.

DISCUSSION OF
THOMAS E. FINEGAN'S PAPER
BY
W. E. STRUTHERS

The Board of Education should be the supreme authority in the school. It is impossible to obtain efficient service and the best results when two supreme directing and governing authorities are controlling different parts of the same work. A house divided against itself must fall. For dealing with disease or control of contagious disease, although an important part, is a small part of medical inspection of schools. The aim of medical inspection of schools is to obtain the very best physical development of school children, not merely the treatment of those having disease, or even physical defects. The teaching of hygiene, personal cleanliness, the laws of health, right habits of life, the relation of health conditions to physical efficiency, mental development, and school progress, physical training, culture, drills, games, etc., and the many other things that make up the school child's daily life, are the things that are of essential interest to the Board of Education if they have a broad conception of their duties to the children under their care. In all these matters the school teacher, the school nurse, the school medical officer, and the parent are the vital factors, and the best working coöperation of these factors is obtained through the Board of Education. To argue that the health officer should control medical inspection of schools because it involves the supervision of contagious disease among school children is to hark back to the old idea that the Board of Education has discharged its full duties when it sees that school children have obtained a full knowledge of the three R's. The school teacher, the school nurse, the school medical inspector, and the parent, have a common interest in the best development of the child. The fundamental work of medical inspection is preventive medicine, and is, therefore, educational. There is no reason in smaller municipalities why the health officer should not also be the school medical inspector, but as school medical inspector he should be appointed and controlled by the Board of Education. The viewpoint of the health officer is not that of the school medical inspector, and the work of the school is, and always will be, best carried out by the school medical official. The vital interests of the child should always be the first consideration, but it appeals to me that these supreme interests of the child, its best physical, mental and moral development are best secured under one directing and supervising authority. This can only be done under the Board of Education—and that should not mean overlapping of work. The Board of Education should have the child under its care from birth until the close of its school life. This is shown at present by the decided and democratic forward step being taken in the establishment of nursery schools. This is true, of course, only in large centers where so-called slum areas exist. Here some systematic effort must be made to care for young children, and the Board of Education is the proper body to undertake that responsibility. Practically all the health officer does for the prenatal life of a child is to improve the home conditions or environments of the mother. Such improvements would continue, and would undoubtedly benefit the life of the child. But this would not be overlapping work. The only way for the Board of Health to do the work of medical inspection of schools is to take over the whole of the school work and abolish the Board of Education. You cannot separate the school work in this way—placing part of it under one authority, and part of it under another authority. School medical officers should be given the same authority as health officers to enter a home where contagious disease is suspected to exist. This is for discovery only, the medical officer then reporting such cases to the Board of Health.

Hills Cole, M.D.: Will Dr. Finegan please explain the relation between the educational authorities and the health officer as provided in the law which he has summarized?

Dr. Finegan: The law requiring medical inspection in the schools of New York provides that trustees of rural schools and the board of education of a village of five thousand people employing a superintendent of schools may, in their discretion, appoint the health officer of the town or village to make the medical inspections required in the schools. The recent health law has endeavored to increase the professional standing of the local town and village health officer. It is desirous of utilizing the service of such officer so far as may be to the advantage of the school and wherever it is feasible to arrange with the health officer for this work, it should be done.

THE EVOLUTION OF HAWCREEK TOWNSHIP

BY

JAMES H. MORRISON

'Round my Indiana homestead wave the cornfields,
In the distance loom the woodlands clear and cool,
Oftentimes my tho'ts revert to scenes of childhood,
Where I first received my lessons—nature's school.

The poet, Paul Dresser, had in mind no lovelier spot than Hawcreek township when he wrote our Indiana song, "On the Banks of the Wabash," and well might he have received equal inspiration from a visit to this place.

This township has some history and some surroundings that show characteristics and conditions peculiar to its people and to describe these may require this paper to be somewhat local in character yet it serves to represent rural conditions in many Indiana schools and in fact in many of the States of the Union.

It is a congressional township. Because of the average intelligence of its inhabitants, the distribution of its population, its roads and its geographical location Hawcreek township was chosen as the first place in the United States in which rural free delivery of mail was tried and one of the original routes established is still in existence. Hawcreek Township has the largest poultry farm in the world devoted to one breed, the corn king of Indiana resides within its borders, and the people are very temperate, not a saloon being within its thirty-six square miles of territory.

I mention a few facts such as the foregoing to show the enterprise of its citizens in secular and moral affairs and when energy is manifest along these lines we might expect to find equal improvement in educational matters, although financial prosperity is not always a key to educational success for the reason that minds and means are not always diverted to channels productive of the most good, and no doubt this township could have been further advanced educationally had more of its trustees been given a vision of its financial possibilities.

The early inhabitants received their education in primitive log schoolhouses characteristic of the forest days in Indiana. These in time were supplanted by more substantial frame buildings and later by brick structures each in a school district of its own, there finally being twelve such districts. The slab seat with its four pins for legs and the slab writing desk extending along the entire side of the room of the log houses were superseded by carpenter-made desks in the frame schoolhouses and later modern desks of various sizes were installed in the brick houses. In the pioneer schoolhouse little thought was given to the amount of light necessary and the heating apparatus consisted of a huge fireplace in one end of the room in which logs were piled and which crackled with pleasure and laughed for joy along with the merriment of the buxom girls and boys. Needless to say the great throat of the chimney was a deadly enemy of carbon dioxide and any other noxious gases. This valuable means of heating and ventilating was supplanted in the frame and brick schoolhouses by the more unsanitary stove still in use in most rural districts of Indiana.

The most perceptible evolution in rural hygiene began with the establishment within the township of Hope Female Seminary in which many of the grandmothers and mothers of the present generation of school children received their education and which accounts for the high character of the motherhood of the township. None the less potent for the cause of sanitation and hygiene was the establishment of Hartsville College which contributed more perhaps than any one factor to advancing education of parents of both sexes of the last two or three generations. This college, now extinct, was the alma mater of many men of note and it was in this township in old Hartsville College that Wilbur and Orville Wright, of aviation fame, received their early college training.

The author of the poem "Indiana" had this period of time and perhaps this township of Hawcreek in mind when he wrote:

Though many laud Italia's clime,
And call Helvetia's land sublime,
Tell Gallia's praise in prose and rhyme,
    And worship old Hispania;
The winds of heaven never fanned,
The circling sunlight never spanned,
The borders of a better land
    Than our own Indiana.

Where late the birchen wigwam stood,
Or Indian braves their game pursued,
And Indian maids were won and wooed,
    By light of soft Diana;
Fair cities, as by magic, rise,
With church towers pointing to the skies,
And schools that charm the world's wide eyes
    To fair young Indiana.

Her gentle mothers, pure and good,
In stately home or cabin rude,
Are types of noble womanhood;
    Her girls are sweet and cannie;

Her sons among the bravest, brave,
Call no man master, no man slave—
Holding the heritage God gave
In fee in Indiana.

People of this class can not be satisfied with the ordinary. School hygiene had not kept pace with hygienic conditions in the majority of homes. The health of the child was being discovered as the greatest asset of the township. To conserve the child's development along nature's own lines to promote mental attainment without sacrificing his physical being, to inspire the development of both mind and body without unnecessary waste of energy, to solve the many health problems in education, began to confront the parents and a demand was begun to mitigate conditions. Overheating of rooms by unmanageable stoves, poor ventilation and improper light by misplaced immovable windows, and misfit school furniture were found to retard mentally, to render physically unfit and make nervously unstable the children of the township. The old schoolhouses produced and harbored too many school diseases. A demand was made and heartily supported by the trustees to build a sanitary, up-to-date consolidated building. Of course kickers sprang up. Nearly always it is the man who gets value received and who gets justice who kicks. Walt Mason describes this freak of the genus homo in his jocose way, by saying:

In every town and city the kicker wields his jaw;
It seems a frightful pity he's not suppressed by law,
That people can not rally around the croaking jake
And take him to an alley and burn him at the stake.
One kicker in a village, who kicks with might and main,
Is worse than pest or pillage or suffragette campaign,
And yet we only snicker or spring a feeble sneer,
When we behold the kicker do deadly damage here.

In the evolution of things some of the opposition to building was withdrawn, and some of the kickers died.

Personally, when one of these kickers had kicked away a life that might have been otherwise useful, and the time comes to cover him with the clods of the valley, I am not going to take any chances by standing at the wrong end of the grave.

Fortunately this class is very much like the screech owl valued more for the noise they make than for their size, and so in Hawcreek Township in spite of their looks of wisdom and their words of censure a contract was let by a trustee who had learned that the way to become popular is to let other people impose on you, so, a substantial brick building with stone trimmings, was erected, properly lighted, heated and sanitary in every respect.

This building is located near the geographical center of the township and the pupils are gathered from all parts of the urban territory and transferred to the school in eleven hacks which are owned by the township. These hacks, well ventilated and properly warmed in cold weather, convey about 200 pupils to school, daily. These pupils, since consolidation, are quite as properly graded as a city school, a condition that would be impossible without consolidation. A marked decrease in sickness is noticeable, so with compulsory education in Indiana the per cent. of attendance runs high. There has never been an epidemic of sickness in the school during the five years since consolidation. The various hygienic improvements in the present building conforming to Indiana State Board of Health requirements, is a great improvement over old style architecture, and does much to conserve the health of the children. Medical inspection thus far has been conducted by the teachers and has shown numerous defects of both eyes and ears. Some of these defects are caused, or at least aggravated, no doubt by the use of automobiles, many of which are used in the township, and which are causing enough injury, because of the rapidity with which objects pass before the eyes, to be recognized as the "automobile eye."

TABLE NO. 1.

Showing Number of Pupils with Defective Sight and Hearing.

Year	No. Pupils Examined	Defective Sight	Defective Hearing
1911–12	197	120	27
1912–13	186	60	17

Snellin's charts were used in making eye tests and the watch and whisper tests were used in ear tests.

A comparison will show that in 1911-12 sixty per cent. had defective sight and thirteen per cent. had defective hearing while in 1912-13 thirty-three per cent. had defective sight and ten per cent. defective hearing.

I attribute the higher per cent. of defective eyes in 1911-12 over 1912-13 to the better understanding on the part of the teachers in the use of the chart in making the tests. Some slight errors of vision will be overlooked and others magnified unless the ophthalmoscope is used or the eyes influenced by the use of local application of medicines, thus while the eye tests may not be as accurate as seat measurements, they prove to be of vast benefit to both teacher and pupil.

Measurements of pupils, seats and desks are made annually, and many misfits are apparent as shown by

TABLE NO. 2.

Year	Number Examined	Seats High	Seats Low	Desks High	Desks Low
1911–12	197	12	80	144	1
1912–13	186	19	38	139	0

Every seat if but one-half inch too high was recorded as such but only seats that were three inches or more lower than leg measurement and desks that were three inches or more higher than elbow measurement were recorded.

TABLE NO. 3.

Showing Measurements by Grades, 1912-13.

Grades	Number Examined	Seats High	Seats Low	Desks High	Desks Low
1 & 2	28	14	0	6	0
2 & 3	44	2	8	40	0
3 & 4	35	2	6	29	0
5 & 6	40	0	13	37	0
7 & 8	39	1	11	6	0

The rules for making the measurements were (1) the length of the leg. This is secured by seating the pupil upon a flat top table. A book is held under the foot of the pupil and the measurement of the leg is taken from the sole of the foot (*i. e.* from the top of the book) to the underside of the thigh (*i. e.* to the top of the table). Then (2) the height of the elbow is measured from the top of the table to the underside of the horizontal forearm, the upper arm being held closely to the side of the body, the forearm being flexed at right angle. Next (3) measure from the floor to the top of the seat used by the pupil, and (4) measure from the floor to the top of the desk. Measure the seat and desk at that point which would be an average height from the floor.

Most remarkable strides are shown in the evolution from district schools to consolidated by the following table for fifteen years, in periods of five years each, making comparisons, and showing gains in number of graduates, the younger age at which they graduate under consolidation, higher general average in grades attained, increase in per cent. of graduates to total enumeration and the remarkable economic gain to the township, the low estimate of $300 being used as the value of a child's education at the time of graduation from the public schools.

Tables for fifteen years in periods of five years each, making comparisons and showing gains of graduates.

TABLE NO. 4.

Period Ten Years Prior to Consolidation.

Year	Number of Graduates	Average Age	Average Grade	No. 13 Yrs. Old	No. 12 Yrs. Old	Enumeration	Per Cent. of Enumeration	Economic Value to Township	Value for 5 Years
1899	2	14	No Record			247	.008	$600.00	
1900	2	16	77.5			242	.008	600.00	
1901	9	15.2	77.2			239	.037	2,700.00	
1902	1	14	78			214	.005	300.00	
1903	10	15.5	77.4			209	.047	3,000.00	
Totals	24	15	77.5			230	.021		$7,200

TABLE NO. 5.

Period Five Years Prior to Consolidation.

1904	7	15.3	81	0	0	194	.036	$2,100.00	
1905	3	15	80	1	0	155	.02	900.00	
1906	8	15	84.2	1	0	160	.05	2,400.00	
1907	3	15.7	84	0	0	150	.02	900.00	
1908	9	14.3	77.6	1	0	160	.056	2,700.00	
Totals	30	15.1	81.3	3	0	164	.036		$9,000

TABLE NO. 6.

Five Years Since Consolidation.

1909	15	15	84.8	1	1	202	.074	$4,500.00	
1910	17	15	80.4	1	0	198	.085	5,100.00	
1911	15	14	87.2	3	0	213	.07	4,500.00	
1912	11	13.7	94.7	6	0	205	.053	3,300.00	
1913	12	14.2	90.3	2	1	289	.042	3,600.00	
Totals	70	14.3	87.5	13	2	221	.065		$21,000

A gain of ⅔ year on each of 70 graduates at $300.00 per year............$14,000

Total gain in five years...$35,000

Out of the fourteen townships of Bartholomew County, Hawcreek Township graduating classes for the years 1912 and 1913 averaged the youngest in years and highest in grades of any in the county.

Evolution has taken place in Hawcreek Township, not only in matters of sanitation and hygiene but in parents, teachers, more regular attendance, punctuality and grading, so we may not attribute all the gains shown, to better health conditions, but surely a well lighted, well heated, well ventilated building, with its properly located blackboards and seats, its soft colored walls, its splendid hallways and roomy basement, with all general conditions catering not only to the mind but to the aesthetic nature of the child, all this, together with a large playground certainly is conducive to scholarship and is an admirable contrast to the conditions under the old district system about which the Hoosier poet said:

Catchin' cold an' gettin' well;
'Twas 'bout all they had to tell
Of this life, it seemed to me,
All the way from A to Z.
Some one asked them, "How d'ye do?"
And they'd only got jes two
Answers, if the truth was told—
"Gettin' well" or "catchin' cold."

When their throat was feelin' sore,
An' their head began to roar,
Then they knew that if they'd wait
Patiently, they'd feel first rate.
An' they knew, when free from pain
They'd be catchin' cold again.
'Twas 'bout all there was to tell—
Catchin' cold and gettin' well.

HEALTH DIRECTION IN THE PUBLIC SCHOOLS

BY

CLINTON P. MCCORD

We are living in the renaissance of science as applied to society. The last five years have given us as great advances along lines of public health as the last twenty-five years have brought us progress along clinical channels. We are in the midst of a great movement toward the improvement of physical conditions, which movement has as its real purpose the prolongation of human life. At work, in some measure, are forces that will make for better living and improved social conditions. Welfare work embraces lines of investigation and activities that have come to have their expression in organized departments in many of our large industrial concerns, in probation officers in connection with our Juvenile Courts, in our various Coöperated Charities and in our institutions for the segregation and proper care of a certain number of our criminals and mental defectives. Lines of research have revealed the dangers that threaten our social body through disregard of laws of heredity of almost mathematical precision.

The day has passed when we can truthfully say that the child owes a debt of gratitude to parents for the privilege of having been born, unless he reach maturity, sound in body and with a fair degree of training. The day *is here* when no Board of Education can shut its eyes to the great need of proper physical care of the community's future men and women during the years when these little ones are so largely within the keeping of the schools. It is no longer enough to supply buildings and books and teachers; there must also be the certainty that attendance upon this training, which law has in so many states made compulsory, shall not mean "compulsory disease," to use another's apt phrase.

The explanation of the whole movement for better health conditions may rest on the possible psychology of altruistic moral emotion, namely, on the selfishness of self-preservation, but no matter, the fact remains that we are looking after our less well-informed neighbor and are trying to give him a better chance for freedom from suffering and a wider share in real happiness.

Emerson said: "The greatest wealth is health," and yet few believed this to the extent of seriously governing their actions and life along health lines, until the past few years. To-day the wisest of our people, no matter how important is their work or how wide the range of their responsibilities, are finding time to think of their physical well-being, realizing that without the physical basis real mental efficiency is never attained.

Along with all this has come the interest in the growing child. This has developed the laws concerning child labor, the infant welfare work, the various lines of social research, and medical inspection and the school nurse. Compulsory education in this country placed approximately 20,000,000 children under a daily routine which often was far from being conducive to good health and normal development. Modern medical inspection arose in this country some nineteen years ago to combat some of these physical evils and to point the way to better health as the first essential to school progress. It in turn has grown to assume a scope which makes it more properly health direction, and I wish to propose a more general adoption of the term, Health Director, as more accurately designating the functions of the officer who is to play a part constantly increasing in importance in our educational systems.

I hope to convey in this paper what I believe should be the scope that health direction may properly assume in the Public Schools of cities of 100,000 or less (the cities which in greatest numbers will introduce the work within the next few years) with reference to some of the details of initiation of such a system so far as we have realized our ideals in the capital of this state. Since in most of the smaller cities persist remains of the "village spirit" which must be combatted in the introduction of a new institution, I have felt that a brief description of conservative methods of establishing the work might be welcomed by executives who are contemplating such innovation in their cities. In a paper, limited as is this one, it will be impossible to amplify any statements. I hope therefore, simply to present a bare outline and trust that this will invite inquiry which it is our hope to satisfy in subsequent publications or in exhibits of the actual workings of our system at Albany, N. Y., as the months bring a realization of ideals and an enlargement of the scope of the work. I direct your attention to our small chart exhibit as a unit of the New York State Education Exhibit at this Congress, not as presenting a startling array of figures, equipment or paraphernalia of medical inspection, but as setting forth what we believe to be the best plan of organization in cities of 100,000 or less, with the chief features of our system together with the lines along which we hope to develop.

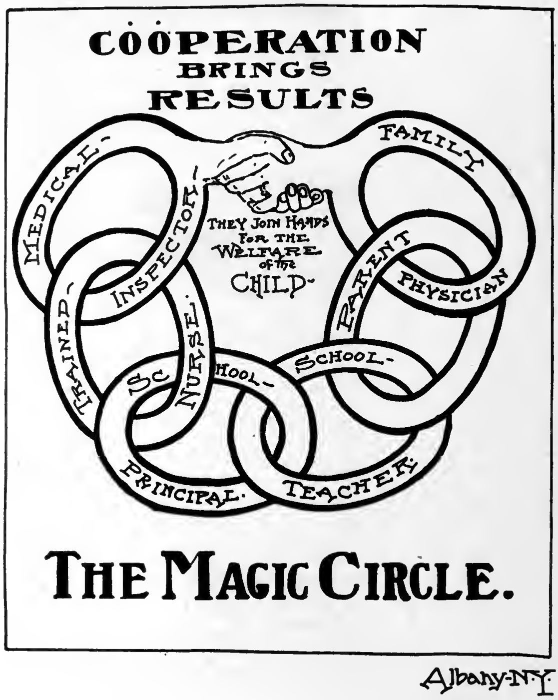
Allow me to deal briefly with the initiation of such a system, touching on the things of special interest to executives contemplating medical inspection, and then pass on to a consideration of such a system when extended to embrace the wider idea of health direction.

The "full-time" man selected preferably should have had some experience as an executive in school work. This, with a first-class medical training, including a knowledge of the elements of the specialties, makes a happy combination. He should have a fair outlook upon pedagogical and sociological problems. He should know the "special case" child. The salary should be somewhere between $2,000 and $3,000 a year. There should be a sufficient number of nurses to assure a daily visit to every school (approximately one nurse to every 1,500 children). The Inspector should have an office adjoining that of the Superintendent of Schools. Provision should be made for a system of adequate records if the work is to be placed from the start upon a scientific basis.

The appropriation for the first year of such a system in a city of 100,000 should be at least $5,000, and this amount will furnish only the minimum number of nurses. It will be necessary to increase this sum from year to year as the number of nurses for the most efficient conduct of the work is approximated, and also to provide for any additional salaries, equipment, attendance upon conventions, etc., such as may be indicated under a system of health direction as outlined farther on in this paper. The Board of Education should secure the coöperation of the medical profession in any city in the matter of the selection of an Inspector, and because of the local jealousies, or often because of the lack of a specially trained man or a high-grade man who is willing to give up his practice for new work, it is often wiser to import a man who will be free from the local prejudices and will be ready to deal fairly with everyone. It is true that the nature of the defects discovered by medical inspection will mean more work for men who are in the specialties, but well-trained family physicians see this and will do only what they would have done had the cases come to them direct from the parent—namely, send the patient to a reputable oculist, rhinologist, etc., if the condition be not within the scope of general practice.

