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THE CANADA EDUCATIONAL MONTHLY.

FEBRUARY, 1902.

PETROLEUM.

By A. H. D. Ross, M.A., Tilsonburg.

What is known under the general name of petroleum or "rock oil" is in reality a very complex mixture of hydrocarbons varying from fluids much lighter than water to viscid and tar-like substances. By hydrocarbons we mean chemical compounds of hydrogen and carbon. These are very numerous, some existing of gases, most of them as liquids, and quite a few as solids. All are inflammable, their hydrogen giving the blue part of the flame, and their carbon the yellow part. Their hydrogen unites with the oxygen of the air to form steam, and their carbon with oxygen to form carbonic acid gas. Experimental researches on light have proved that the yellow rays are the most penetrating. This explains why hydrocarbon gases and oils are such good illuminants, particularly acetylene, which contains a larger percentage of carbon than any of the others.

Properties of the Hydrocarbons.

The hydrocarbons are usually divided into three great groups, viz: Paraffin, ethylene and ben-

zine. The paraffin series includes methane ("marsh gas"), ethane and propane, which are gases; also liquids like butane, pentane, hexane, heptane, octane, nonane, dodecane, heptecane, whose boiling points range all the way from 34 degrees Fahrenheit, up to 532 degrees. The ethylene series includes ethylene, propylene, butylene, amylenes, hexylene, heptylene, &c.; and the benzine series, benzine, toluene, xylene, mesitylene, chlorene, hexamethyl benzine and many others of no interest whatever to the average citizen were it not for the fact that each and every one of the hydrocarbons contains hydrogen and carbon in certain fixed proportions and is highly inflammable—the hydrogen furnishing most of the heat and the carbon the light of the flame.

Where it is Found.

Petroleum has been discovered in many countries, and occurs in Italy, France, Roumania, Persia, Burma, along the shores of the Caspian sea, China, Japan, Siberia, and last, but not least, in many

parts of North America. According to the locality, its color varies from light yellow to orange and reddish brown to dark green and black; and in odor it varies quite as much as in color, some kinds having a pleasant and others a disagreeable smell. Some kinds contain considerable bitumen and asphaltum, which are closely allied substances in a solid or semi-solid form, others contain many of the paraffins. In some places it issues constantly from the earth, but usually it is necessary to bore for it.

Early History of Oil Wells.

In 1627 Pennsylvania petroleum was known to the Jesuit missionaries as a natural curiosity, and was spoken of in the eighteenth century as 'Seneca oil,' being named after the Seneca Indians, who kindled in it their religious ceremonies. In 1854 the Pennsylvania Rock Oil Company was formed, but languished until 1858, when