Fortunately there are in every community cultured, well-trained ethical physicians, who, as soon as they see that the Inspector in no way trespasses upon their rights as family physicians, are ready to examine the workings of the system, and in many cases come to be the Inspector's most helpful counselors. These are the real "pillars" of the profession, and if the Inspector and the educational authorities under whom he works are sincere, and show this sincerity by a strict adherence to the highest type of professional ethics, the coöperation of these men is assured, as is their approval of *any* public work which has for its object the betterment of health conditions and the advancement of health standards.

The policies involved in the initial plan, the analysis of a local situation, the avenues of appeal to the parents, principals, teachers, etc., are matters of detail, depending upon the city, the type of people, the personality of the Inspector and those with whom he is most closely associated. When medical inspection is a part of the educational system



as in the plan here discussed, the question of its relation to the local Board of Health arises. The most courteous relations should of course exist although they "touch hands" in comparatively few cases. The acute contagious diseases are the only cases occurring among school children which fall under the authority of the Board of Health.

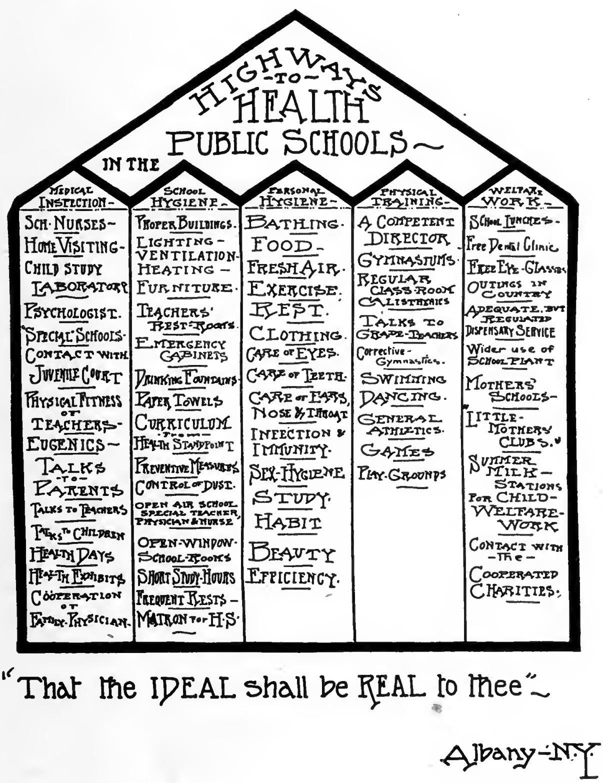
By a most satisfactory arrangement effected with the Board of Health in our particular field, all cases of the "so-called" reportable diseases discovered by the Inspector are reported by telephone to the Board of Health, and in turn, each morning, the office of the Medical Inspector receives a report of all such cases known to the Board of Health. Here these cases are tabulated in relation to the different schools, and where any school is affected the Inspector and the Principal concerned have prompt knowledge of the fact. When speaking of contagious diseases I feel that one is always moved to criticism of the existing inefficient methods of quarantine observed in many of our second-class cities. In view of recent researches on measles and scarlet fever the question arises as to whether or not the period of exclusion for these diseases, or at least for measles, might not be materially shortened in some cases with a great saving in school time to the child. In the matter of diphtheria, the question forces itself as to whether or not a more careful quarantine, the proper enforcement of the rule requiring two negative "cultures" on two successive days for release (which is seldom enforced in smaller cities) might not greatly decrease the number of cases of this disease which every winter takes its "toll" from the ranks of the school children.

From the point of view of the Medical Inspector there is one avenue open, which involves considerable work but which offers greatly to lessen the spread of this disease in the schools, namely—to make "cultures" of every sore throat, and where a case of diphtheria develops to culture at once the throat of every child in the class and exclude the "carriers."

You will notice that I seek to suggest a wider range of activity for the Health Director than the field commonly assigned to a Medical Inspector.

What is the scope that this direction, as part of the educational system, should assume?

There are five chief highways to health in the public schools. Health direction should in a large measure take cognizance of them all. The accompanying chart perhaps best presents the details.



It is very plain that such a system cannot be adopted outright at the start of the work in any given city. Perhaps the first step usually will be the initiation of a system of medical inspection with one "full time" physician and four or five nurse assistants, and only those record cards, equipment, etc., absolutely essential for careful and scientific work. As the need for additions to such a system becomes evident (which is usually when a year of good work has demonstrated the great value of the venture to the city) it may well be expanded along the lines indicated. Eventually such a system would include, beside the Health Director, a "full-time" physician, devoting his energy to the medical inspection phase of the system, a psychologist or at least a person skilled in the use of the Binet Tests, with a child study laboratory, and a sufficient number of nurses to assure a visit to each school every day (approximately one nurse to every 1,500 children).

With such a working force the Health Director would be in a position to make exhaustive studies of the various health problems, to keep the needs of the child before the public and the educational authorities, to confer to some purpose with the Superintendent of Schools upon medico-pedagogical questions, to supervise the conduct of the various school plants from a health standpoint, to give expert advice to the Board of Education upon matters of school hygiene, furniture, physical fitness of candidates for the teaching force, etc., to act as consultant to the Director of Physical Training, to act as adviser to the Director of School Lunches, to supervise the work of the child study laboratory and consult with the Superintendent of Schools in regard to the training of the "special" child—all these things in addition to the supervision of the actual work of medical examination of children by the "full-time" examiner and nurse assistants. The open-air school may well be visited by a special physician and nurse whose reports should be filed with the Health Director. The question of the work in the child study laboratory perhaps requires more careful amplification. We have in our schools some 10% of children suffering from poor nutrition, some 20% of nervous cases, some 2% with speech defects, some 2% of those mentally deficient. All the above are "special case" children. The Director's Office might well be made a "clearing house" for the worst of these cases. Here, with proper equipment, a more careful study could be conducted than is possible at the schools, and proper disposition of the cases could then be made. The cases of speech defect would be assigned to special teachers for varying periods of training, the poor nutrition cases to the open-air schools or the open-window class-rooms and the care of the Director of School Lunches, the nervous and "backward" cases to the child study laboratory, where special apparatus is available and where the Binet Tests could be applied by a person skilled in the use of these valuable diagnostic aids. The children found mentally deficient could then be assigned to the "special schools." Let me emphasize the fact that there are in the public schools certain mentally deficient children that are detectable only by the specially trained examiner, and upon whom positive diagnosis should be made only after a careful psychological examination. Is the system I have pictured possible?

I do not say that in Albany to-day we have even the beginnings of some of these lines of good, but I am confident that we have the right start. For the benefit of cities contemplating a system, formulated along scientific lines, I would say, that the first requisites for the realization of such a system are: (1) men on the Board of Education who are broad-minded and far-seeing, fearless in their manhood and dignified in their citizenship, and with hearts warm for human suffering, and (2) a Superintendent of Schools who is an educator and scholar in the true sense of those words—a man who can see beyond the present system of desk and book and blackboard, and can appreciate the real end of education—human happiness. These chief requisites our city possesses, and I can predict, that, with Commissioners of Education and a Superintendent who are alive to the wisdom of prevention as well as the good of cure, and with letters from leading physicians of the city approving of any plan which means more careful supervision of children of school age from the standpoint of health, in a couple of years you can visit Albany and see such a system in practice, working untold good to 12,000 future men and women. If the profession as a whole awoke to the wisdom of such supervision *prior* to school age, the coöperation which they would then measure to the school and child hygienist would more than double the results of present methods, raising the health standard among school children and fulfilling one of the vital objects of school training—to bring the child to maturity with his powers so developed and his energies so conserved that the richest return may accrue to the state in its vigorous, aggressive, progressive men and women.

DISCUSSION OF CLINTON P. MCCORD'S PAPER BY DR. C. EDWARD JONES

I am pleased to hear that there is a tendency to substitute "health direction" for "medical inspection." The work under its proper conception has to do with hygiene rather than with medicine, and it calls for careful and definite direction rather than for mere inspection. With this understanding there can be no conflict with the Board of Health. The Health Director barely touches hands with the city Board of Health, but he is a vital factor in the school system, and as such his work belongs under the Board of Education as much as does that of the director of drawing, music, physical education or even that of the superintendent himself.

At present the work of the Health Director has not been clearly defined. He is looked upon by some as a physician, by others as a compiler of statistics. When he comes to his own he will be recognized as belonging to a new profession. He needs to know hygiene, anatomy and medicine, he needs to know psychology, he needs also to know school administration. Out of the demand for better health conditions this profession will be created and the sooner it is, the better will we be able to cope with health problems as they relate to schools.

DISCUSSION OF

Clinton P. McCord's Paper

BY

Dr. Frederick E. Downes

Mr. Chairman: I have noted with interest that a considerable portion of the time of each session of this department has been taken up with discussions as to conflict of authority between Boards of Health and Boards of Education. I cannot full appreciate arguments along this line for the reason that in the city which I have the honor of representing no such conflict exists or is likely to exist. I am inclined to the belief that most of the fears along this line have nothing more or less than imaginary grounds for arising.

In Pennsylvania the law provides for Boards of Health and prescribes their authority. It also provides for school medical inspection and prescribes the authority of medical inspectors. The former bodies, generally speaking, have to do with contagious diseases, the vaccination of school children, community sanitation, etc. School medical inspection has to do very largely with a field of service which Boards of Health do not and cannot enter, such as the general inspection and examination of school children and teachers, home visitation for instruction and guidance, special schools for the mentally backward and tubercular, the common or specific hygienic needs of the child, etc. In our state the law makes it the duty of both Boards of Health and Medical Inspectors to look into the sanitation of school buildings, but on this point there has never been an instance of conflict of authority in Harrisburg, for the reason that it has always been conceded that the authority of the Board of Health supersedes that of the school medical department, or any other department, for that matter, of the city government.

In the five years that medical inspection has been in practice in our city, there has never been a conflict of authority, and I do not believe that there is any reason for any such conflict.

DISCUSSION OF

Clinton P. McCord's Paper

BY

Dr. Albert VanderVeer

Dr. McCord, from the standpoint of history and experience has given us a very wholesome paper. He gives us a firm foundation upon which to build, and has presented a whole lot of material from which to select. He has combined, in his valuable paper, a statement of facts commanding our entire confidence. He has correlated these facts in such a manner as to impress one with the necessity of an analysis of conditions presenting in connection with school hygiene, and of organization and methods in a most charming manner. He has given us, in clean clear language the clinical conditions he has observed from time to time, has shown how this sort of information can be applied, and has held up, in a very interesting manner the subjects that call for action, along his line in school inspection. That he has thoroughly in hand the medical side of the work, and how to approach it, there can be no doubt. His careful study of conditions in the latter, of which I am personally cognizant, regarding the public schools in Albany, leaves little opportunity for argument against the introduction of the methods he advocates. His whole paper is full of the germ of active work. There is no hesitancy on his part in presenting the practical points we are so much in need of at this time. He has clearly shown how that action may be taken after his careful discussion of the important work he has been doing for the past year. He has not left us ignorant of what to do but proceeds in a clear, judicial manner to tell us how to accomplish these results. He has given us a complete résumé of the situation, in cities of one hundred thousand inhabitants.

The conditions, and the methods of organization, lead to simplification of the entire work, in fact his paper is one manifesting great generalship, and must result in much good in the better understanding of this branch of eugenic work.

TWO YEARS' WORK IN THE SCHOOLS OF LYNCHBURG

BY

MOSBY G. PERROW

When the Health Department, somewhat over two years ago, undertook an inspection of the school buildings and grounds of the city, it was probably the first time a real sanitary survey of them was ever made. The public schools had for years been classed by the State educational authorities as the best in Virginia, and had ranked as unexcelled by none in the entire South. The classification of course was based on the curriculum, and the scholastic efficiency of the pupils. The schools had enjoyed the continued supervision of a man, highly competent and enthusiastic in the usually recognized educational lines, and what is said here is intended as no reflection on him, or for that matter, on anyone. The facts simply illustrate that one may be very diligent in certain departments of activity, and yet allow other and even more important work to go neglected.

The inspection showed that many of the rooms were overcrowded. The State law required 200 cubic feet of air space per pupil. The measurements of one room were taken and found to give not quite 118 feet per pupil. The law exacted a minimum of 15 square feet of floor space per pupil. The measurements showed 13 feet. The law also stated that the ceiling should be at least 12 feet high. This room had only 9 feet and to make matters worse, there was no way to get sufficient ventilation, although the law required that there must be 30 cubic feet of air per pupil every minute.

A regulation of the State Board of Health also read: "Every room used for school purposes, whether public or private, shall be furnished at all times, when in use, with an adequate supply of drinking water of good sanitary quality. This shall be running water whenever same is available. If running water is not available, a tank or cooler shall be supplied, furnished with a spigot; or a dipper shall be supplied, which shall be used only for dipping the water from such tank or cooler.

"In addition to the dipper there shall be furnished a cup or glass to be used only for drinking, and which shall not be used for dipping water from the tank or bucket, or for any other purpose. The contents of every receptacle for drinking water must be renewed fresh every morning, and every receptacle, dipper, cup, or glass shall be well washed every morning, and scalded with boiling water at least once a week."

As a matter of fact in only one building were drinking fountains found, and in this building but two. Open buckets were forbidden by law, and yet half the schools had open buckets, and in many instances the drinking vessel was without a handle so that the fingers dipped with the glass beneath the water. Some schools, however, were furnished with coolers having closed tops, but these coolers seemed unacquainted with cleaning, and in the bottom of one was a very heavy deposit of dirt. Regular scalding of the coolers appeared unknown although a plain legal requirement. The law also stated, "That where sewerage is available, proper water closets must be installed." In the face of this a number of the schools not only had no water closets, but the worst form of unprotected and unsanitary privies.

Methods of heating and ventilation, while in some cases commendable, in others were very bad. The ordinary unjacketed coal stove was in frequent use, with the consequent vitiated air, and no systematic method of securing fresh air. In many of the rooms the desks were ludicrously small, making a condition ruinous to health, and in itself absolutely intolerable.

Below is given the detailed description of each building sent to the School Superintendent, and Chairman of the School Board. Along with this description went a letter urging immediate action.

Building No. 1. Two modern drinking fountains. Closets new. First-class condition. Plaster along stairway on boys' side needs repairing. Floor rough and defective in several places. Weeds in yard need cutting.

Building No. 2. Water coolers greatly in need of cleaning. In four rooms there was no glass dipper for the pupils to drink out of, and in one room a very rusty tin cup. A layer of dust over the water in each cooler. There was a heavy deposit of dirt in one cooler under the water. Two hydrants, neither of these having the drain required by law. Only two rooms with slop buckets and one of these extremely dirty. In one room a large puddle of water was on the floor where it had been apparently thrown by the pupils. No slop bucket in some of the rooms. Plaster broken in several places, and paper peeling in two or three places. Plaster in upper hall apparently dangerous.

Building No. 3. Seats in boys' closet strongly in need of cleaning. Sanitary conditions generally good.

Building No. 4. All walls with the exception of one room glaringly white, which is very injurious to the eyes. These walls should be tinted. Walkways to buildings of plank in which several of the planks are broken, making the walks dangerous. Heating and ventilation of this building the best in the city, however the intake of fresh air is too near the ground, and it would seem that a large quantity of dust is sucked up. Measures should be taken to prevent this.

Building No. 5. Two tower rooms on third story have very narrow steps, and are consequently very dangerous in case of fire. Coolers in all the rooms kept unusually clean. In one room was a rusty tin dipper. General condition good.

Building No. 6. Insufficient supply of water. Intake for ventilation too low thereby causing dust. General conditions good.

Building No. 7. Conditions intolerable. Stove heat. No jackets. On east side of building, within 20 feet of school, two privies and one cow stable. On west side boys' privy was within 20 feet. Girls' privy within 10 feet. Girls' privy owned and used by a colored family, who extend the use of same to girls as a courtesy. Odor in schoolroom unbearable. No water on lot. Open bucket for water. Desks obsolete. (This building was summarily closed by the Health Department in ten days from the inspection after due notice to the School Board.)

Building No. 8. Spot of plaster off in one room. Floor in two rooms not stained. Only one cooler with glass. No slop bucket. Old-fashioned earth closet. Stove heat and no jacket on stove.

Building No. 9 (colored). Filthy old-fashioned earth closets. Ventilation bad and paper scattered all over the grounds. Undesirable conditions.

Building No. 10 (colored). Open buckets in five rooms, but the Principal had secured old coolers from another building to replace these. Wall chipping in spots. Plaster in one place and downstairs hall broken. Both plank walkways to closets from buildings broken and dangerous. Building three stories high with narrow stairway. No fire-escape, making the building almost a fire-trap. Over 650 pupils in attendance. Two hydrants neither having drain in accordance with law, and making a mess all over the back yard.

Building No. 11 (colored). In all the rooms an open water bucket, and a glass for each bucket, without handle, making it not only necessary to put the glass into the bucket, but to dip the fingers into the bucket as well. Walls chipping in places. Closets directly over sewer with apparently no trap. Boys' closet very dirty.

Building No. 12 (colored). Low pitched. Boards broken. Heated with stoves without jackets. Open buckets and plaster broken in spots.

Water closets, but these were old fashioned, and have bad odor. Needs hinged door in front. Gutter opens on yard, making wash.

Building No. 13 (colored). Open buckets. Broken plaster in two places. Desks very low. Stove heat, no jackets. Old-fashioned unsanitary earth closets.

When this report reached the School Board, the Board was astounded. No one had ever thought that conditions could be so bad, and yet when attention was called to the facts they were seen to be too true. Action was taken at once, and the results will here be stated. Every building in the city is in excellent repair and repeated inspection sees that it is kept so. All buildings are equipped with drinking fountains, and nothing like a common drinking cup can be found. The privies have been abolished and modern plumbing installed. Obsolete desks have given place to those of proper size and pattern; adjusted to individual pupils. Old buildings have been torn down and in their stead have been erected new ones, with the best heating, lighting and ventilation that science in its present stage could suggest. One building for colored children, although the Health Department passed over the plumbing in its original report, the plumbing being excellent compared with that in some other buildings at that time, the School Board this summer decided should be better and more amply equipped, and is now spending $2,500 to put the water closets in the best of shape.

So much then for the buildings themselves. Two years ago no medical inspection of children was in existence. Now we have examination of eyes and ears, and a good control of contagious diseases. The medical inspection is inadequate, but adequate inspection is coming, and coming fast. We hope soon to have school nurses, and the examination of nose, teeth and throat. At a recent meeting the Board created the position of Playgrounds Director, whose duty it will be to develop the school yards as playgrounds, and to further generally the outdoor activities of the children.

The object of this paper is to suggest that executives are as much needed as investigators. Oftentimes we have the law, but it is null and void because no one pays any attention to it. School Boards and Superintendents are usually not only willing but anxious to comply with hygienic requirements, if only their attention is called to the requirements, and they are told definitely what to do. School officials should work in close harmony with health departments. Neither school board nor health board can meet with the fullest success without the aid of the other.

HYGIENE OF THE RURAL SCHOOLS

BY

James A. Nydegger

Sanitary laws in great numbers have been enacted and enforced for the betterment of the complex health conditions of our cities. Extensive public health educational campaigns have been carried on in all that pertains to health and hygiene; and in the onward movement which at the present time is being agitated more than in any former period, in behalf of better methods of living, physically, mentally and morally, with the great advances made in hygienics, eugenics and euthenics, the rural and urban districts, which now offer the most fruitful fields for the promotion of hygiene, in all the term implies, seem in a great measure to have been overlooked, and practically passed by, and up to the present time, almost forgotten. This has been due in a measure to the engrossing attention paid to improving health conditions in the cities and large towns, while the rural areas have been sadly neglected.

Other factors of importance in this connection are the remoteness of some of the sections from the more populous cities and environs, and partly through lack of knowledge and ignorance of the existing injurious environment, insofar that the rules for correct living and good health have been almost completely ignored.

In further explanation of the backwardness in the rural hygienic movement, it might be said that the non-investigation into the true status of health conditions in rural areas more thoroughly, has not been intentional on the part of the sanitary and health officials of any state, but partly follows as a result of the lack of interest and knowledge concerning these matters, of the inhabitants themselves. What will apply as a whole to the tardiness in advancing better hygienic and health conditions in the rural communities, of the majority of our states will likewise apply to any particular environment in which the population in these areas might happen to be placed.

How frequently do we hear the assertion made by statesmen and others, that the country district school is the foundation of the republic, the bulwark of the nation, and yet how little has the nation apparently done for the public schools of the rural communities. In the cities and larger towns the schools are as a rule, fairly well administered; and the buildings fairly well constructed and equipped, in accordance with hygienic measures, but how about the sadly neglected rural schools? When we come to consider the subject of school hygiene, this is one of the supreme questions of the hour, as I take it.

When we fail to respond to the call for more modern school houses in the rural areas, and better equipped and better paid teachers, we fail in a great public duty.

The claim that the children in the country districts are entitled to just as well lighted and heated buildings, to just as habitable, modern and sanitary schools, as are the children of the cities and towns, is a just one, and the demand must be met if we would heed the call of progress and justice.

Every American child is entitled to a free common school education, and where the rural communities cannot properly provide and support their schools, the State and Federal Governments should see to it that better provisions for the rural schools are provided.

It is highly important for us to understand that schools are provided for that part of our population which is peculiarly susceptible to the influences of bad hygienic surroundings. It is now a well recognized fact that the hygiene of school life is of paramount importance in connection with the subject of political economy and the prosperity of a nation.

It is also highly important that those who are in any way connected with the education of the young should have uppermost in mind that the greatest asset or resource of a nation is its healthy citizen; and that unless we do provide better and more modern and sanitary schools in the rural districts, we cannot expect the children of these communities to grow up into healthy citizens, and a citizen without good health is a non-valuable quantity when resources are being considered. As a people we spend comparatively little money on the conservation of health, our greatest national resource, while vast sums are expended for other public purposes of lesser importance.

In the little white, one-roomed, country school house, many of our greatest men began and completed their school education, yet there can be no doubt that there were others who would have been great but for the undesirable environment and limitations of the country school.

It is a sad fact that the school houses in many of our rural communities are far from sanitary, and that the work imposed upon the teachers, who are chiefly women, is greater than they can perform without endangering their health.

The majority of the rural school children spend from twenty to thirty hours weekly in the school room for a period of several months each year, for eight or ten years. Such being the case the need of hygienic schools and environs, and a good personal hygiene must be admitted by all.

Formerly we were taught that the country is more healthful than the city, and we accepted this without comment, but recently the sanitarians have called attention to the fact that the death rate in the cities is falling more rapidly than in the rural districts. The cause of this is simply a matter of sanitation. While sanitary and hygienic provisions have been made for the cities, the urban and rural areas have been sadly neglected. When the country was first settled the population was scattered, and the virgin soil was not polluted, the waters were pure, and many of the contagious diseases which now claim thousands were practically unknown.

If we but compare the existing unhygienic condition of the average rural school with that of the schools of the cities, the contrast will be shown to be all the greater. How often do we see—especially those of us who are somewhat more familiar with rural life and rural conditions—the district school located at some one or other extreme limit of the school district, placed there doubtless more to please some influential trustee, or patron, or because of a stronger local faction, rather than being placed centrally, where it would be equally distant and accessible to all, thereby lessening the hardships, fatigue, and exposure in inclement weather, imposed on the children who attend from the more distant parts. Again on the aforesaid grounds, as also by reason of ignorance of the laws of hygiene, how frequently do we see the rural school house located at some unhygienic or badly oriented spot. Occasionally do we see the school placed on low ground where drainage is poor or where the ground water is near the surface, or perhaps it is seen surrounding and overhung by trees, which are conducive to moisture and insufficient sunlight, or it is situated at the base of a hill or eminence, thereby depriving the building of the proper amount of light, as also affording an ill-pleasing view from the windows.

The filth and foul air of the toilet rooms of many schools in decent urban and town communities is unspeakable, but if we venture into the more remote rural districts, we are wont to observe the total absence of this important sanitary accommodation of the school; and the scholars, responding to the daily calls of nature, must make use of the privacy afforded by natural objects, and otherwise, in the vicinity of the building, with necessarily resulting soil pollution and the liability of the dissemination of disease germs contained in the excreta, deposited on the ground. In this manner pathogenic germs may easily gain access to the source of supply of drinking water for the school. The dangers of the drinking water are thus two-fold: From the impure water, and from the common drinking cup, in transmitting disease, still in common use in the rural school.

The water supply of the rural school generally comes from a surface spring or shallow well. The former, if free from pollution, is frequently made inaccessible by reason of the distance necessary to transport the water, with a resulting deprivation in the amount supplied for drink and purposes of cleanliness in the personnel of the school, their effects, and the building itself. Drinking water coming from a shallow well is more dangerous than from a spring, as it is located near the school and is more liable to receive surface drainage from the vicinity of the building, and therefore is more likely to be polluted and its use a greater risk to health.

When we come to consider the rural school itself, the lack of cleanliness is perhaps the most glaring and universal defect, being worse frequently in this respect than the school in the city, while also it is generally found to be poorly constructed, and imperfectly heated, ventilated and lighted. The average country school house is usually a one-room affair, with thin walls and thin floors, with cloak-room, wash-room and school-room combined in one, with emanations from unwashed bodies and soiled clothing and collected gases tainting the atmosphere. No vestibule or ante-room is provided, and the single door opening directly without assists in making the heating of the country school a *question*. This is generally done by stoves, and in cold climates is as unsatisfactory a method as possibly can be imagined. The floors are always cold and the children suffer cruelly from chilblains and colds. While the upper part of the room is too warm, the outer row of seats is in an icy atmosphere, and the whole room suffers from bad air. How many of us here recall the cold and cheerless mornings of our early school days, when the wood stove failed to draw, and smoked, and the frequent sorties of the scholars in search of better fuel to make it burn.

The floors in rural schools are covered with dust, as are also the walls and furnishings, and while the floors are scrubbed once or oftener a year, were it not for the vacation interim, doubtless a number of pupils would not escape serious illness thereby, though perhaps the country school's lack of cleanliness is less harmful on account of the presence of better air and more sunlight than in the cities; but the cold floors, poor ventilation and lighting and absence of all toilet conveniences make them extremely uncomfortable and often unsanitary. The improper ventilation and lighting of these schools frequently justly call for words of extreme criticism on the part of the hygienist. What provisions do we see made for the proper ventilation of the school rooms of the rural communities? To nature is entrusted this all-important function. Foul air must find its egress from the room *per via naturalis*, as also must fresh air gain access in the same manner. To supply these defects in construction, windows must frequently be raised or lowered and doors thrown open, when the air becomes overcharged with accumulated gases, or the room overheated, as frequently happens, thereby resulting in exposure of the scholars to cold drafts, with consequent detrimental effects on health. Also do we see many rural schools where the lighting is totally inadequate. Either the building is not properly oriented, so as to receive the maximum amount of sunlight throughout the day, or the windows are improperly placed or insufficient in number and size, with the resultant detrimental effects on the eyes of the scholars, leading to eye strain, headaches, and other discomforts, and eventually impairing visual acuity.

The lack of systematic medical inspection of rural schools is also a matter of crying need. While this excellent method of eliminating the danger of transmitting contagious diseases from among school children in our cities and some of the larger towns is being extended and improved, as also the relief of faulty health conditions in the children themselves which would interfere with their progress, physically and mentally, and frequently would eventually lead to serious disorders, the rural and urban schools are practically totally deprived of this valuable service. The recent wonderful awakening on the part of the State Boards of Health and the State Boards of Education, and the Federal authorities, in respect to this point in certain sections of our country, cannot be praised too highly. The initiative in solving this particular phase of rural school needs seems therefore to have been taken, but time will be required for the development of public sentiment along this line among the rural people, and for the passage and enforcement of state and local laws providing for this much needed inspection.

The common drinking cup, the common towel, the badly constructed, placed and kept blackboard, and the common tin wash basin, all will be found still to fill a prominent part in the equipment of the rural schools in many communities, and two of these at least play well their part in the spread of disease among the school children.

Many other subjects which have an important bearing on the promotion of hygiene of the rural school, such as providing proper and sanitary playgrounds, proper toilet rooms, the proper care of school rooms, equipment with proper furniture, providing baths, lunch rooms, shortening of the long school hours, the color of the walls with respect to light, the prevention of certain games played by children with the view of preventing the spread of disease through osculation, and others, might well here be discussed, but time will not permit.

Having dwelt upon the unsanitary and unhygienic condition of the rural schools, naturally the question is asked what is the solution of this whole problem. The answer is, education in public health matters, and the adoption of a state-wide policy of improved health and hygienic measures. The splendid health organizations in force in some states, cities and large towns only need extension and increased scope of action to include the rural districts in all their beneficial operations, while others need to have health departments organized and put on a proper footing of efficiency. Many of our rural public school hygienic problems are difficult of solution, and will require the outlay of much time, talent and money. The latter is not always forthcoming from the State Legislatures, but with it in hand the other two can be obtained.

If the rural communities cannot properly support their schools it would seem but proper to maintain that the State or Federal Government should do so. We know the states are limited to the amount of money they can raise by direct tax, while the Federal Government, by indirect taxation, can provide, without in any way embarrassing its efficiency; and the farmers who hold the balance of power should see that they are made, and the funds thus released used for the betterment of the country schools.

As has been said, what is most needed to improve and promote the hygiene of the rural schools is the arousing of public interest in all matters pertaining to hygiene and health in these communities. This can be accomplished effectively in one way, and that is, by education of the public, by lecture campaigns, talks, traveling exhibits, by State Boards of Health, and Education, by the school teachers, trained in detecting the contagious diseases in school children, and other interested organizations and individuals, and the district school nurse.

Under this head, the Federal Government, working in conjunction with State health and education officials in establishing model schoolhouses, with model equipment, playgrounds and toilet rooms, etc., adapted to the needs of the several rural communities, these to be used as standard types of buildings for similar purposes in the future, would find a field of great usefulness and great public benefit, thereby making good the oft-quoted statement, that the rural school is truly the foundation of the republic, and that it aims to conserve the health of our school children, our greatest national resource; by improving the sanitary conditions surrounding the country school to a point where it will not form, as it forms to-day, the great disease-spreading center for rural and semi-rural communities.

By these methods, it is believed, modern school houses, as well lighted and heated and as habitable and well equipped as those in the cities, can be provided in the rural communities, at no great increase in cost; and in this manner it is believed that all residents of such districts can be reached and interested and instructed, and be brought to realize that life can be conserved and prolonged, by observing certain and not difficult hygienic rules for the schools, thus insuring increase of health and happiness, and in the end greater prosperity in any community.

DISCUSSION OF

James A. Nydegger's Paper

BY

Himself

The object in presenting the paper on Hygiene of the Rural Schools was to emphasize the importance of turning our eyes on the rural schools of our country. The inhabitants of our rural communities have to pay taxes on their property the same as the city dwellers, and why should they not be entitled to just as habitable and comfortable and well adapted school buildings as the people of the city? I do not mean to minimize the importance of attention to the hygiene of the city schools, but the rural schools are the ones most lacking in it. If we expect to have the children of the rural communities grow up into healthy citizens we must provide them better schools.

The photographs which are being handed around do not exaggerate the unhygienic rural schools and their unhealthy environments. They speak for themselves stronger than words.

DISCUSSION OF

James A. Nydegger's Paper

BY

John A. Ferrell

We do not always understand each other in these discussions because the remarks of one are directed to city problems where there is great wealth, a dense population, and specialization in public work is necessary; whereas the remarks of others are directed to the solution of rural problems where funds are scarce and the creation of a new office calls for an appreciable contribution from each of the comparatively few property holders.

My interest in the main is in the rural problems such as have been described by Dr. Nydegger in his excellent paper on "Hygiene of the Rural Schools." We must have a whole-time health officer to begin with in every county in inaugurating proper medical supervision of the schools and children. He should be a physician representing the Board of Health and the Board of Education conjointly. His duties should embrace an inspection of school premises relative to the sanitary conditions of the school property and the vicinity immediately surrounding it; the school children for the identification of all those requiring medical care; the exclusion of those suffering from communicable diseases; the detection of ailments, defects or diseases other than communicable diseases, the examination of the drinking water, the inspection of privies and other school facilities necessary to the protection of the health and vitality of those attending school.

It is the work of the health department in that it aids to prevent or eradicate disease, to protect health, and to teach our children how to live to be useful citizens. It is the work of the educational department in that it saves and preserves the child for the school, a healthy, educatable child, one whose heart and mind is receptive to training, one whose life will bless the State with the highest type of citizenship. Both departments in endeavoring to meet what may have seemed emergencies have been giving their efforts primarily to other lines of work, and only secondary consideration has been given to the line of activity fundamentally essential to placing the work of either department on a firm foundation.

The conducting of medical inspection is so essential to both departments and so inseparable, at this time, from either, that the inspector should be a representative of both acting conjointly. With any other arrangement there might arise a conflict of authority. If there is to be any separation of the respective departments in the work the authority for its conduction should be logically vested in the educational department, with power when conditions warrant it to delegate the authority to the health department.

As the medical inspection among our rural schools represents something of a pioneer work its success or failure will be governed very largely by the man selected as inspector. He should be a physician well equipped with collegiate and professional training. He should possess discretion, tact, patience, enthusiasm for the work, and the power to inspire enthusiasm in others. Previous experience in school and health work is a very desirable requisite. Possessed of these qualifications the man needed will always command an adequate income. It need not be expected, therefore, that he can be had without his being compensated on a basis commensurate with what he would receive in private practice. To let out work of such vital importance to the lowest bidder, to one perhaps who needs the salary because in private practice he is so seldom sought, would be fatal to the work, and should be regarded as criminal. The man chosen should be the fittest physician obtainable, without regard to county or state boundaries.

The county commissioners now pay a county superintendent of health to care, as a rule, for those who, often perhaps through medical neglect, have become paupers or criminals, and to fight disease usually after it has become epidemic. It is the exception to find applied the principle of "a stitch in time saves nine." The toll paid directly and indirectly as a result of such a system is appalling. The jails are filled; the county homes are crowded; the dependents are numerous; schools are poorly attended; many children are backward and require two years to complete what should be accomplished in one; frequently on account of epidemics schools are actually closed for weeks and months, quarantines are established, business suffers, and there is general stagnation.

The county cannot afford to longer tolerate this poor business policy. It must invest in the best talent obtainable, regardless of price, to protect it from such conditions. The "stitch in time" principle must be applied.

To take the entire amount needed from either the general county fund or from the school fund in a small county might cause some slight inconvenience, but if both funds will support the inspector who is mutually the choice of the Board of Health and the Board of Education, the expense will not be heavy on the Commissioners nor on the Board of Education. As a matter of fact, it should make little difference which tax money is used to provide for medical inspection, as it affords protection to all the people and may well be regarded as either regular health or regular school work.

A STATISTICAL STUDY OF THE PHYSICAL DEFECTS OF THREE HUNDRED THOUSAND RURAL SCHOOL CHILDREN

BY

B. FRANKLIN ROYER

Medical inspection of schools in Pennsylvania has been conducted in a more extensive way among the rural children than has been common in other sections of the country. Probably the statistics of Pennsylvania now show a greater number of visual tests, tests of hearing, records of the condition of breathing, of the condition of their teeth and tonsils and of certain other defects and deformities than have been accumulated elsewhere for this class of children.

The object in preparing this paper is to present the statistics with a brief analysis and give an opportunity for the Congress to discuss them and to contrast them with statistics in municipalities where figures have been accumulated for years. The statistics upon which this analysis is based deal with a total of 305,372 rural school children, none of whom reside in settlements having over 5,000 population and in fact quite ninety per cent. of them are children living in the country districts on farms or in little villages. My first thought was to include the children from the third-class districts with these in the fourth-class districts, but on further consideration determined that it would make the study more interesting to limit it to the purely rural child.*

Out of the 305,000 odd children examined, more than 210,000 of them were found to have some defect, that is, upward of seventy-four per cent. of the children were defective.

COMMONWEALTH OF PENNSYLVANIA—DEPARTMENT OF HEALTH

SCHOOL MEDICAL INSPECTION—FOURTH CLASS DISTRICTS
SCHOOL YEAR 1912 AND 1913

No. Schools Inspected	7,375	
No. School Rooms Inspected	11,684	
No. Pupils Inspected	305,372	
No. Pupils Defective	228,693	74.9%
No. Pupils Not Defective	76,679	25.1%
No. Single Defects	91,408	
No. Multiple Defects	187,285	
Total No. Defects	599,272	

*In Pennsylvania a school district of the third class is one having a population of not less than 5,000, nor more than 30,000; a district having a population of less than 5,000 is of the fourth class.

Eyes		
Pupils Having Defective Vision	82,454	27.0%
Defective Vision, Right Eye Only	12,190	
Defective Vision, Left Eye Only	13,515	
Defective Vision, Both Eyes	56,749	18.6%
Total No. Corneal Defects	2,293	
Corneal Defects, Right Eye Only	658	
Corneal Defects, Left Eye Only	825	
Both Cornea	810	
Blepharitis	1,183	
Conjunctivitis	1,031	
C. simplex	1,009	
C. follicularis	22	
Iritis	27	
Trachoma	18	
Hearing		
Pupils Having Defective Hearing	8,818	2.9%
Defective Hearing, Right Ear Only	3,487	
Defective Hearing, Left Ear Only	2,970	
Defective Hearing, Both Ears	2,361	
Total No. Having Otorrhea	2,724	
Right Otorrhea	858	
Left Otorrhea	943	
Otorrhea Both Sides	1,923	
Breathing		
Slight Impairment	6,845	
Serious Impairment	2,117	
Mouth Breathing	1,617	
Adenoids	4,454	
Teeth		
Unclean	27,685	9.1%
Decayed	91,561	30.0%
Gums Diseased	928	
Tonsils		
Slightly Enlarged	60,846	
Greatly Enlarged	26,356	
Acutely Inflamed	1,126	
Enlarged Cervical Glands	19,650	6.4%
Tuberculosis		
Lungs	192	
Glands	367	
Bones	33	
Joints	43	

Nervous Disease	
Chorea	291
Epilepsy	82
Skin Disease	
Scabies	88
Impetigo Contagiosa	260
Favus	1
Ring Worm	58
Nits in Hair	3,657
Head Lice	11
Body Lice	6
Deformities	
Hunchback	40
Clubfoot	50
Curved Spine	59
Ankylosed Joint	13
Hair Lip	29
Cleft Palate	95
Goitre	347
Miscellaneous	896
Nutrition	
Fair	11,463
Poor	2,155
Quarantinable Disease	
Chicken-pox	27
Whooping Cough	24
Measles	5
Diphtheria	1

The following tables and diagrams show the number and percentage of children defective at each age period from 6 to 16 inclusive:*

Age	Normals	Percentage	Defectives	Percentage
6	9,028	2.9	24,957	8.2
7	7,057	2.3	26,122	8.6
8	6,591	2.2	27,764	9.1
9	6,329	2.1	27,477	9.0
10	6,866	2.2	25,860	8.5
11	7,126	2.4	22,058	7.2
12	7,975	2.6	22,089	7.2
13	7,285	2.4	17,602	5.8
14	6,412	2.1	13,814	4.5
15	4,741	1.5	8,795	2.9
16	3,233	1.1	5,247	1.7

*Children under 6 (Kindergarten and others), those past 16 and with ages not recorded, are omitted from this tabular and diagrammatic analysis.

305,372 RURAL SCHOOL CHILDREN CLASSIFIED BY AGE, SEX, COLOR AND NATIVITY GROUPED AS NORMALS AND DEFECTIVES

		AGES														
		TOTAL ALL AGES	UNDER 6 YEARS	6	7	8	9	10	11	12	13	14	15	16	OVER 16	AGE UNSTATED
AGE AND SEX	TOTAL	305372	3467	33985	33179	34355	33806	32726	29184	30064	24887	20226	13536	8480	6791	686
	MALE	151427	1646	17306	16899	17165	17069	16380	14495	15073	12179	9990	6269	3700	2899	357
	FEMALE	153945	1821	16679	16280	17190	16737	16346	14689	14991	12708	10236	7267	4780	3892	329
AGE AND NATIVITY	TOTAL	305372	3467	33985	33179	34355	33806	32726	29184	30064	24887	20226	13536	8480	6791	686
	NATIVE	293236	3374	31962	31470	32717	32280	31309	28066	28901	24107	19859	13360	8441	6755	635
	FOREIGN	12121	93	2022	1708	1636	1526	1414	1113	1163	780	367	175	39	35	50
	UNSTATED	15		1	1	2		3	5				1		1	1
AGE AND COLOR	TOTAL	305372	3467	33985	33179	34355	33806	32726	29184	30064	24887	20226	13536	8480	6791	686
	WHITE	302597	3448	33717	32907	34023	33529	32448	28899	29752	24605	20025	13415	8420	6736	673
	BLACK	2767	19	267	272	331	277	277	284	312	282	201	121	58	54	12
	OTHER COLORS	8		1		1		1	1					2	1	1
		NORMALS														
AGE AND SEX	TOTAL	76679	1174	9028	7057	6591	6329	6866	7126	7975	7285	6412	4741	3233	2664	198
	MALE	37005	556	4430	3560	3204	3098	3197	3475	3881	3570	3156	2181	1437	1160	100
	FEMALE	39674	618	4598	3497	3387	3231	3669	3651	4094	3715	3256	2560	1796	1504	98
AGE AND NATIVITY	TOTAL	76679	1174	9028	7057	6591	6329	6866	7126	7975	7285	6412	4741	3233	2664	198
	NATIVE	74188	1147	8558	6736	6309	6073	6399	6900	7702	7090	6329	4696	3217	2650	182
	FOREIGN	2479	27	469	321	281	236	265	221	273	195	83	44	16	13	15
	UNSTATED	12				1		2	5				1		1	1
AGE AND COLOR	TOTAL	76679	1174	9028	7057	6591	6329	6866	7126	7975	7285	6412	4741	3233	2664	198
	WHITE	75897	1168	8931	6986	6489	6281	6791	7063	7883	7206	6350	4701	3211	2642	195
	BLACK	778	6	97	71	101	48	74	62	92	79	62	40	22	22	2
	OTHER COLORS	4				1		1	1							1
		DEFECTIVES														
AGE AND SEX	TOTAL	228693	2293	24957	26122	27764	27477	25860	22058	22089	17602	13814	8795	5247	4127	488
	MALE	114422	1090	12876	13339	13961	13971	13183	11020	11192	8609	6834	4088	2263	1739	257
	FEMALE	114271	1203	12081	12783	13803	13506	12677	11038	10897	8993	6980	4707	2984	2388	231
AGE AND NATIVITY	TOTAL	228693	2293	24957	26122	27764	27477	25860	22058	22089	17602	13814	8795	5247	4127	488
	NATIVE	219048	2227	23404	24734	26408	26207	24710	21166	21199	17017	13530	8664	5224	4105	433
	FOREIGN	9642	66	1533	1387	1355	1270	1149	892	890	585	284	131	23	22	35
	UNSTATED	3				1		1								
AGE AND COLOR	TOTAL	228693	2293	24957	26122	27764	27477	25860	22058	22089	17602	13814	8795	5247	4127	488
	WHITE	226700	2280	24786	25921	27534	27248	25637	21836	21869	17399	13675	8714	5209	4094	478
	BLACK	1989	13	170	201	230	229	203	222	220	203	139	81	36	32	10
	OTHER COLORS	4		1										2	1	

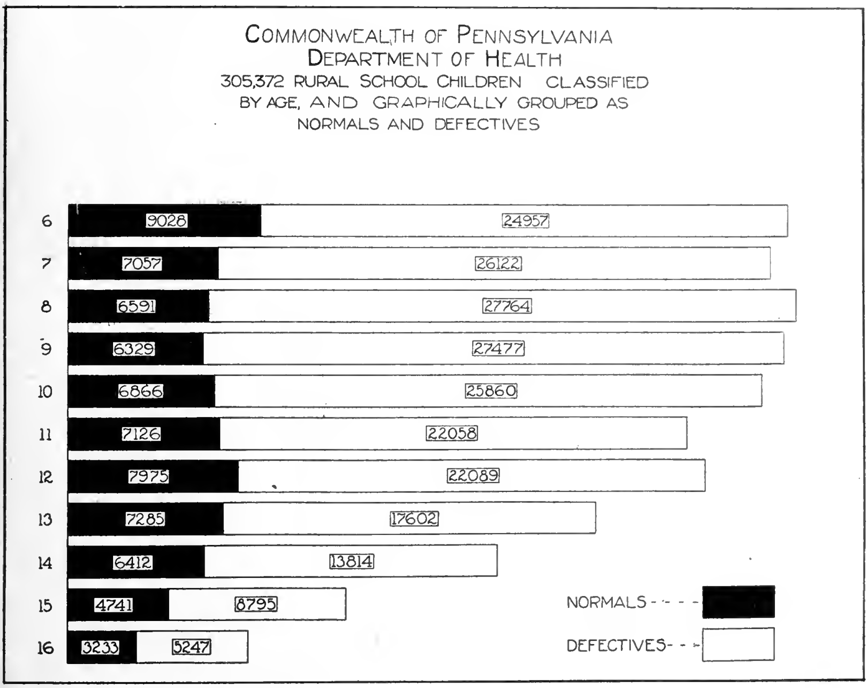
PERCENTAGE GROUPING OF 305372 RURAL SCHOOL CHILDREN. PERCENTAGES ARRANGED BY AGE SEX, COLOR AND NATIVITY GROUPED AS NORMALS & DEFECTIVES

TOTAL 4TH CLASS DISTRICTS	TOTAL														
	AGES														
	TOTAL	-6	6	7	8	9	10	11	12	13	14	15	16	16+	UN STATED
TOTAL	100.0	1.1	11.1	10.9	11.3	11.1	10.7	9.6	9.8	8.2	6.6	4.4	2.8	2.2	.2
MALE	49.6	.5	5.7	5.6	5.6	5.6	5.4	4.7	5.0	4.0	3.2	2.1	1.2	.9	.1
FEMALE	50.4	.6	5.4	5.3	5.7	5.5	5.3	4.9	4.8	4.2	3.4	2.3	1.6	1.3	.1
TOTAL	100.0	1.1	11.1	10.9	11.3	11.1	10.7	9.6	9.8	8.2	6.6	4.4	2.8	2.2	.2
NATIVE	96.1	1.1	10.4	10.4	10.8	10.6	10.2	9.2	9.4	7.9	6.5	4.4	2.8	2.2	.2
FOREIGN	.9	–	.7	.5	.5	.5	.5	.4	.4	.3	.1	–	–		–
UNSTATED	–		–	–	–		–	–		–		–			–
TOTAL	100.0	1.1	11.1	10.9	11.3	11.1	10.7	9.6	9.8	8.2	6.6	4.4	2.8	2.2	.2
WHITE	99.1	1.1	11.0	10.8	11.2	11.0	10.6	9.5	9.7	8.1	6.5	4.4	2.8	2.2	.2
BLACK	.9	–	.1	.1	.1	.1	.1	.1	.1	.1	.1	–	–	–	–
OTHER COLORS	–			–		–		–	–				–	–	–
	NORMALS														
TOTAL	25.1	.4	2.9	2.3	2.2	2.1	2.2	2.4	2.6	2.4	2.1	1.5	1.1	.9	–
MALE	12.1	.2	1.4	1.2	1.1	1.0	1.0	1.2	1.2	1.2	1.0	.7	.5	.4	–
FEMALE	13.0	.2	1.5	1.1	1.1	1.1	1.2	1.2	1.4	1.2	1.1	.8	.6	.5	–
TOTAL	25.1	.4	2.9	2.3	2.2	2.1	2.2	2.4	2.6	2.4	2.1	1.5	1.1	.9	–
NATIVE	24.3	.4	2.8	2.2	2.1	2.0	2.1	2.3	2.5	2.3	2.1	1.5	1.1	.9	–
FOREIGN	.8	–	.1	.1	.1	.1	.1	1	1	.1	–	–	–	–	–
UNSTATED															
TOTAL	25.1	.4	2.9	2.3	2.2	2.1	2.2	2.4	2.6	2.4	2.1	1.5	1.1	.9	–
WHITE	25.1	.4	2.9	2.3	2.2	2.1	2.2	2.4	2.6	2.4	2.1	1.5	1.1	.9	–
BLACK	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
OTHER COLORS	–		–		–		–	–					–	–	–
	DEFECTIVES														
TOTAL	74.9	.7	8.2	8.6	9.1	9.0	8.5	7.2	7.2	5.8	4.5	2.9	1.7	1.3	.2
MALE	37.5	.3	4.3	4.4	4.55	4.6	4.4	3.5	3.8	2.8	2.2	1.4	.7	.5	.1
FEMALE	37.4	.4	3.9	4.2	4.55	4.4	4.1	3.7	3.4	3.0	2.3	1.5	1.0	.8	.1
TOTAL	74.9	.7	8.2	8.6	9.1	9.0	8.5	7.2	7.2	5.8	4.5	2.9	1.7	1.3	.2
NATIVE	71.8	.7	7.6	8.2	8.7	8.6	8.1	6.9	6.9	5.6	4.4	2.9	1.7	1.3	.2
FOREIGN	3.1	–	.6	.4	.4	.4	.4	.3	.3	.2	.1	–	–	–	–
UNSTATED	–			–	–		–								
TOTAL	74.9	.7	8.2	8.6	9.1	9.0	8.5	7.2	7.2	5.8	4.5	2.9	1.7	1.3	.2
WHITE	74.0	.7	8.1	8.5	9.0	8.9	8.4	7.1	7.1	5.7	4.4	2.9	1.7	1.3	.2
BLACK	.9	–	.1	.1	.1	.1	.1	.1	.1	.1	.1	–	–	–	–
OTHER COLORS	–		–										–	–	

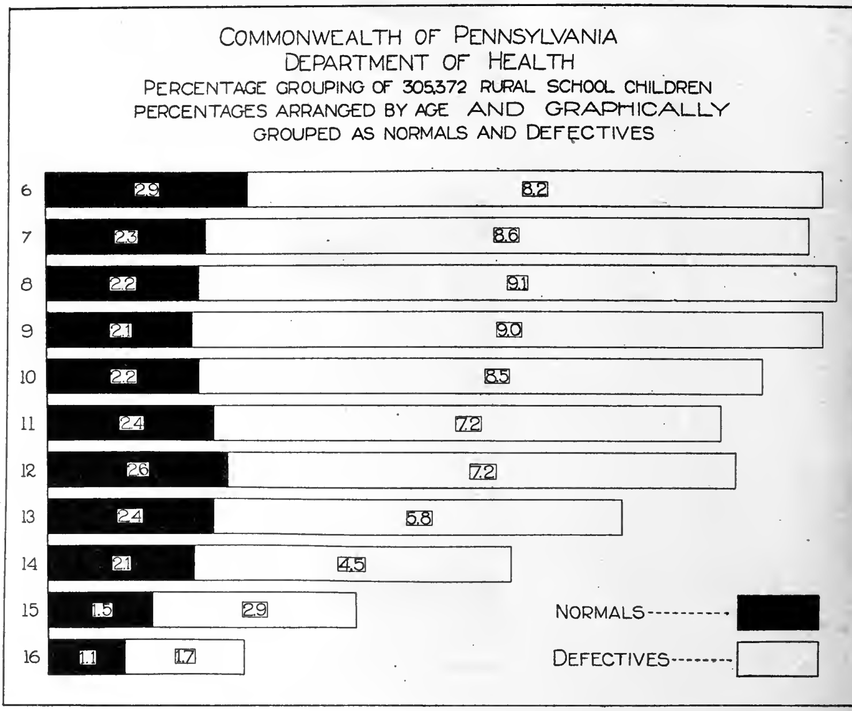
– LESS THAN ONE TENTH OF ONE PER CENT

Of the total number examined, just twenty-seven per cent. showed defective vision; that is, by the use of Snellen's Chart twenty-seven per cent. of all of these children failed to read the line at a distance of twenty feet that the normal children should read, which means that they were either nearsighted or had some serious refractive error or some obstruction to the admission of light to the retina. This percentage takes no account of children whose vision has been corrected by lenses.

Two and nine-tenths, or almost three per cent. of all pupils examined showed defective hearing; that is, a defect of sufficient moment to seriously impair the progress of the child in school and probably not only to impair the progress of the child, but to seriously affect the progress of the class.



Not far from five per cent. of all of these children show some defect of nasal breathing; that is, there was enough obstruction somewhere in the nasal orifices or naso-pharynx to prevent breathing through the nose. In this group of course is included adenoids, growths, hypertrophied turbinate bones, deflected nasal septa and other deformities. Nearly twenty-nine per cent. of all children examined show enlarged tonsils; in about ten per cent. the enlargement was enough to affect the pupils' health and general nutrition. The teeth required attention in nearly forty per cent. of the children. One quarter of these have un-



clean teeth; that is, teeth darkened in color by collection of bacterial debris and other evidence of beginning disease that might be averted by discreet use of the toothbrush; and the other three-quarter also show actual decay of the teeth; that is, cavities were noted by the examiner or diseased gums were found resulting from decayed teeth and neglect of the proper hygiene of the mouth.

As a result of the impaired nasal breathing, unclean and decayed teeth and diseased tonsils, a goodly percentage of the pupils—between six and six and one-half per cent.—show enlargement of the lymphatic glands in the neck; the superficial glands in the vicinity of the tonsils and lower jaw.

Everyone of these pupils, with the exception of a few first term children in kindergarten and regular schools, was examined in the same routine way and for each pupil examined a complete record was made on Form 51 reproduced in this volume, in a paper by Dr. Samuel G. Dixon.

In order to tabulate these records and secure complete statistics, a punch card system was adopted, the card being ingeniously arranged to record the data in fields for mechanical tabulation, the official method of statistical compilation adopted some years ago in the United States Census office, this card being made up as follows:

Punch card used by the Department of Health in tabulating the defects recorded in the Medical Inspection of the Rural School Children of Pennsylvania

PHYSICAL INSPECTION

Cty.				Co.		Yr.	12 Mo 11	Age		SX	CL	NT	N D	VISION R	VISION C D	VISION L	VISION C D	HEARING R	HEARING OT	HEARING L	HEARING OT	BR	TH	TL	CG	T. B. LG	T. B. GL	T. B. B	J	NV	SK	HL	DF	NU	Q D	E D								
0	0	0	0	0	0	20	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
										M	W	US																																
1	1	1	1	1	1	21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
										F	B	FOR																																
2	2	2	2	2	2	12	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
											OT																																	
3	3	3	3	3	3	13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	14	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	15	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	16	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	17	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	18	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	19	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

The method was adopted with a two-fold object in view; first, that it would give us the statistics more accurately and in a less expensive way than could be secured by the ordinary hand methods of tabulation and second, in that it lent itself to a system of grouping of defects and association of ailments not possible except at an enormous cost by any other method with which we were familiar. In designing the punch card form and statistical tables we took advantage of the expert knowledge of Dr. Wilmer R. Batt, State Registrar of Vital Statistics, in these particulars and with his aid believe we succeeded in compiling statistics that when entirely complete will be unique in school medical inspection work. In pupils having defective vision it is interesting to know how many of them may have associated with defective vision other ailments that might tend to impair sight, as for instance a child having defective hearing on one side such as to cause the head to be held in an abnormal position in school work, thus giving faulty position of the eye; or in hearing defects what percentage of pupils having impaired hearing have associated with this defect impaired nasal breathing, adenoid growths, etc. Or with children having defective teeth what percentage of them show in association hypertrophied tonsils, palpable cervical lymph glands.

This association of defects naturally brings up the query: How far do defective teeth impair the usefulness of the cervical lymph glands and thus lessen the pupil's resistance to disease, interfere with nutrition or impair his progress in school work?

In those having defects of vision it is interesting to know that but sixteen per cent. of them have visual defects alone. About two per cent. of the total number have associated with the visual error defects of hearing, about one per cent. have associated errors of breathing, about twelve per cent. have defective teeth, about nine per cent. have diseased tonsils and less than one per cent. have curvature of the spine.

Of those having defective hearing, about five per cent. have impaired breathing, about ten per cent. have defective teeth, about twelve per cent. have diseased tonsils and a like number have adenoids.

From what we know of the causes of impaired hearing, we believe that the abnormal conditions in the nose and naso-pharynx and in the vicinity of the tonsils, that is, the bad hygienic condition of the nasal and oral cavities, are directly responsible in most instances for the ear conditions.

The unhealthy condition of the mucous membranes, especially in the naso-pharynx and vicinity of the tonsils where the lymphatic circulation is wonderfully rich, readily presents opportunity for bacterial invasion and dissemination both to the organs of hearing and to the glands near by.

Possibly greater difficulty is met with in encouraging the toilet of the mouth, especially about the teeth, than in any other portion of children's bodies and it is doubtful if parents can for some time be made to appreciate fully that unclean teeth are factors in impaired health of children. They are not apt to believe that what appears to them as discoloration of teeth and dirt actually means germ life and that this germ life gains entrance to the alimentary canal, disordering digestion, to the circulatory system, impairing nutrition or to the nervous system, making the child irritable and of bad disposition.

So, too, with decayed teeth. Parents are apt to feel that decay, especially of the deciduous or baby teeth, is a natural process and that it does no harm to the health of the child, when as a matter of fact there is very great probability of neglect of this sort seriously impairing the health of the individual pupil both by affecting the lymphatic glands in the vicinity of the jaw by affording opportunity for germs to gain entrance to the body through the circulation and by preparing the soil for prompt decay of the permanent teeth; and there is no way to estimate the wear and tear on a child's nervous system caused by exposure of nerves in teeth that have not actually ached.

Probably a thousand pupils in all the rural schools of Pennsylvania show some form of tuberculosis, a very small percentage of them showing tuberculosis of the lungs and this percentage is decreasing because of the provisions of the School Code for excluding those having tuberculosis disease of the lungs except in schools prepared for the purpose. At the present time but few of these schools are established in the fourth-class districts.

DISCUSSION OF

B. Franklin Royer's Paper

BY

Dr. Harold B. Wood

The old belief that rural school children are in better physical condition than city school children has been proven to be erroneous. In some work in the west, I found that there is little difference, except the rural child has somewhat better teeth. The reliability of the Pennsylvania records show that these percentages of defects may be accepted as representative of rural conditions. That they are reliable is shown by the exact method of scoring adopted. The examinations were made by 821 physicians, and show surprisingly uniform results. Exactitude in making and recording examinations results when the method of scoring does not leave room for variations due to the difference of opinion or judgment of the different examiners. Score cards, for whatever use, whether for scoring dairies, food supply houses, hotels or schools, should be made so definite and in such detail that the recorder himself does not determine percentages to be allowed, nor use his own judgment of the degree of defect present. In reporting that a certain percentage of children have defective vision, writers should state what is their selected evidence of normal vision. In the Pennsylvania work if a child in reading the Snellen test card missed two letters on the 20-30 lines, he was recorded as defective.

DISCUSSION OF

B. Franklin Royer's Paper

BY

Dr. B. Franklin Royer

I agree with Dr. Ball in good part and have some quarrel with statistics that give only a gross percentage of defects, and for that very reason read carefully from the paper the percentage of total defects, the percentage of defects of vision and hearing, of enlarged cervical glands and each of the other principal defects, separately tabulated so that those who want to know the percentage of the serious defects may easily find them. The Department works with considerable handicap in using busy physicians who run the whole gamut of medical practice in the country districts and in being forced to give them their instruction largely by correspondence, yet very much to our satisfaction, when comparing the statistics presented this morning with similar statistics presented from Boston, New York, Philadelphia and Jacksonville, Fla. (some of which will be found displayed in the Exhibit at the Auditorium) less than two per cent. variation is found between the combined findings of the 871 country doctors doing these inspections and that done in the large cities where a corps has been doing the work for years and where the work has been done by men presumably well trained for it. Indeed, these statistics speak volumes for the country doctor and his adaptability to this work.

A PRACTICAL METHOD OF PROMOTING SCHOOL HYGIENE IN SMALL CITIES

BY

J. L. LUDLOW

Two factors are essential to the problem of promoting school hygiene. First, there must be created a public sentiment that recognizes the value and importance of medical inspection of the students in the public schools as a community function, and, second, there must be a practical plan by which this inspection can be properly financed.

In the larger cities of accumulated wealth and other taxable property financing this element of public education is not difficult, but in towns and smaller cities it becomes quite a problem to be reckoned with, along with the development of a sustaining public sentiment.

It is believed by the writer that a fully organized department for the medical inspection of schools, and other study and practice of school hygiene, cannot be secured, in many of the smaller cities at least, except at a minimum cost through a maximum of volunteer coöperative service on the part of the local physicians and dentists, and particularly of the officers and teachers in the schools. Such a plan has been in operation in the public schools of Winston-Salem, North Carolina, during the past two years, more particularly in the feature of coöperation on the part of the school officers and teachers.

This plan had its birth in a civic conscience aroused to the appreciation of public health, brought about through a local public health propaganda conducted by the Winston-Salem Anti-Tuberculosis Committee of One Hundred, which the writer had the privilege of directing. Beginning with the lessons taught through the exhibition of the National Association for the Study and Prevention of Tuberculosis, an intensive public health crusade was conducted by the organization referred to. It soon became manifest that the subject of school hygiene had permeated the public mind with a favorable response, and that a workable plan to pursue it, in harmony with local conditions, would be more than acceptable to the school authorities and to a large part of the public. But to have all the students examined by physicians and dentists involved more of financial support than was readily forthcoming, so it became necessary that some more economic plan should be devised.

From its inception, this public health movement had the hearty and active coöperation of most of the teachers, and of the Superintendent of Schools, Mr. R. H. Latham, who diligently gave his time and energies to evolving the plan which is herewith presented.

In general the plan provides a means by which a minimum of strictly professional work is required. It is predicated on two other ideas, namely, that the teachers themselves should have a greater knowledge of the symptoms of good health—or the lack of it—than is usually the case, and that they should be prepared to make a sufficiently comprehensive physical examination to be able to select, with a reasonable degree of certainty, the healthy students, as well as to detect the symptoms of minor defects in others. With such knowledge properly utilized the teachers can largely reduce the number of students to be examined and treated by the physician or specialist.

The plan was fully outlined in detail by the Superintendent to all the teachers and the working plan was comprehensively set forth in the printed pamphlet, a copy of which makes the body of this paper. The teachers were required by the Superintendent to study the pamphlet of instruction and pass an examination thereon. They cheerfully complied with the requirements of preparation and, by putting the plan into effective practice, the financial difficulties involved in medical inspection of schools have been very largely overcome. With such interest and activity on the part of the public school teachers, much general advancement to the cause of public health has been incidentally accomplished. But the specific results have been very effective work in promoting the general health of the students, and substantially accentuating in the public mind the importance to community life of sanitary environment and hygienic living conditions.

The Pamphlet of Instruction, etc., embraced the following matter:

To the Teacher:

The laws of the State of Massachusetts relating to Medical Inspection contain this clause:

"The school committee of every city and town shall cause every child in the public schools to be separately and carefully tested and examined at least once in every school year, to ascertain whether he is suffering from defective sight or from any other disability or defect tending to prevent his receiving the full benefit of his school work, or requiring a modification of the school work in order to prevent injury to the child or to secure the best educational results."

The examination of school children with reference to the relation of the condition of their eyes, ears, throat, etc., to their mental efficiency has now proceeded far enough to justify the following conclusion:

First: A considerable part of the dullness, truancy, and backwardness of childhood, and the nervous breakdowns occurring in later life, preceded or not preceded by the above defects of childhood, are due not to defective minds, but to the existence of some easily detected disease of the eyes, ears, throat, etc.

Second: That many children have their dispositions ruined by being scowled at and punished by parents and teachers, and ridiculed by schoolmates, when their only trouble is some removable physical defect.

Third: That the test necessary for the detection of these defects may be made by any accurate person who can read. The Massachusetts State Board of Health, after two years' application of these tests by the public school teachers of this State, say that the tests made by the teachers were not less efficient than those made by the specialists.

Fourth: That it is the duty of teachers to apply these simple tests, before some serious injury to the child's disposition or nervous system results.

Along with the pamphlet, we are handing you the following:

1. "Eyes and Ears," Public School Health Bulletin No. 1.

2. "Tuberculosis and Its Prevention," issued by the Anti-Tuberculosis Committee of One Hundred of Winston-Salem, N. C.

3. Hookworm Edition (December, 1910) of Bulletin of North Carolina Board of Health.

Every teacher ought to get and study carefully Richie's Primer of Sanitation (60c.). With this book and the pamphlets and your own common sense you can do more for your pupils than you ever dreamed of. If you need help on doubtful points, every doctor in Winston stands ready to come to your assistance.

Teachers will call pupils' attention to the following Rules of the School Board:

"No pupil suffering from an infectious of contagious disease, or coming from a family where such disease exists, shall be allowed to remain or return to school without the certificate of the attending physician, or the city health officer."

"No pupil shall be admitted into the City Public Schools who cannot show a certificate of successful vaccination within the past three years, or of immunity."

The following described children should be sent to the principal's office for inspection:

1. Every child returning to school without a certificate from the family physician after absence on account of illness, or from unknown cause.

2. Every child who shows signs of being in ill health, or suffering from infectious or contagious disease.

3. Every child returning to school after previous exclusion.

4. Children previously ordered under treatment.

5. Children examined by teachers for non-contagious affections that seem to interfere with the work of the children in school, but upon which teachers are unable to pass judgment.

Let me urge upon every teacher the importance of the work you are about to undertake. Do not regard it as one more burden added to your many school duties. You can do nothing that will bring greater returns to you and your pupils than to be the means of helping them to take care of the physical body which "is the temple of the Holy Ghost." Only exercise good judgment and tact in what you say to or about pupils who need medical attention.

Very respectfully,

R. H. Latham, Superintendent.

Infectious Diseases.

Diphtheria. It is a well-recognized fact that nasal diphtheria of a mild type without constitutional disturbance is one of the most important factors in causing the spread of the disease, and also that children very frequently have profuse discharges from the nose. It therefore follows that, in order properly to inspect the public schools, it is important that cultures should be taken from the nose in every case where there is a persistent discharge, particularly if there is any excoriation about the nostrils.

The throat should be examined at varying intervals, depending upon the physical condition of the children. Any hoarseness or any thickness of the voice should cause an examination of the throat. If the tonsils are enlarged, if the mucous membrane is congested, if there is swelling of the palate, a culture should be taken. These symptoms precede diphtheria.

A child with positive cultures should be excluded from school until two consecutive negative cultures at an interval of forty-eight hours have been obtained.

Scarlet Fever. If there is a sudden attack of vomiting, if there is any redness of the throat, if the child complains of headache, if there is an unexplained rise in temperature, the child should be isolated at once. Any desquamation (peeling of the skin) should be looked upon with suspicion. If there are any breaks at the finger tips, if on pressing the pulp of the finger there is a white lining at the juncture of the nail with the pulp of the finger, particularly if this occurs in the majority of the finger tips, the child should be excluded from school.

A child who has had scarlet fever should not return to school until the process of desquamation has been entirely completed and all discharge from the nose and ears has ceased.

Measles. Running from the nose and slight intolerance of light may call for an examination of the mucous membrane of the mouth for Koplik's sign. Koplik's sign, so called, is the presence on the lining membrane of the mouth, near the molar teeth of minute pearly white blisters, without any inflammation around them. There may be only two or three of these blisters, and they may easily escape detection if the patient is not carefully examined in a good light. These blisters are certain forerunners of an attack of measles.

No child should return to school after an attack of measles until the desquamation is entirely completed, and the child has recovered from the incurrent bronchitis.

Mumps. Any swelling of tenderness in the region of the parotid glands (situated behind the angle of the jaw) should be looked upon with suspicion. It is important to notice any enlargement or swelling about Steno's duct (inside the mouth, opposite the second upper molar teeth) as this is a very frequent symptom of mumps.

A child should be excluded from school until one week has elapsed after the disappearance of all swelling and tenderness in the region of the parotid glands.

Whooping Cough. A persistent paroxysmal cough, frequently accompanied with vomiting, no matter whether there is any distinct whoop or not, is indicative of whooping-cough.

In cases of whooping-cough of long standing, even if there has been no distinct whoop, an ulcer on the band connecting the lower surface of the tongue with the floor of the mouth is found in a certain number of cases. If there is no distinct ulceration, there may be a marked congestion of the band.

As long as there is any cough, the child who has had whooping-cough should be looked upon with suspicion.

Varicella (*Chicken Pox*). A few black crusts scattered over the body are evidence of an attack of chicken pox. The crusting seen in impetigo must be differentiated from that of chicken pox. (See diseases of the skin.)

No child should return to school until all crusts have diasppeared from the body, particularly from the scalp, for in this region the crusts remain longer than elsewhere.

The Eyes. There are certain children who show normal vision by ordinary tests, yet whose parents should be notified to have the eyes examined. These are: (1) children who habitually hold the head too near the book (less than twelve or fourteen inches); (2) children who frequently complain of headache, especially in the latter portion of the school hours; (3) children in whom one eye deviates even temporarily from the normal position.

The Ears. See directions for testing eyes and ears in "Eyes and Ears," Public School Health Bulletin, No. 1.

The Throat and Nose. In all cases of acute illness, the throat should be examined for the presence of the eruption of scarlet fever and measles and for the exudation or membrane of tonsilitis and diphtheria, and a culture taken in any suspected case of the latter.

The presence of discharge from the nose should be noted, and if it is thick and creamy, a culture should always be taken. In all cases of severe hoarseness, with difficult breathing, diphtheria should be suspected. If the discharge from the nose is only from one nostril, a foreign body in the nose should be looked for.

In cases of chronic nasal obstruction, as evidenced by mouth-breathing, snoring, continual post-nasal catarrh or recurring ear trouble, the presence of an adenoid growth (third tonsil) should be suspected, and the child referred for special examination and treatment. As a rule, digital examination for adenoids should be made only by the operating surgeon. Obviously large tonsils, recurring tonsilitis and enlargement of the glands of the neck, suggest the advisability of referring the child to the family physician as to the propriety of removing the tonsils.

Recurring nose-bleed should be referred for special treatment.

In cases of eczema about the nostrils, a cause may be sought in pediculi capitis (head lice).

In referring cases for treatment, school physicians, in addition to the diagnosis, should state the symptoms upon which the diagnosis is based for the benefit of the family physician or specialist.

Diseases of the Skin.

Scabies (The Itch). A contagious skin disease, due to an animal parasite which burrows in the skin, causing intense itching and scratching. The disease usually begins upon the hands and arms, spreading over the whole body, but does not affect the face and scalp. Between the fingers, on the front of the wrist, at the bend of the elbows and near the arm pits are favorable locations for the disease; but in persons of cleanly habits the disease may not show at all upon the hands, and its real nature is determined only after a most thorough and careful examination. There is a great variation in the extent and severity of the disease, lack of personal care and cleanliness always favoring its development. Scratching soon brings about an infection of the skin with some of the pus-producing germs, and the disease is then accompanied by impetigo, or a pus infection of the skin.

At the present time itch is very common and widespread, and, because of the great variation in its severity, mild cases have been mistaken for hives, eczema, etc., the real condition not being recognized, and the disease spread in consequence. All children who are scratching or have an irritation upon the skin should be examined for scabies.

It is very important that all infected members of a family be treated till cured, else the disease is passed back and forth from one to another. It is also important that all under-clothing, bedding, towels, etc., things that come in contact with the body, be boiled when washed.

All cases of scabies should be excluded from school until cured.

Pediculi Capitis (*Head Lice*). An extremely common accident among children, either from wearing each others' hats and caps, or hanging them on each other's pegs, or from combs and brushes. No person should be blamed for having lice—only for keeping them.

The irritation caused by vermin in the scalp leads to scratching which in turn causes an inflammation of the skin of the neck and scalp. The skin then easily becomes infected with some of the pus-producing germs, and large or small scabs and crusts are formed from the dried matter and blood. Along with this condition the glands back of the ears and in the neck become swollen, and may be very painful and tender.

The condition of pediculosis is most easily detected by looking for the eggs (nits), which are always stuck onto the hair, and are not readily brushed off. The condition is best treated by killing the living parasites with crude petroleum, and then getting rid of the nits. With boys, this is easy—a close hair cut is all that is needed; with girls, by using a fine-toothed comb wet with alcohol or vinegar, which dissolves the attachments of the eggs to the hair. All combs and brushes should be carefully cleansed.

Children with pediculosis should be excluded from school until their heads are clean.

Ringworm. A vegetable parasite disease of the skin and scalp. When it occurs upon the skin, it yields readily to treatment; but upon the scalp it is extremely chronic. Ringworm of the skin usually appears on the face, hands, or arms—rarely upon the body—in varying sized more or less perfect circles. One or more, usually not widely separated, may be present at the same time. All ringed eruptions upon the skin should be examined for ringworm. When the disease attacks the scalp, the hairs fall or break off near the scalp, leaving dime to dollar sized areas nearly bald. The scalp in these areas is usually dry and somewhat scaly, but may be swollen and crusted. The disease spreads at the circumference of the area, and new areas arise from scratching, etc.

Another disease somewhat like ringworm of the scalp, is known as favus—a disease much more common in Europe than in America. In this disease quite abundant crusts of a yellowish color are present where the process is active, so that the loss of hair from this disease is permanent, a scar remaining when the condition is cured.

Care must be taken to see that all combs and brushes are thoroughly cleansed, and to prevent children wearing each other's hats, caps, etc.

Children with ringworm should not be allowed to attend school.

Impetigo. A disease characterized by few or many large or small flat or elevated pustules or festers upon the skin. The condition is often secondary to irritation or itching diseases of the skin (hives, lice, itch), and scratching starts up a pus infection.

The disease most often appears upon the face, neck, and hands; less often upon the body or scalp. The size of the spots varies very much, and they often run together to form on the face large superficial sores, covered with thick, dirty, yellowish or brownish crusts.

The disease is contagious, and often spread by towels and things handled.

Children having impetigo should not be allowed to attend school until all sores are healed and the skin is smooth.

Diseases of the Bones and Joints.

All noticeable lameness, whether sudden or continued, may indicate serious joint trouble, or may be due to improper shoes. These cases as well as curvatures of the spine, as indicated by habitual faulty postures at the desk or in walking, should be referred for medical inspection.

Spinal curvature should be suspected when one shoulder is habitually raised or drooped, or when the child leans to the side, or shows persistent round shoulders.

Complaints of persistent "growing pains" or "rheumatism" may be the earliest signs of serious disease of the joints.

Some General Symptoms of Disease in Children Which Teachers Should Notice, and on Account of Which the Children Should be Referred to the School Physician.

Emaciation. This is a manifestation of many chronic diseases, and may point especially to tuberculosis.

Pallor. Pallor usually indicates anæmia. Pallor in young girls usually means chlorosis—a form of anæmia peculiar to girls at about the age of puberty. It is usually associated with shortness of breath; the general condition otherwise usually appears good. Pallor may also be manifestation of disease of the kidneys; this is almost invariably the case if it is associated with puffiness of the face.

Puffiness of the Face. This, especially if it is about the eyes, points to disease of the kidneys; it may, however, merely indicate nasal obstruction.

Shortness of Breath. Shortness of breath usually indicates disease of the heart or lungs. If it is associated with blueness, the trouble is usually in the heart. If it is associated with cough, the trouble is more likely to be in the lungs.

Swelling in the Neck. These may be due to mumps or enlargement of the glands. The swelling of mumps comes on acutely, and is located just behind, just in front, and below the ear. Swollen glands are situated lower in the neck, or about the angle of the jaw. They may come on either acutely or slowly. If acutely, they mean some acute condition of the throat. If slowly, they are most often tubercular. They may also be the result of irritation of the scalp, or lice in the hair.

General Lassitude, and Other Evidences of Sickness. These hardly need description, but may, of course, mean the presence or onset of any of the acute diseases.

Flushing of the Face. This is very often indicative of fever, and on this account should be reported.

Eruptions of Any Sort. All eruptions should be called to the attention of the physician. It is especially important to notice eruptions, because they may be manifestations of some of the contagious diseases. The eruption of scarlet fever is of a bright scarlet color, and usually appears first on the neck and chest, spreading thence to the face. There is often a pale ring about the mouth in scarlet fever, which is very characteristic. There is usually a sore throat in connection with the eruption. The eruption of measles is a rose or purplish red, and is in blotches about the size of a pea. It appears first on the face, and is usually associated with running of the nose and eyes. The eruption of chicken pox appears first as small red pimples, with quickly become blisters.

A Cold in the Head, with Running Eyes. This should be noticed, because it may indicate the onset of measles.

Irritating Discharge From the Nose. A thin, nasal discharge, which irritates the nostrils and the upper lip, should always be regarded with suspicion. It may mean nothing more than a cold in the head, but not infrequently indicates diphtheria.

Evidences of Sore Throat. Evidences of sore throat, such as swelling of the neck and difficulty in swallowing, are of importance. They may mean nothing but tonsilitis, but are not infrequently manifestations of diphtheria or scarlet fever.

Coughs. It is very important to notice whether children are coughing or not, and what is the character of the cough. In most cases, of course, the cough merely means a simple cold or slight bronchitis. A spasmodic cough, that is, a cough which occurs in paroxysms and is uncontrollable, very frequently indicates whooping-cough. A croupy cough, that is, a cough which is harsh and ringing, may indicate the disease diphtheria. A painful cough may indicate diseases of the lungs, especially pleurisy or pneumonia. A long continued cough may mean tuberculosis of the lungs.

Vomiting. Vomiting, usually of course, merely means some digestive upset. It may, however, be the initial symptom of many of the acute diseases, and is therefore of considerable importance.

Frequent Requests to Go Out. Teachers are too much inclined to think that frequent requests to go out merely indicate restlessness or perversity. They often, however, indicate trouble of some sort, which may be in the bowels, kidneys, or bladder; therefore, they should always be reported to the physician.

The Teeth.

Unclean mouths promote the growth of disease germs, and cavities in the teeth are centers of infection. Pus from diseased teeth seriously interferes with digestion, and poisons the system. It causes a lowering of vitality, and renders mental effort difficult. Diseased teeth, temporary as well as permanent, are frequently the causes of abscesses, and should be carefully watched and treated.

Irregularities of the teeth, especially those which make it impossible to close the teeth properly, lead to faulty digestion, to mouth-breathing, and to other diseases and evils which an insufficient supply of oxygen produces.

The first permanent molars are perhaps the most important teeth in the mouth, and are the most frequently neglected, because they are so often mistaken for temporary teeth. (It should be remembered that there are twenty temporary teeth, ten in each jaw, and that the teeth that come at about the sixth year immediately behind each last temporary tooth—four in all—are the first permanent molars.)

The teacher should be on the lookout for pain or swelling in the face. When the child keeps the mouth constantly open, an examination of the teeth should be made. When symptoms of indigestion occur, or physical weakness or mental dullness are observed, the teeth should be inspected. It should be remembered that diseases of the ears, disturbance of vision and swelling of the glands of the neck may be caused by diseased teeth.

It should be shown that decay of the teeth is caused primarily by the fermentation of starchy foods and sugars, and that the greater factor in preventing dental caries is the removal of food particles by frequent brushing. Children should be prevented from eating crackers and candy between meals, and when possible the teeth should be cleaned after eating. Inspection of the teeth by a dentist should be made once in six months at least.

Nervous Troubles and Mental Defects.

Teachers and medical inspectors of the schools should investigate children who show certain physical and mental symptoms. Especially should they take notice of the presence of these symptoms in a child who did not formerly show them. The most important of these are the following:

1. Restlessness and inability to stand or sit quietly in a previously quiet child, especially if to this is added irritability of temper and loss of self-control, as shown by crying for trifles, or inability to keep the attention fixed.

There may also be present quick, twitching movements of the muscles of the trunk, face, and especially of the hands, fingers, arms, or legs. If severe, these may cause the child to drop things, render its work awkward, or interfere with buttoning the clothes, writing or drawing. Such children are often scolded for being inattentive or careless.

These symptoms are the slighter one of chorea (St. Vitus' Dance). With these should not be confounded other forms of twitching of muscles, such as the blinking of the eyelids, the slower twisting movements of the face or shoulders, or other parts of the body, often called habit spasms, which may be due to effects of vision, adenoid growths or other reflex causes.

These latter cases do not usually need to be withdrawn from school work, though often requiring treatment; while the former class should be removed from school at once, both for the child's sake, and to prevent an epidemic of imitative movements, such as sometimes occurs.

2. Another class of symptoms requiring investigation are repeated faintings, especially if the child's lips become blue; attacks, often only momentary, in which the child stares fixedly and does not reply to questions, or in which he suddenly stops speaking or whatever he is doing,

and is unaware of what is going on about him. These lapses of consciousness may be accompanied also by rolling up of the eyes, drooling, or unusual movements of the lips, and often appear like a "choking" attack.

Sudden attacks of senseless movements of various sorts, such as twisting and pulling at the clothes or handkerchief, fumbling aimlessly at the desk, especially if there is no recollection afterwards of what was done, are often another expression of the same conditions.

Such attacks, particularly if repeated at varying intervals, even when not accompanied by complete loss of consciousness, are frequently as characteristic of epilepsy as the severe convulsions.

Epileptic convulsions usually involve the entire body in sharp jerking movements, with blueness of the face or lips, complete loss of consciousness, and are usually followed by a period of sleep or drowsiness, and occasionally by wetting or soiling of the clothes.

Another class of convulsions is the hysterical, which are often difficult to distinguish. The hysterical convulsions, however, differ from epileptic in the following respects. The hysterical patient often shouts, cries, or raves, not only previous to but frequently throughout the attack, and is often able to reply to questions during the convulsions. The epileptic gives a single cry, immediately followed by unconsciousness and the spasm. The movements in the hysterical convulsions are often accompanied by bowing of the body backwards, and very frequently simulate intentional or voluntary movements, such as tearing the hair, pulling at the clothes, and such things; while the epileptic movements are characterized by their jerking or twisting character. The hysterical patient, also, in place of a convulsion, may strike an attitude, such as of fear or entreaty, often accompanied by raving or singing. This again may follow the convulsion, taking the place of, and strikingly contrasted with, the almost invariable sleep of the epileptic, which is almost never seen in hysteria. Hysterical patients if they fall seldom injure themselves by the fall, as epileptic frequently do. Biting the tongue almost invariably indicates an epileptic seizure, as does wetting or soiling the clothes when it occurs.

Cases of epilepsy, whether mild or severe, require treatment, and advice as to whether they should be removed from school. Many cases do not require to be withdrawn from school, and are benefited by its discipline.

3. Excessive nerve fatigue, which is shown by irritability or sleeplessness, may indicate a neurasthenic condition, that is, a threatened nervous breakdown. Such symptoms may be due to irregular habits, want of proper sleep, lack of suitable food, poor hygienic conditions, or

simply from the child being pushed in school beyond its physical or mental capacity.

Excessive fear or morbid ideas, bashfulness, undue sensitiveness, causeless fits of crying, morbid introspection and suspiciousness may also be symptoms of a neurasthenic condition, and call for investigation, and for the teacher's sympathy and winning of the child's confidence to prevent developments of a more serious nature.

This nerve fatigue may result in a child being unable for the time being to keep up in its work in school.

Forgetfulness, loss of interest in work and play, desire for solitude, untidiness in dress or person, and like changes of character, are sometimes incidental to the period of puberty.

4. Mentally defective children in the public schools exhibit certain common characteristics. The essential evidence of mental defect is that the child is persistently unable to profit by the ordinary methods of instruction, as shown by lack of progress or failure of promotion through lack of capacity. After one, two or three years in school, they are either not able to read at all, or they have a very small and scanty vocabulary. One of the most constant and striking peculiarities is the feebleness of the power of voluntary attention. The child is unable to fix his attention upon any exercise or subject for any length of time. The moment his teacher's direction is withdrawn, his attention ceases.

These children are easily fatigued, by mental effort, and lose interest quickly. They are not observant. They are often markedly backward in number work. They are especially backward in any school exercise requiring judgment and reasoning power. They may excel in memory exercises. They usually associate and play with children younger than themselves. They have weak will-power. They are easily influenced and led by their associates. These children may be dull and lifeless, and restless and excitable. They are often willful and disobedient, and liable to attacks of stubbornness and bad temper. The typical "incorrigible" of the primary grades is often a mentally defective child of the excitable type. They are often destructive. They may be cruel to smaller children. They are often precocious sexually. They may have untidy personal habits. Certain cases with only slight intellectual defects show marked moral deficiency.

The physical inferiority of these defective children is often plainly shown by the general appearance. There is generally some evidence of defect in the figure, face, attitude, or movements. They seldom show the physical grace and charm of normal childhood. The teeth are apt to be discolored and to decay early.

It is a most delicate and painful task to tell a parent that his child is mentally deficient. This duty should be performed with the greatest tact, kindness and sympathy. It would be a great misfortune for the school physician and teachers, as well as for the child, to designate a pupil as feeble-minded who was only temporarily backward.

Temporary backwardness in school work may be due to removable causes, such as defective vision, impaired hearing, adenoid growths in nose or throat, or as the result of unhappy home conditions, irregular habits, want of proper sleep, lack of suitable food, bad hygienic conditions, etc. Great care must always be used in order not to confound cases of permanent mental deficiency with cases of temporary backwardness in school work, due to the causes mentioned above, or those described under the head of excessive nervous fatigue.

In some cases, where the existence of mental defect is in doubt, accurate information is usually obtained in the early history of the child. The time of first "taking notice," the time of recognition of the mother, that of beginning to sit up, to creep, to stand, to walk and to talk should be learned. Marked delay in development in these respects is usually found in all pronounced cases of mental deficiency.

It may be found useful to require teachers to refer at stated intervals to the medical inspectors for examination all children who, without obvious cause, such as absence of ill health, show themselves unable to keep up in their school work, who are unable to fix their attention, or are incorrigible—though it does not follow that all such cases have either physical or mental defects.

Tuberculosis.

It is important that we should realize that the earliest sign of consumption is not necessarily the so-called hacking cough, hemorrhage from the lungs, or the presence of night sweats and fever. These frequently do not appear until comparatively late in the disease. The earliest signs, in children especially, are those of failing health, from whatever cause. Loss of appetite, weakness, languor, listlessness, are among the early signs. Pallor, marked anemia, loss of weight, excessive emaciation, the presence of enlarged glands in the neck, are indications that there is something wrong. If, in addition to this, there is a cough, with or without any sputum, the child should most certainly be examined by a physician.

Teachers and pupils should study carefully the pamphlet on "Tuberculosis and Its Prevention," issued by the Anti-Tuberculosis Committee of One Hundred.

Hookworm.

Hookworm disease is infectious, and is caused by hookworms which, in the mature stage of their development, are about one-half an inch long, are round and about the thickness of an ordinary pin, or a course sewing thread. They live in the small intestine, usually the upper portion, that is, the portion next to the stomach, and there firmly hold on with their teeth to the flesh lining the intestine, sucking blood from it, making wounds from which much slow bleeding occurs into the intestine, secrete and inject a poison into the flesh and so damage the intestine that a chronic inflammation is set up which hinders digestion.

The great loss of blood, the damage done to the intestine and the poison combined, soon sap the vitality of infected persons so that they become thin, pale, weakly, and are easily tired, have queer appetites and are unable to accomplish as much work as healthy and strong people. In very mild cases and in cases where the disease is just beginning, no great change in the appearance of a person may be noticed. But in severe cases, as those of long standing, the tallow-like skin, the pale lips, the listless dull eyes, the dry hair, the prominent shoulder-blades and abdomen are all features which lead one to suspect the disease.

Moreover, if the disease begins, as is usually the case, during the growing age of a person, the development is likely to be either checked or at least delayed. Oftentimes boys and girls are no larger at 15 years than they should be when 12, and are slow at work and in school. In such cases hookworm disease should be suspected. Especially is this so if such a child has ever had ground-itch, which is usually the first step to be noticed in the beginning of the disease.

Sometimes victims of hookworm disease have their face, especially under the eyes, and their legs to puff or swell. Again they seem to have sores which do not heal rapidly. They suffer at times with headaches and dizziness, may have some tenderness in the upper part of the abdomen, indigestion, and are often feverish. In severe cases the infected person is so frail, so thin-blooded, so dwarfed in body and mind, that any one who has read of the disease will recognize it.

WINSTON-SALEM PUBLIC SCHOOLS

Daily Report to Principal

....................School. ....Grade. Date................

M....................................Teacher.

	BOYS	GIRLS	TOTAL
Total Enrollment....................	....	....	....
Left by Transfer....................	....	....	....
Entered by Transfer { Building..........	....	....	....
Entered by Transfer { Grade..........	....	....	....
Left....................	....	....	....
Restored....................	....	....	....
New Pupils....................	....	....	....
Present Enrollment....................	....	....	....
Absent....................	....	....	....
Daily Attendance....................	....	....	....
Tardy....................	....	....	....

NAMES

Left by Transfer..

Entered by Transfer { Building..
Grade..

Left..

Restored..

New Pupils..

Absent Pupils..

Tardy Pupils..

Pupils Falling Behind in Their Work

Names *Subject*

School Physician Should See the Following:

....

No......... No.........

WINSTON-SALEM PUBLIC SCHOOLS

Teacher..............................
School..............................
Pupil..............................
Age........ Grade........ Date........
Parent..............................
Address..............................
Inspector's Diagnosis and Advice........
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..........................M.D.

Notice to Parents or Guardians:

..............................has received a physical examination and is found to be in need of immediate medical or dental attention. Please see your physician or dentist at once. Take this notice with you. The child............
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..........................M.D.

No......................

WINSTON-SALEM PUBLIC SCHOOLS

Name of Teacher............................ ....School
Name of Pupil................... Age.................. Grade............
Name of Parent..
Address..
The Medical Inspector will please examine this child for..........................
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Inspector's Diagnosis and Advice

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Signed..............................M.D.

Name..................
Age........Grade......
Date...................
School.................
Gums:......Good. Fair
.... Bad......

Mouth:....Good........
Fair...... Bad....

Tooth Brush............
Yes......No.........

Malocclusion:...........
Yes......No.........

No. Fillings.............
No. Cavities............
No. Extractions.........
No. Teeth Out..........
No. Abscesses...........
Urgent Attention........
Yes.......No........

Examined by...........
Treated by.............
Results:................
....
....

WINSTON-SALEM PUBLIC SCHOOLS

Dental Examination Under the Direction of the Superintendent of Schools by the Winston-Salem Dental Society.

Name........................ Age..................
Address..
Grade..........Date..........School................

Condition of Gums......Good......Fair......Bad
Condition of Mouth.....Good......Fair......Bad
Use Tooth Brush........Yes......No........... (——)
Malocclusion...........Yes......No........... ( )
No. of Fillings.............................. ( )
No. of Cavities.....................
No. of Extractions..................
No. of Teeth Out....................
No. of Abscesses....................
Urgent Attention....Yes....No.......
(Hand) Cross out words that do not apply

{ Dentist's Diagram of Mouth. }

Examined by..........DDS.

Teeth Marked o Out
" " x Cavities
" " v Fillings

To Parent or Guardian:

This report is sent for your careful consideration. The examination has been made without cost to you. Of course you do not have to pay any attention to the conditions here stated, but we believe that you will not, after receiving this notice, allow your child to suffer the consequences of further neglect. We feel that we have discharged our duty in going this far, and it now rests with you to do your part. This examination places you under no obligation whatsoever to the examining dentist. You can have the work done by any dentist you may see fit to employ. When the child is sent to the dentist, kindly send this blank. To do so will help matters very much.

To the Dentist Consulted:

We ask that you keep this blank that we may know how many of the pupils examined have taken advantage of the examination. We will be glad to send for the blanks at any time that will suit your convenience.

Very respectfully,

R. H. LATHAM, Superintendent.

THE STATUS OF HYGIENE IN THE SCHOOLS OF YORK COUNTY, NEBRASKA

BY

Alice Florer

For years, for many years, children went to school to study the three R's—Readin', Ritin', 'Rithmetic. During these years teachers were contented with having taught these three subjects; parents were perfectly satisfied, and the children were apparently happy. But times have changed. Brain development has advanced materially. Educators have discovered that in order for a child's brain to develop properly it must necessarily live in a clean, healthy body.

City schools are putting in equipment for serving hot lunches to the children for the noon-day meal and have demonstrated that such children do better work and are healthier than when they go home long distances on cold or excessively warm days and perhaps have improper food when they get there. In many places, breakfasts are served by the school authorities as many children would have no breakfast if they did not get it at school.

Why this change? A few years ago, this was an unheard of idea. It is because the people have awakened to the fact that the child must have good health in order to do good work and that good, clean, wholesome food is necessary in order to have good health.

No other educational movement has made such rapid progress in absolutely securing results as has that which contributes to the health. Generally, throughout the country, this agitation has resulted in an unrest which will not be satisfied until some systematic plan has been established, moderately uniform, to promote the health of our children.

All of this change in "Public Opinion" has practically been brought about by educators. All over this "great country of ours," at every educational gathering, the subject of "Hygiene and Health" is rightfully given an important place on the program. Men and women of prominence, ability, good judgment and influence are everywhere to-day making individual and united efforts to influence teachers, parents, pupils and school officers to regard the laws of health.

Upon the health of our people depend, in a great measure, the efficiency of our schools, the efficiency of our professional people, the efficiency of the individual American citizen.

Great and noble men and women are making research daily to discover causes for ill health and also to discover how to remove such causes.

The old, old maxim, "An ounce of prevention is worth a pound of cure," may very appropriately be applied to the health question or condition which is before us to-day.

We shall no longer say as was formerly said, "It is the duty of the parents and not that of the teacher, to look after the health of the pupils." Since this question of public health has been agitated, people begin to realize that parents who have never, as children, received any training along the lines of sanitation and health, are really not capable of teaching it to their children. Then, if the schools do nothing toward the education of the children in this respect, many children of the present generation will grow to be men and women with families of their own with no more knowledge of sanitation and health than had their parents before them. Thus it might have gone on forever, had the educators of this country not realized the situation, looked the matter squarely in the face and sought to meet the proposition and to remedy conditions as rapidly as possible.

All this discussion has been brought about and public opinion is being molded along these channels from no selfish motives. "The world is growing better" and there exists a keener sympathy between individuals. People, as a rule, dislike to see others suffer and if they can do anything to alleviate such suffering they rejoice in doing it.

A renaissance in health is at hand. The people realize the possibilities in prolonging life. The time has come when all forces should and must unite and work together for a common cause.

"To have a perfect body, crowned by a perfect brain is the grandest hope of the race to-day." To be strong and healthy, the pupils must have nourishing food and plenty of it; they must have pure, fresh air; they must have the proper clothing and they must have sanitary school houses which include proper architecture, heating, lighting, seating and ventilation. They must be free from the use of narcotics.

That this great International Congress on Hygiene has convened with a view to bettering conditions along these lines is an indication that better conditions will prevail in this country in the future than in the past.

This Congress is dealing with the basic, the fundamental problem of citizenship. It is important, yes necessary, that all forces join in promoting the health, not only of the individual, but of the nation.

Sanitary laws and the laws of public health can only be promoted when they are supported by the general public. When the people are educated to the fact that such laws should and of necessity must be passed, then will such laws easily be secured. This Congress will do much to bring the proposition "squarely" before the people of the country.

Grover Cleveland once said, "The health condition that confronts us to-day is one of ignorance,—ignorance on the part of the individual, state and nation and the only hope of amelioration is by educating our boys and girls in sanitary science and public health conditions."

This statement is true. We must educate our boys and girls to be able to throw off diseases, to regard the laws of health. Infectious diseases are all parasitic in nature, that is, are due to some form of plant or animal life and the pupils must be taught how best to resist these parasites.

The application of such principles makes for right living, morality, temperance, cleanliness and an understanding of the necessity of the individual, the state and the nation joining forces and working as a unit, thus bringing home to consciousness, a keener sense of civic obligation.

Some illustrations of what has been done and what is being worked out in rural communities in York County, Nebraska, along the line of health and sanitary conditions might be of interest.

For several years we have been working along a few lines, the essential one being a systematic study of the subject of physiology and hygiene from the third grade up. For such study we have used Blaisdell's Child's Book of Health, How to Keep Well and Our Bodies. For two years we have been having in many of the schools, the "Gulick Series" as supplementary texts. This study has been systematic, grade by grade, and the children, in order to make certain grades were required to complete a certain amount of work and pass the examination.

We have now on our list the following points that are observed almost without exception yet there is much to be done along some of these lines before perfection is reached.

1. Dispensing with the open water pail and common drinking cup.

2. Quarantining for contagious diseases.

3. Fumigating the homes and school rooms for contagious diseases.

4. Sterilization of lead pencils.

5. Proper construction of new buildings and the proper heating, lighting, ventilating and seating of the same.

6. Requiring sweeping compound in every school room to take up the dust.

7. Establishing the proper playground apparatus.

8. Abolishing the narcotic habit.

Now we have not accomplished nearly all of these points but I shall indicate what we have done and the progress we have made thus far in what we have undertaken.

Open Water Pail. Six years ago, the old fashioned water pail and the common drinking cup were found in every rural school in the county, one hundred and three districts. It was my privilege to visit a rural school that first year of my administration, about sixteen miles in the country. At the noon hour, the children on the playground kept expressing their desire from time to time for Catherine to come. Upon making inquiry, I discovered that Catherine was one of their schoolmates; she had gone on an errand for her mother and the children feared she would not be back by one o'clock. To my delight, I observed that they had had a perfect record that week and if this little girl should have been tardy, their record would have been broken. However, Catherine came. I noticed that she was tired and dusty and warm. Her face was very much afflicted with sores about her mouth, nose and chin. She was brought into the house where the teacher washed her face in a common pan, dried it on a common towel, gave her a drink from a common cup. This concerned me very much and I talked with the teacher about it. She had never thought of it before. Right there, I said in my own mind, "If this condition exists in many places it must be stopped and it must cease here." I talked with the school officers and insisted upon a change. They asked, "What can we do?" Then I advised first, that they ask the parents to keep the child out of school and consult a physician; second, that they get a sanitary drinking fountain and individual drinking cups. This was done at once and the parents in that district were thankful. They had been uneasy but had feared causing hard feelings if they said anything and "*the parents of that child were their neighbors.*" No one was more thankful than those parents after a while, but at the time they thought it rather a hardship. When the physician told them it would have resulted seriously had they not attended to it, when they did, the parents were satisfied.

The results were that the child's face was cured, the district owned a sanitary water fountain and individual drinking cups. With this as an example, a general campaign was started throughout the county and to-day every district in the county has a sanitary drinking fountain of some kind and individual drinking cups. The pupils, young and old, are particular about using their own cups and realize the importance of it.

Quarantining. When we first attempted to enforce the quarantine law, the people exhibited about the same attitude toward it as they did at first toward the open water pail. They refused to be quarantined or in other words, were free to break the quarantine if they wished. However, a county physician was appointed by the County Board of Supervisors to act in conjunction with the County Superintendent in quarantining all homes where contagious diseases were discovered. After some discord and many heated discussions, the people have practically become convinced that it is the only thing to do. The teachers now understand that it is their duty to report cases of contagious diseases either to the County Superintendent or the County Physician. The County Physician proceeds at once to quarantine. The pupils in such homes are not permitted to return to school until the physician has fumigated the clothing, rooms, etc. In case the pupil has taken ill during school hours or at school, the school room, books, etc., etc., are fumigated. Pencils are sterilized with formaldehyde frequently.

Architecture. We have not constructed many new buildings recently but several will be constructed next year. A special architect will be employed to see that they are sanitary in the way of lighting, ventilating, heating, seating, etc.

Heating and Ventilating. One great problem has been how to equip rural schools with some kind of heating apparatus that would ventilate at the same time. This year, however, all former agitation seems to have begun to bring results. Twenty such heaters have been installed within the year and orders for something like forty more have been given and the plants will be installed in time for the winter school. The schools where the heaters have been in use a year have been a great help to us in securing new ones as the people in those districts are so delighted with the results. It has been the means, the parents think, of the children being free from coughs and colds that they formerly have had and school boards and parents have unconsciously disseminated the information regarding the good results brought about by installing the heater and ventilator.

Sweeping Compound. One of the most unwholesome, unhealthful practices in school rooms is that of sprinkling the floor with water, to sweep, or that of leaving it dry and allowing the dust to fly. We have succeeded in securing a good sweeping compound in the school houses of the county which leaves the floors in an oily condition and takes up all dust, germs, etc. It is inexpensive and is one of the essentials that every school district should furnish, as dust particles not only irritate the delicate membranes causing sore throat and other diseases, but dust is a carrier of contagion and should be kept out of the school room as much as possible.

Medical Inspection. We have no medical inspection in the county. However, we have succeeded in agitating the question of sanitation as cases have arisen until the people generally are discussing the health problem of school children and they are looking at that side of the question more favorably than at the financial side entirely as they formerly did. While it seems there is an organization at work to try to defeat the medical inspection movement in this country, it is surging forward rapidly. It will eventually be the means of eliminating the spread of contagious diseases in our schools and is bound to be the means of prolonging life.

Playground Apparatus. In many districts we have playground apparatus. We believe that while good food is essential to good health, plenty of the right kind of exercise is also essential. The playground movement is spreading rapidly. Last year was the first time we have agitated the question and about one-fourth of the districts have provided their schools with either swings, teeter-boards, giant-strides, or other apparatus, and a great many more will furnish them this year.

Formerly, it was considered that only city schools needed the playground apparatus but this idea has vanished and our people are interesting themselves in not only playground apparatus, but in many things that were formerly thought to be appropriate only for city schools.

Cleanliness. After all, the *teacher* has a responsibility aside from teaching the contents of the text book, that is even more important to the health of the pupils. Each teacher is requested to look after the general appearance of the pupils. They must appear with clean hands and clean faces. If they do not, they must go through the process of a good "scrubbing" before beginning their work. Teachers are also requested to urge the importance of clean clothing. Children are not expected to have expensive clothing but "*it must be clean.*" Sometimes this has been difficult to accomplish and sometimes the teacher has not been strong enough, shall I say, has not had the "nerve" to ask parents to dress children in clean clothes but "the campaign" is on in York County and very much has been accomplished and more will be as the campaign proceeds, along the line of "Cleanliness in the Schoolroom."

Nothing Too Good For The Rural Child. It has been my custom and is my custom to insist at all times and in all places where opportunity offers, that the best the city can afford to offer their city children is none too good for the rural child. They must give up the idea that "anything" is good enough in a country school. Experience has proven that our strongest citizens, nationally and otherwise, were born and reared in the country, educated in the country schools. Horace Mann once said, "There is nothing too good for the child—if it is my child," and this is a pretty good motto for each parent to put into practice.

This International Congress of School Hygiene is one of the grandest conservation gatherings ever assembled in America or any other country because "the greatest of all natural resources is human life." It is important to conserve our national forests, our supply of water and soil, but far more important to this country to-day is "the conservation of human life," the ability to make it superior in efficiency. That the people of this Congress have assembled for this purpose, that of advising with one another and using united resources for making a more healthy efficient humanity, is evidence that results are not far distant and that our future citizens will have superior knowledge and privileges for developing healthy bodies which mean healthy minds and superior citizenship.

SESSION EIGHT

Room F. Wednesday, August 27th, 2:00 P.M.

STATUS OF SCHOOL HYGIENE AND METHODS OF INSTRUCTION IN CITY, VILLAGE AND COUNTRY SCHOOLS (Part Four)

(Special Group on Women's Colleges)

President ANNA J. MCKEAG, *Chairman*

MRS. DEXTER P. RUMSEY, Buffalo, N. Y., *Vice-Chairman*

Program of Session Eight

ANNA JANE MCKEAG, Ph.D., LL.D., President Wilson College, Chambersburg, Pa. "Methods in Use in Colleges for Women for the Maintenance and Advancement of the Health of Students."

AMY MORRIS HOMANS, M.A., Director of Hygiene and Physical Education, Wellesley College, Wellesley, Mass. "Some Problems in the Administration of a Department of Hygiene and Physical Education in a Woman's College."

ELIZABETH LEIPER MARTIN, M.D., Adviser of Women and Medical Examiner in the University of Pittsburgh, Pa. "The Importance of Teaching the Conservation of Nervous Energy to Our Advanced Women Students."

MRS. FRANK DEGARMO, B.S.D., One-time Chairman Country Life Department, National Congress Mothers; Collaborator U. S. Office Public Roads. "Good Roads and Good Health."

Paper Presented in Absentia in Session Eight
(Read by Title)

MARGARET C. BEER, Principal Gardner School, Valparaiso, Ind. "Hygiene Instruction in the Gardner School, Valparaiso."

METHODS IN USE IN COLLEGES FOR WOMEN FOR THE MAINTENANCE AND ADVANCEMENT OF THE HEALTH OF STUDENTS

BY

ANNA J. MCKEAG

The separate college for women, unconnected with any of the great universities, is peculiarly an American institution. It finds its highest development in the eastern part of our country, as co-education prevails in most of the western colleges and universities. The colleges which I have chosen for special consideration are eight institutions in the New England and Middle States: Bryn Mawr, Elmira, Mount Holyoke, Smith, Vassar, Wellesley, Wells and Wilson. Four of these colleges are of more than five hundred students: Mount Holyoke (754), Smith (1,617), Vassar (1,658) and Wellesley (1,378). The remaining four have fewer than five hundred: Bryn Mawr (426), Elmira (175), Wells (189) and Wilson (362). The statistics are taken from the latest Report of the Commissioner of Education (1911, Volume II).

While each of these institutions has a few day students, almost the entire student body is made up of residential students lodged in buildings under the full control of the college authorities. This residential character of the typical American college for women makes possible a more minute supervision and regulation of matters of health than would be found in an institution where students are lodged in private boarding-houses.

The colleges in the group under consideration, it may be added, are similar in their academic purposes, being primarily institutions of the "liberal culture" type, and offering courses leading to the degree of Bachelor of Arts, though some offer courses also for the Master's degree and Bryn Mawr gives the Doctorate. There is therefore a greater degree of homogeneousness in the student body than would be found in a professional institution or in a university.

The student who desires to enter one of these institutions must present, among her credentials for admission, a certificate of health from her physician. Unfortunately, standards differ so greatly among physicians that the presentation of such a certificate is not always indisputable evidence of the candidate's physical fitness for college work, but the colleges themselves conduct a physical examination of new students which gives the necessary additional and more detailed information. At Bryn Mawr, this examination is made by the Resident Physician; at Wells and Wellesley by the Department of Physical Education; and at Vassar and Mount Holyoke by the two departments in coöperation. In some of the colleges—Wells and Bryn Mawr, for instance—the examination is repeated annually for each student.

All of the eight colleges have courses of lectures, required of all freshmen, on the application of physiology and hygiene. These courses are of an extremely practical and simple nature, and are intended to give to the new student the fundamental rules of personal hygiene. In Wellesley the course lasts throughout the freshman year; in Vassar it consists of six lectures. A few of the colleges have introduced lectures (optional) for seniors on subjects connected with social hygiene.

Physical training, both in the gymnasium and in outdoor athletics, is given in all of these colleges. The requirements are as follows:

Bryn Mawr: 2 hours per week in the freshman, sophomore, junior and senior years.

Elmira:

Mount Holyoke: 3 hours in the freshman, sophomore and junior years.

Smith: 4 half-hours from November 1 to Easter in the freshman and sophomore years.

Vassar: 3 hours in the freshman and sophomore years.

Wellesley: 2 hours in the freshman and sophomore years.

Wells: 2 hours in the freshman and sophomore years.

Wilson: 3 hours in the freshman, sophomore and senior years.

The outdoor sports include archery, basketball, baseball, rowing, running, field hockey, golf, tennis, swimming and riding. Most of the colleges impose a scholarship requirement upon candidates for teams in athletics, consisting usually in the exclusion of conditioned students from the teams.

In most of the colleges the work in physical culture counts toward the degree in the sense that a student may not be graduated until she has completed it, but, except at Wellesley, it is usually not reckoned in the 120 semester hours for the B.A. degree.

Before leaving this matter of physical training, attention should be called to the unique service which is being rendered by Wellesley College to the cause of physical education in the department specially established there for the training of teachers of physical education. The greatest hindrance to the progress of physical education has heretofore been the scarcity of properly trained women. Wellesley is attempting to remedy this defect, though the graduates of the course are not numerous enough to fill the positions that await them.

All of the colleges mentioned have their own infirmaries, nurses and, usually, resident women physicians. The isolation of patients in the case of infectious and contagious diseases is provided for, and there is almost no danger of epidemics, so carefully are all matters of sanitation safeguarded and supervised.

The heads of college houses of residence are usually women of a high degree of general intelligence, with special training in domestic science. The table is necessarily simple, as the prices paid for board are moderate but in general the food is wholesome and the menu well-balanced from a dietetic standpoint.

It may be asked, however, whether, in spite of all these admirable administrative arrangements for the conservation of the health of young women, there is not some truth in the popular theory that a college education is detrimental to the health of young women. After all, do not the strenuous academic demands upon students and the intense nervous strain of living in a college community tend inevitably to lower the vitality of students and perhaps to produce specific physical injury? In particular, is not the practice of the colleges in requiring examinations or final papers in all subjects in February and June in itself a menace to health?

After twenty years of experience in large and small residential colleges, I have to say that I have never seen any evidence that college life *per se* is detrimental to the health of young women. I have known cases of breakdown in college, some of which were traceable to pre-collegiate causes, some to non-academic pursuits in college, and some to unwise methods of work, but I do not now recall a single instance in which a young woman who entered college in good health and with fair academic preparation and carried her work sanely was broken in health thereby. A more vigorous and active body of women than those of our colleges it would be hard to find anywhere.

A few years ago a faculty committee, on which I served as chairman, made an investigation in a large college for women, of the matter of the relation of semi-annual examinations to the health of students. Our data were secured from students, from members of the faculty, from the resident physician, from the heads of houses of residence, and from administrative officers of other colleges for women. The evidence gathered from these sources was overwhelmingly convincing that most of the talk about the detrimental effects of examinations is not based on fact. We learned for instance, to our surprise, I confess, that the majority of the members of our senior class had never at any time during the college course, studied during the greater part of the night. In a student body of over 1,300, we could find the names of only nine persons who seemed to have felt in any detrimental way the strain of examinations, and on further investigation we found that these were cases in which the vitality of the student had been low before the examination period; there were, for instance, several cases of grippe among these students shortly before the examination period. The administrative offices of other colleges stated that there was little, if any, abnormal tension during examination time.

So far as my personal observation extends, the methods in use in the colleges for women for the maintenance and advancement of the health of students have already resulted in the attaining of an unusually high standard of health in women college students. I think it may be seriously questioned whether there can be found, anywhere, conditions more favorable to the maintenance of health than those which prevail in colleges of the type we have considered.

SOME PROBLEMS IN THE ADMINISTRATION OF A DEPARTMENT OF HYGIENE AND PHYSICAL EDUCATION IN A WOMAN'S COLLEGE

BY

Amy Morris Homans

The Department of Hygiene and Physical Education of Wellesley College was organized four years ago. Previous to this athletics and sports had been carried on, chiefly by student initiative and under student management. The facilities for systematic training were very inadequate as there was only a small, poorly equipped gymnasium, without baths or dressing rooms, in one of the college buildings; nevertheless much was accomplished. Since that time there has been steady progress in the effectiveness and scope of the Department's work and responsibility, so that now it embraces not only the supervision of the physical activities, but all phases of the lives of the students which in any way are related to their health. While there is thus much reason for satisfaction and encouragement, conditions are by no means perfect, and much remains to be done.

The functions of the Department in relation to the health of the student body may be considered under the following general heads:

1. Preventive and corrective measures.

2. Constructive and educational measures.

Preventive and Corrective Work.

Medical and Physical Examinations. There is scarcely a woman's college in the country of which it is not said that many of the students are broken down in health because of the exacting demands of the curriculum. This is not true. It is true, however, that a large number of students are permitted to enter college whose health does not warrant the undertaking of an academic course of study with its attendant papers, reports, tests, and final examinations. In view of this, Wellesley College has introduced preventive measures that shall keep out those applicants (pathological cases) who should seek health and endurance before undertaking serious academic work. The college has also adopted measures intended to help those who are well, but who lack endurance and robust strength, not only to conserve energy but to gradually increase their vitality. To this end the college requires that applicants for admission shall be organically sound and in good health; that they shall present a physician's certificate to this effect. Upon entrance a thorough medical examination is made (experience has shown that not one in ten has been properly examined before entrance), and upon the advice of the Medical Staff the College reserves the right to reject the applicant altogether, or to require her to take the course in five years instead of four. If a student be registered after having presented a certificate of organic soundness and good health, the physician who signed her certificate must bear the onus of the applicant's rejection and her disappointment in consequence.

Students admitted to take the course in five years have their work distributed accordingly, and under the direction of the Department of Hygiene are required to devote much time to the acquirement of good habits of living, such as right feeding, bathing, clothing, rest, systematic exercise, regular habits, etc. Special stress is laid upon posture in its relation to efficiency and upon proper footwear in the same relation.

Beginning with 1913-14 the medical and physical examinations begin, and will be finished before the formal opening of College, in order that registrations may be complete at that time. In this connection it has been found desirable to have the clinical, personal and family history blank filled out at home, so that the applicant may have the advantage of her parents' help and knowledge. The filled-out blanks are sent in to the College in June with other documents. This arrangement saves much time and confusion at the medical examination and in the filing of records.

The medical staff consists of the Resident Physician and six Assistant Physicians. Besides, the physician belonging to the Department Staff, with special training in orthopedics, aided by two assistants, likewise trained, makes a detailed examination of backs and feet. In this part of the examination the students are shown, by the aid of mirrors and drawings of the torso, the need (if such need exists) of special posture work and also of immediate attention to the feet. (In this connection it would not be extravagant to say that the percentage of correct posture and of perfect feet is found to be less than ten per cent.)

A full staff of trained assistants makes the drawings of the torso (using the Demeny thoracimeter), the anthropometric measurements and the strength tests. While the collection of this data is desirable for statistical purposes, the College acquires all this information primarily that it may help the individual student.

Grading and Assignment. After the examinations are completed and the unfit are rejected, the students are graded according to the showing made in the examinations. Doubtful cases are placed upon probation for three months and followed up. Those who are sound but weak are put upon a five years' schedule. Those who are sound and vigorous, but show marked defects of posture or have weak feet are given special individual corrective work in the required periods. The Department is well equipped for this kind of work, both as regards facilities and personnel. Special work, in small groups or individually, is also given to students who have some temporary or permanent disability, as weakness due to recent operations, permanent lameness, weak heart, etc. Students who are, or become, run down for one reason or another may even be required to take absolute rest during the required periods. The College has set aside a large room with capacity for between 75 and 100 wicker cots, where students will be taught to relax, and where they must rest, if so advised, under supervision, during the required periods as well as at other times. American women need to learn how to relax and to form habits of regular periods of rest. The bulk of the students who are sound and vigorous and reasonably normal in all respects are assigned to the regular classes and given graded, progressive work in gymnastics, dancing, games and athletics.

The object of the medical and physical examinations is then twofold: Serving the purpose of excluding applicants whose condition and care would involve too great responsibility, and serving as a basis for advice of a preventive, as well as positive character.

Construction Work

Personal Hygiene. One of the main objects of the Department is to train students in the knowledge and practice of right habits of living. Instruction and advice to this end are given: (1) At the time of the physical and medical examination; (2) in a formal course of lectures on personal hygiene, one lecture a week throughout the freshman year (with examinations); (3) and in personal conferences. Through the latter much of the follow-up work is done.

While instruction and advice are fairly adequately provided, to insure the following out and application of such advice and instruction is a more difficult matter. In the first place, the living conditions of the students must be such as to encourage and facilitate hygienic habits. The Department is gradually extending its influence in this direction, coöperating with those officers who have supervision of the housing and feeding of students, as well as with the Student Government Board, which is vitally interested in all that pertains to the uplift of the student body.

Regular Habits. One of the problems especially relating to the freshman students who, on account of insufficient dormitories on the campus are still obliged to live in the village, is being gradually solved. The College has assumed control of a number of large houses in the village where about two-thirds of the class live, the remaining third live in village homes, in which, through the urgent request of the College authorities, additional bath rooms, shower baths and separate closets are gradually being provided. The large houses are moderately well equipped. In this way one of the most imperative needs is being met and regular habits are made possible. The habit of constipation, formed largely because of lack of adequate facilities, is easily the cause of half the ills of women college students. The advantage of the shower bath over the tub is obvious; as a time-saver, and in its tonic effects. Many students find the shower invigorating who get no reaction from immersion, and who must, therefore, avoid it. The habit of the daily bath, in some form, is not so common as one would expect. I shall speak later of other means provided to encourage this most desirable habit.

Diet and Feeding. Another problem which confronts the Department, and one most difficult of solution, is the matter of diet and habits of eating. The students are, on the whole, given a good wholesome diet, but whether always sufficient and suited to their individual needs is questionable.

As regards the eating habits of the students, "promiscuous" eating between meals is one of the evils which the Department is trying to combat. The village lunch and tea rooms and confectionery shops do an entirely too flourishing business. Many students are addicted to eating at all hours for the mere gratification of the palate. How to remedy this evil is not clear. Efforts are being made to impress the students with the value and dignity of *self-restraint* and its result in influence, power, and physical efficiency. Another most powerful appeal is the relation of regular and reasonable habits of eating to good appearance. College authorities must be made to recognize their responsibility and provide an abundant and balanced diet, appealingly served. However that may be the necessity for increased self-control and self-respect still remains and is constantly kept before the students. The growing interest in organized games and sports and the keen zest with which the students enter into them, is perhaps the most promising and effective avenue of appeal in this matter. All members of crews and teams, as well as all aspirants, must give up all such irregular eating when they are "in training."

School Hygiene. The Department is constantly looking into the hygienic conditions under which the academic work is carried on, making suggestions and bringing about improvements in class room and laboratory furniture, in heating, lighting, ventilation, sanitation, etc.

Exercise. The Department believes that habits of exercise that shall last through life should be formed in college, if not previously formed. Aside from the required bodily activities—organized games, sports, gymnastics and dancing—it tries to encourage more and more such forms of exercise as may be done alone, such as walking, running, rowing, paddling, swimming, cycling, skating, snowshoeing, skiing, coasting, etc. The student, like the average person, is too dependent upon the company of others, in the matter of exercise as well as in other respects. She seeks solitude too little. She does not think, she knows not how to meditate. She wants to talk and she must have someone to talk to, and generally prefers to talk to many. She lives in a crowd. This is not conducive to a contented frame of mind after leaving college, especially for those not required to enter upon some occupation.

Required Work. At present all freshmen and sophomores are required to take two periods a week of practical work in the Department of Hygiene and Physical Education. The freshmen, as has been already stated, take in addition a course of weekly lectures. Both the practical and the theoretical work receive academic credit counting towards the degree of B.A. The practical work prescribed by the Department to meet individual needs may be regular graded class work in the gymnasium, in the posture room in a special class; or outdoors in the Spring and Fall, or it may be absolute rest. The bodily activities comprise:

1. Unorganized games on the general playground for freshmen; crew rowing, hockey, basketball, tennis, golf, archery, field and track sports (of a modified character) for sophomores, juniors and seniors. Each student participates in one of these sports at least three times a week during the first five weeks in the Fall and the last six weeks in the Spring.

2. During the Winter two hours a week of gymnastics are required of freshmen and sophomores. For the upper classes gymnastic work is optional. Dancing, aesthetic and folk, is also optional.

Indoor baseball is also practised by about fifty students once a week during the Winter.

These activities aim to secure: (1) *Organic development and training* as a necessary basis for health and vitality.

The majority of the young women, while not ill, fall far short of that degree of organic efficiency which shows itself in robust health and abounding vital energy. Many are "delicate," cannot stand much exertion—mental or physical—and so are subject to many (unnecessary) limitations. Again, the sedentary life most women lead, from high school age on, entails various functional irregularities (such as constipation and menstrual disturbances) which in turn react unfavorably on the whole bodily economy and cause temporary or periodic incapacity for work. Through abundant and varied muscular exercise, furnished both by the outdoor and gymnastic work, the functions of all the organs are stimulated, become more regular and the whole organic system gains power, better adjustment and greater efficiency. The motor organs too, are strengthened and toned up. A moderate and harmonious muscular development is one of the necessary "tools" for complete and efficient living. The majority of incoming students are conspicuously lacking in this respect. While muscular development is not a prime object of the work, it almost invariably results, to a moderate extent, from the regular and vigorous exercise each student is required to take. The bodily activities are of such a character that they *cultivate the right kind of motor and posture habits.* There is a great deal of unnecessary "breaking down," partial or complete, among people of sedentary occupation, and especially among women, which may be traced to wrong use of the body. Good posture and efficient economical motor habits bear an important relation to health and vitality insofar as they eliminate unnecessary strain and waste of nervous energy, and insure better working conditions for the vital organs as regards space, support and circulation. In the gymnastic work the students are trained to move all parts of the body with precision and power; to perform with promptness, accuracy and vigor those elementary movements of which all skilled actions are made up. Throughout all gymnastic work the training of good posture, erect carriage and ease of bearing are especially emphasized. This subjective motor training furnished by gymnastics is thus closely related to the purely hygienic phase of the work. But it is something more than that—it has a distinct and positive educational aspect. It means the development of latent powers of coördination, the increase of motor adaptability; it makes for physical efficiency and the self-reliance which is always associated with it. It gives the student both the idea and the means to live a fuller, freer, healthier and more efficient physical life. All this as well as the direct training of attention and will, the habit of coöperation and unison of action in the gymnastic work; the unquestioning obedience to leaders, the observance of rules, the team work, spirit of sportsmanship and applied ethics in games and sports, cannot fail to have a pronounced and permanent effect on mentality and character and to bring the student to a fuller realization of the meaning of education—health—or wholeness, which is the harmonious development of the body, the mind and the spirit.

Medical Care. The physical care of the students is under the immediate supervision of the Resident Physician. By the terms of admission the student may have two weeks care per year in the infirmary, and all necessary medical care at all times. She may, of course, consult any outside physician if she wishes to do so. There should be complete coöperation between the Department and Resident Physician. In Wellesley College I am happy to say that this is the case.

The Plant. The plant consists of a large building in T shape. The gymnasium is 100 x 70. Beneath it, and entirely above ground, are two large dressing rooms with 120 alcoves and a bath room with 60 alcoves. There is also a locker and drying room. The students are given their baths in groups, whole classes at one time, the showers being under control of the bath matron. It is possible to give a full tonic bath to classes of sixty every ten minutes in the day, with absolute individual privacy. Bath sheets and towels are furnished by the Department and sent daily to the college laundry. A required gymnasium fee covers all expense of dressing room, locker and bath. No gymnastic lesson is complete that does not include the bath. Students unaccustomed to it soon acquire a liking for the shower bath, which often results in the habit of a daily bath. After constant use for nearly four years, we are satisfied that our bathing facilities cannot be improved. The arrangement saves time, water and possibility of accident. It is to be regretted that we have no swimming pool, however we hope to have one in the near future. In the main part of the building are located the offices of administration; a suite of four large rooms for medical and physical examinations, and for remedial work. A beautiful well equipped department library is on the second floor, as well as two large lecture rooms. On the third floor may be found the anatomical and histological laboratories; the physiological and bacteriological laboratories. Surrounding the building on three sides are fourteen tennis courts, a fine archery court, four courts for basket ball, and two courts for hockey. There is also a running track and a large field for group games. Further development of the grounds for additional sports is in progress.

It must be remembered that the hygienic care of the student body is but one part of the work of this Department, which includes, as well, a training school for teachers. The Department of Hygiene and Physical Education in Wellesley College has equal rank with all other departments, and numbers virtually the entire student body. It has also charge of the physical education in the public schools of the town of Wellesley, acting in conjunction with the school officials, and it is planning to do further extension work in this and other towns in the immediate future. It is a debt that the College owes to the town and to the Commonwealth in return for exemption from taxation—a debt that it is a privilege to try to pay.

THE IMPORTANCE OF TEACHING THE CONSERVATION OF NERVOUS ENERGY TO OUR ADVANCED WOMEN STUDENTS

BY

ELIZABETH LEIPER MARTIN

In presenting this paper before the body of experts who are present at this Congress I feel that I can add nothing to the facts already familiar to you all.

Physiology and Psychology are so universally required subjects in the curriculum of our normal schools and colleges that it would seem that all our advanced students would consider the conservation of their nervous energy of paramount importance. Indeed, did we practice what we all know so well theoretically such a paper as this would be distinctly unnecessary. Unfortunately my five years' experience as Medical Examiner and Adviser in institutions that are training young women for various kinds of professional work, and my association with graduates of many colleges, has convinced me that we are still far from the ideal system which prepares the greatest number of individuals for the greatest personal efficiency. Strangely enough it is usually the more brilliant students who fail to realize the physical basis of nervous energy and the methods of its conservation and who often therefore fail to reach the goal to which their ambitious and natural ability would otherwise lead them. That this attitude of mind is found among men, as well as women students, is illustrated by the following anecdote: A student in one of our large eastern universities was sent by an instructor to a prominent psychiatrist for a medical examination with the statement that he was decidedly the most brilliant student in the University and had the best mind. After the examination the physician reported that though he might be the most brilliant in some lines he was woefully lacking in common sense and that in knowledge of his own body he was about three years old.* Probably every school and college physician here has had similar experiences. The recent movement for the prevention of nervous diseases and the advancement of mental hygiene shows that great need for practical work along this line. It is a sad reflection on our educational system that while factories and all business concerns are considering every means for increased efficiency of their employees that many of our higher educational institutions are applying so little of the knowledge that they have.

*Related by Dr. Paton in another session.

For the woman of intellectual ability this subject is of importance from three viewpoints. First, that of the individual, for this is the type of woman who, if she breaks down, is liable to have the most severe exhaustion, and unless very judiciously managed, to become one of the chronic nervous invalids who fill our sanitariums and whose lives are a burden to themselves and their friends. It was my experience with these patients in sanitarium practice which aroused my interest in the prevention of these conditions and made me feel the burning necessity for early training in mental hygiene. Although under proper care many of these patients recover and become most useful members of society and from their hard experiences learn how to conserve their energy, they probably are rarely able for what they should be had they learned the lesson earlier. But who can say how many never are able for the ordinary duties of life. So many of those who suffer from overstrain drop out of high school and college before they have been properly tested.

We are in danger of thinking that those who thus fail are hopelessly defective and so far below the normal physically as to be hardly worth any effort. Of course this is true in some cases, but my experience makes me sure that many cases are the result of lack of knowledge of hygiene, which may be defined as the art of living according to biological laws. Many of these girls are refined and ambitious and have will power and ideals much above the ordinary, but they fail because they attempt the impossible, believing that mental work depends solely upon the will and apparently unconscious of its physical basis. Their ideas are indeed those of the ancient spiritualistic philosophers and seems to be a remnant of the superstitions which dominated our ancestors through the ages.

We must not unduly blame the girl for this, for how many of her teachers and her still more ignorant family are responsible for this attitude and often put on her burdens that are too grevious to be borne.

If from the standpoint of the individual we are doing the woman a grave wrong by giving her a training for life which in any way handicaps her for her highest and happiest function, that of wifehood and motherhood, from a eugenic standpoint we are doing no less a wrong to society. While we must admit that brilliancy of intellect is often associated with an instability of the nervous system which makes parenthood undesirable for some of these women, still there are many others who with a proper training in hygiene are needed to be the mothers of future generations. It is certainly of great importance for the intellectual development of the race that the women of highest intellectual ability should not be rendered unfit for motherhood by undue mental strain during adolescence and early adult life; while by our laws for the protection of women in industry we are endeavoring to conserve their ability for maternity. While we care for the one, let us not forget the other. It is a well recognized fact by all physicians that upon the women of our upper and more intelligent classes the physical burden of maternity falls the heaviest. I do not believe that this is the result of hard mental work, but because she has not the knowledge, and does not realize the absolute importance of a conservation of nervous energy, and because the educational and social world conspire to stimulate her beyond human powers. Were she properly educated she would recognize that her highest and most solemn moral responsibility is her physical well being. Just so far as she is below normal, so far is she unable for the duties and pleasures of life. As the largest proportion of our highly educated women enter the teaching profession it is surely of importance to society that they enter upon their life work so trained that they will not only be more efficient themselves, but also properly prepared to care for and set correct standards and ideals for those under their influence. How can a woman whose highest ambition has been to obtain honors in some purely intellectual line, no matter what the cost to her own health, be expected to take a rational and sympathetic view of what is of the greatest importance to her pupils. Nor, when she begins to suffer from the results of her own physical extravagance is she fit to have charge of impressionable children. No matter how brilliant intellectually, a neurasthenic mother or teacher is unfit to guide children of any age. Professor Terman in his excellent monograph entitled "The Teachers' Health" has collected a number of statistics that show that while the mortality among teachers is low, the morbidity is very high; a large proportion of the illness being caused by nervous affections. The fact that the members of few professions are subjected to the nervous strain which teachers undergo makes it most essential that they should be especially trained to withstand conditions which are apparently inevitable. Professor Terman states "that the belief that the fatigue coefficient of teaching is about twice that of other kinds of mental work is probably nearer the truth than the common assumption that an hour always equals an hour." In answering a questionnaire issued by Dr. Burnham to 569 normal school students 20% name conditions of school life as responsible for their ill health. No doubt the increased teaching of practical hygiene in our schools and the medical examinations and vocational guidance of our students will tremendously raise our health standards, and thus contribute to a better mental hygiene, but we must also reckon with the factor of increased stimulation to work, which affects us all in these days of increased opportunities which are such a great temptation to those who see the great amount to be done. How many of our tired teachers and students are entering upon summer courses of study, when above all the need is to let the mind lie fallow in preparation for the work of the next regular session.

One of the early symptoms of neurasthenia is increased impulse to work beyond the reasonable amount, and in many nervous individuals this is especially marked whenever they are tired. Dr. Mosso says that "in proportion as the energy of the brain is consumed and our organism weakened, the excitability of the nervous system increases. Here we have an automatic means of defense of great efficacy which nature has provided to counteract enfeeblement. The senses become more acute and the nervous system more excitable, when in consequence of fasting or fatigue an animal becomes less fit for the struggle." Many illnesses would be avoided if this fact were more often recognized. To my mind the most important facts that we must emphasize in our teaching of Physiology and Hygiene is the physical basis of nervous energy and the chemical changes in fatigue. While different individuals have varying capacities for work, all work consumes a certain amount of living material as truly as fuel is consumed by an engine in producing energy with a corresponding production of waste products. As in an engine, there may be great loss of power on account of defective construction or faulty management including the provision of unsuitable fuel, so in our bodies there is an even greater opportunity for the products of faulty metabolism and insufficient nourishment or hereditary weakness to prevent accomplishment of the work of which we should be capable. Probably the different capacities of different individuals for work depends upon the amount of latent energy available depending in turn largely upon their habits of personal hygiene, affecting constructive metabolism, oxidation and the removal of waste, and also upon their methods of work. Indeed, the question is largely an economic one, and we must decide how we are to spend the latent energy or, in other words, the available materials with which we have to work. Some very interesting observations on fish have been reported showing the relationship between the metabolism of the different tissues during times of special stress and also studies in starvation which demonstrate how the tissues are sacrificed in the order of their importance, to the heart and brain, which are essential to the life of the organism and are the last to suffer loss of substance. These studies all demonstrate the need for proper regulation of the various bodily activities and that strain on one part affects, more or less, other important functions. We often forget that all the physiological functions require expenditure of nervous energy and that probably only one-tenth of our necessary nervous expenditure is controlled by the will. By training children to do the routine work of life automatically energy would be saved for conscious efforts. If one has not acquired such habits it is worth the effort and time necessary to learn to make such acts automatic. When by forcing ourselves to do more than is normal in certain directions we first rob other organs of what is needed for their work and finally we reduce our total store of energy to the point of physical bankruptcy. The person who does not retain a "margin of safety" in health expenditure is much more foolish than he who lives entirely up to his financial income. For health is our capital in more ways than we realize. Women must realize that upon the female in all higher organisms falls the burden or privilege, according to point of view, of storing latent energy for future generations, and no matter what the individual wishes, nature has provided certain physiological processes and laid down certain laws which cannot be broken without entailing suffering for the individual and injury and loss to society. In the normal metabolism of women, provision is made for a periodic loss of latent energy which, in health, the woman can easily meet. Much of the mental sluggishness during the menstrual period is due to the local pelvic congestion. Another factor on the economical side is that of improper methods of work, and the lack of efficiency caused by fatigue. "It has been estimated that not less than 25–50% of the entire possible output has been wasted by lack of knowledge of the most economical ways of running the psychological machine." Dr. Mosso's studies on fatigue show that only one-fourth of the time necessary for restoration of the muscle is required when one-half the amount of work necessary for complete exhaustion is done. I find we must constantly emphasize this to our students who work late at night when they are fatigued and remind them of the time that would be saved if they rested then and worked when they were rested. So much time is lost by working when we should rest. It is interesting to note that the tremendous work done by Charles Darwin was the result of only three hours of concentrated work daily and many others who have influenced the intellectual life of the world could spend little more time. This should be considered in arranging students' schedules. We need quality so much more than quantity.

Mosso's experiment also shows that muscular fatigue follows mental work to such a marked degree that we must be more careful how we recommend physical exercise to our students who are under great mental strain. Much nervous exhaustion is no doubt caused by our theories that change of occupation is rest. This is partially true and occurs when one part of the nervous system is fatigued and when the total amount of waste products in the body is well below what is tolerated by the individual. By muscular exercise after an ordinary amount of mental work the circulation is so modified that a fresh blood supply is brought to the fatigued cells, and waste products are more quickly removed and as we all know the proper proportion between mental and muscular work is very important. We should, however, consider carefully the nature of the exercise and select that which makes the least strain on the nervous system, those exercises being selected that are largely automatic in character. Much of our physical training consists of complicated dances and difficult gymnasium feats, not to mention competitive games, which instead of relieving the over-taxed nervous system adds directly to the strain. One important factor in conserving nervous energy is the training in proper posture and correct poise of the body. Many symptoms of nervous strain are those resulting from incorrect sitting and standing posture with the increased muscle strain which is required for ordinary movements, as well as interference with the circulation. So often our gymnasium instructors are teaching highly coördinated movements when the students have not learned the rudiments of muscular training. I have been amazed in some cases at the improvement in health which has followed instruction in methods of correcting faulty posture with a consequent saving of energy.

In teaching of physiology and hygiene we must dignify and idealize all the physical functions by teaching that our bodies are the instruments by which we are enabled to fulfill our highest responsibilities and that our mental efficiency depends upon the application of biological laws. This dignified attitude is especially important in the teaching of sexual hygiene and I believe that we should avoid in our talks with students the emphasis that is so often laid upon the pathological and the desecrated sexual functions. It is impossible to calculate how much harm has been done to sensitive individuals by taking a morbid attitude concerning this subject and by creating a disgust for the most sacred human functions. That a proper teaching of the facts concerning sex is a factor in mental hygiene I have no doubt, for anything that causes a false view of, or a morbid curiosity concerning the great facts of life must cause psychic injury. Upon many of us lies the responsibility of helping the student to decide what her life work is to be and we must be very careful in our study of the individual. Dr. Stewart Paton in his work on Psychiatry states that one of the common causes of insanity is over-education of certain people who are unable for the strain of mental work. I believe we must learn to give credit and honor to all useful work and make our students realize that to do well what they can is much more creditable than to attempt lines of intellectual endeavor in which they will never excel on account of the tax on the nervous system for which they are not fitted. The present movement for vocational training will help us solve the problem, but we must avoid the danger for some students of loading vocational courses with theoretical work which puts a strain on the nervous system plus that of the muscular work inherent to the course. It has only been possible to-day to touch on the necessity for the teaching of the conservation of nervous energy from the physical side and to mention a few of the points I have found helpful in dealing with a very interesting class of girls so full of enthusiasm and anxious to make the most of their lives, but in their zeal and ignorance so often courting disaster and failure forgetting that what they need most is rational consideration of physical ability and a sensible attitude toward life.

To summarize these points:

1. The necessity for a hygienic regime to insure proper nutritive processes and the elimination of waste.

2. The formation of correct habits that much work may be done automatically.

3. The economic loss of time and energy from working until exhausted.

4. The importance of training in correct posture to prevent mechanical waste of energy and consequent strain of nerve and muscle.

5. The necessity that more honor and dignity be given to good work outside the purely mental field.

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GOOD ROADS AND GOOD HEALTH

BY

MRS. F. DE GARMO

To combine the subject of good health with good roads, may seem a little "queer" for an International Congress on School Hygiene. But all health is so essential, so meritorious, so compelling and so vital to the growth and stability of nations that any worthy element that enters into child hygiene, which is the world's hygiene, should be regarded with thoughtfulness, even though it be the conservation of the public roads.

What is a Road? A road is a path or highway for the people.

Use of Roads. Good roads are the milestones that mark the progress of all humanity "up to ampler destinies."

Kinds of Roads. There are physical, mental and moral paths, or highways.

Mental roads are the highways of immortal mind, over which high-power thought-motors are acting as pathfinders for the highest type of modern race development.

Moral highways are the "Old Trails Road" of the Decalogue, whose ten guide-posts have stood throughout the ages—at the cross-roads of life—to point out the right of way to good earthly citizenship and eternal hope and happiness.

Physical highways are the basic element in the rise or fall of humanity and are largely responsible for the mental and moral conditions of mankind.

Kinds of Health. The wider use of the word health, like that of highways, naturally divides itself into physical, mental and moral conditions of the body, mind and soul.

Values of Health. Improved health, in this larger sense, will bring a new race with infinite possibilities for good.

Value of Roads. Improved roads will bring, among other things:

Better farms and more cultivated land, better cities and more civic pride;

Better crops and cheaper transportation, better economic conditions and more products;

Better church attendance, better citizens;

Better social conditions, less isolation and selfishness and more refinement;

Better neighborhood understanding, and less community antagonism;

Better schools and greater attendance, better health and quicker medical attention;

Better home economics and less drudgery and insanity.

These reasons alone for public road improvement should be sufficient to create a public sentiment for better highways, and a greater interest in arousing all thinking people to study the awful condition of the roads in America.

It is gratifying to know that there is a national awakening as to the economic values of good roads, and we are grateful to the automobile and all other agencies, whatever their motive, for the increased activities in road improvement; but it remains for the future to make known in a scientific manner and from scientific investigations the greatest menace of bad roads to the development of the human family—that is the danger to health.

Bad roads are hard to define, because they differ in their kind of "badness," according to their location, and the climate and topography of the country.

But any road that is impassable, for any period of the year, for travel, traffic, pleasure or profit, by children or adults, is bad for the physical, mental and moral welfare of the people.

Bad roads are easily distinguishable by mud-holes, frog ponds, choked-up culverts, soggy, stagnant pools, and hog-wallows. Bad highways may also be rocky, rutty, washed-out and impassable hill roads; but, in either case, bad roads always mean bad drainage.

Bad drainage means breeding places for the filthy fly, and the deadly mosquito.

Bad drainage and the flies and mosquitoes mean yellow, typhoid, malarial and other fatal fever diseases. Muddy roads mean tuberculosis, croup, pneumonia, catarrh and rheumatism.

If for no other reason than to exterminate the mosquito and fly, by draining their breeding places, the medical world and all other students of health agencies should advocate the immediate improvement of the public roads, by expert highway builders. Thinking people should wage a campaign of education to teach the taxpayers that good roads are not a tax, but an investment in health, wealth and happiness.

Boards of Health should have legal powers to close bad roads against traffic and travel just as they now have against unsanitary Produce Markets, or epidemic breeding schoolhouses.

Good Roads Make Possible Pure Milk and Pure Food. "Pure Food," the slogan of "The Consumer," is almost impossible to obtain even under the most stringent laws by National and State Boards of Health, unless the roads to market are good, throughout the year, so that pure milk, pure eggs, pure meat, and pure vegetables can be rushed to the consumer in a very short time.

Dr. Dowling, President of the State Board of Health of Louisiana, is concentrating on the "better drainage of roads to destroy the breeding places of mosquitoes and flies" and also to urge the value of good roads as a "pure food measure."

Dr. John J. Sippy, Assistant in the State Board of Health of Kansas, under the heading, "Good Roads Prevent Disease," gives the following reasons for a health campaign for good roads.

I. *By Reason of the Removal of All Weeds and Trash.*

Weeds and trash prevent the prompt evaporation of moisture, and promote retention of the ground water. This makes ideal breeding spots for mosquitoes, flies and other insects which are known as disease carriers, not to mention chinch bugs, hoppers and other insects which are crop damagers. Furthermore, an undergrowth of weeds invites the dumping of garbage, manure and excrement by offering concealment, of which fact careless and thoughtless people are prone to take advantage, thus increasing the facility of insect breeding and at once providing these insect carriers with proper material for disease transmission.

II. *By Providing Good Drainage.*

Many farms have no means of drainage except by ditches along roadways. Open ditches, clear of brush and debris with hardened surface and proper fall, afford these farms the opportunity of ridding themselves of many a stagnant pool. The removal of weeds, together with proper road grading, surface hardening and oiling, insures prompt drainage of all pool, ditch and surface water, at once removing the possibility of insect breeders, for none can multiply without moisture. Road oiling, in itself, is destructive of insect larvae, especially mosquitoes—a well known fact.

Dry roads offer pedestrians, and notably children, who are compelled to walk to and from school, dry shoes and feet; while colds are undoubtedly due to specific germ origin, more or less, it is a well-known fact that cold, wet feet and chilling limbs lower the resistance of individuals and make them favorable subjects for infections of the respiratory passages, including pneumonia and tuberculosis.

III. *By Example to Adjoining Farm Premises.*

Good roads promote travel on those highways and in themselves they set examples to the farmer whose premises are bordered by them. The comparison of a well graded, clean highway with an unkept and trashy barnyard adjoining is sufficient to stimulate every land owner to a clean-up. Pride compels him to offer to passers-by a neat appearing and attractive house and barnyard. Results are only too obvious—Q. E. D. Thus, good roads are active disease prevention agencies aside from their financial and commercial value.

The "Saint Louis Republic," which has waged a popular good roads campaign recently, and one which will have far reaching results, says of good roads and good highways:

"Good Roads and Good Health.

"Good roads are inseparably connected with good health." When the average indoor worker is out of doors, in two hours out of three he is on the road, or immediately adjacent to it. He is breathing the air of the road, such as it is. If this air is full of germs or of mosquitoes obligingly acting as common carriers of germs, or if it is full of dust or foul odors, it will surely exert its maximum effect upon just those members of the community whose exclusion from sun and air during working hours makes them most susceptible to unfavorable influences.

When an invalid goes for his first drive, he goes out on the road. When a baby goes for a walk, he is taken along the highway. The aged and infirm, called forth by necessity, or desire, for the rest that comes from change, breathe the air of the road. It ought to be good air. It cannot be if the road is diversified by mosquito breeding pools, carpeted clean up to the roadway with dank and matted weeds, littered with filth, or permitted to become knee deep with dust.

It is vastly important to the public health, that users of the roads should be able to go where they want, when they want to, and arrive there on time. The baby that died in the midst of the rigors of winter on a farm because the doctor could not be gotten in time, is only one of the victims. Many a life has paid the penalty of over exposure on account of bad roads, and it chances that the roads are worst just when the weather is worst. Bad roads, too, prevent the conservation of human energy by making "going to town" so hard that the delicate person in the country gives up the medical treatment that would restore health and strength, because the exertion of a long drive through bog and mud-hole more than counterbalances the benefit of the treatment.

But, perhaps, the most marked effect of good roads on health comes by way of the mind and soul. Shut up to itself, fresh water stagnates, so does human life. The very word "pagan" originally meant the villager, who, remote from the great currents of life and thought of his time, remained untouched by the Christianity that had leavened the cities. The secret of rural civilization is the preservation of the link which unites the men and women of the far-off hamlet with the great world outside.

Wherever good roads go, the vital energy of the world flows along the highway. And the building of a good road is a challenge to which national manhood responds.

The slums of big cities are on bad streets. Many a neighborhood has been lifted out of a slough of vice and poverty by the process of improving its streets. Well curbed, neatly paved streets have induced the property owner to improve his house and his lot; the lessons in neatness given by street cleaning have been an object lesson in good housekeeping; the good highway has helped to transform the people's lives by bracing their self-respect. And the building of a good road into a backward country district has often lifted the whole life of the people and given children a better chance for health of body, mind and soul.

The civilization of a country may justly be gauged by the healthfulness of the life lived in the open on its roads.

Bad roads cause the churches to be neglected and deserted, and their decay and dissolution follows. Along with the use of the churches for corn cribs instead of spiritual evangelization, the moral health of a community vanishes.

Are not the conditions of the roads of a nation the measure of the efficiency of its health authorities, as well as the test of the efficiency of the highway engineer, or the public spirit of its citizens?

May we not measure the health and efficiency of the schools of our nation by the efficiency of its transportation facilities to the educational centers?

Is it not time for the humanitarian doctor to join with the highway engineer in an irresistible and remedial team-work slogan for better homes, better schools and better sanitary environments?

Dr. Robert M. Funkhouser, President of the Missouri State Medical Association, has furnished a remarkable ocular demonstration of the danger to travelers along bad, swampy, fly-breeding roads. A few weeks ago a man living in the country near St. Louis, came to the distinguished doctor's office complaining of a headache. The doctor examined his nose, and found that the eggs of a fly had been deposited far up in one of the nostrils.

The patient, when questioned, remembered that while he was walking along the road, some days before, an insect flew into his nose. He immediately forced it out, and forgot all about it.

On the day he visited the doctor, suffering from severe pains in his head, the doctor extracted five green fly pupae from his nose by chloroform. These five pupae were deposited, by the doctor, in a paper box. All five of the units developed, although very little air could have reached them in the box. This illustrates not only the persistence of life, but the danger from the common fly. Yellow fever which has claimed its victims by the thousands and tens of thousands is directly traceable to the mosquito, known as the *Stygomia fasciata.*

Any breeding spot for mosquitoes is a deadly menace to the health of humanity.

Innumerable examples could be cited to prove the origin of fatal diseases from bad roads and bad streets, directly and indirectly.

Good roads make possible so many opportunities for prosperity, for health, for education, for culture, for music, for art, for amusement and for recreation, that their value might be expressed in general terms as the antitoxins for the physical, mental and moral ailments of mankind.

When every road leading to every home and every school is a clean, modern highway, and when every agency is utilized to preserve the perfect health of all the children in every home and every school, all nations will boast a perfect child, from whom will spring the perfect race, and thus mankind will fulfill the prophecy of the poet:

> The brute man of the planet, he will pass,
> Blown out like forms of vapor on a glass,
> And from this quaking pulse of life will rise,
> The Superman-child of the higher skies,
> Immortal, he will break the ancient bars,
> Laugh and reach out his hands among the stars.

HYGIENE INSTRUCTION IN THE GARDNER SCHOOL OF VALPARAISO

BY

MARGARET C. BEER

Instruction in hygiene in the Gardner School has been reduced to a system and is taught regularly in all of the grades. The work is oral and written.

For the oral work the teachers use Health Hints. These have been classified as follows: Sunshine, Air, Personal Cleanliness, Care of the Eyes, Care of the Teeth, and Flies. There is also a miscellaneous list. Each morning the teacher writes upon the board a health hint. A few comments are made. Care is taken to make these comments as concrete and practical as possible. Sometimes a story is told by way of illustration. The health hint is left upon the board during the day. Every Friday boys and girls give a health hint. It may be one they have learned or an original one. A girl of seven years gave this, "Air beds at least two times every day." This was at the completion of the instruction on air.

The written work begins in the second grade. It takes the form of stories and compositions. The subject is sometimes assigned by the teacher. At other times the pupils choose their own subjects. The aim in the written work is to make the expression free and spontaneous, not laying too much stress upon form.

This work has been carried on for three years. Neither teachers nor pupils have tired of it. Its success is shown in the interest which the pupils take in the instruction and in their application of it in their homes. The parents are in sympathy with the work and many expressions of gratitude have come from them which show that they appreciate the work which is being done.

AIR

Night air is purer and more wholesome than day air.
Night air is charged with health and strength.
Let night air into your bedroom abundantly.
Night air contains less smoke, less dirt and fewer microbes than day air.
Night air is cooler than day air.
Night air is a good tonic.
Night air is the only air we have to breathe in the night time.
Live all you can in the open air.
Foul air is full of disease and death.

Pure air is full of health and life.
Do not live, study or sleep in rooms where there is no fresh air.
Do not live in dusty air. Keep your rooms clean.
Get rid of dust by cleaning with damp cloths. Do not sweep with a dry broom.

AIR

The air is nice.
There is no thing better than air.
Air is good for you.
The air is fresh.
Air your lungs.
Play in the air.
Air makes us happy.
We love the air.
There is no thing better than air.
Air your beds.
The air is good for you.
The air helps to make us grow.
The air makes things smell fresh.
You must air your beds.
Air your homes.
You must air your clothes.
You must love the air.

Ella May Vevia.

Second Grade, Gardner School.

SUNSHINE

We love the sunshine.
Sunshine is good for us.
Keep on the sunny side.
Let the sunshine shine in on the beds.
We could not live without sunshine.
The woman said pull down the shade the sun is fading the wallpaper.
O, put it up said the little girl let the beautiful sunshine shine in.

Florence May Stansell.

Second Grade, Gardner School.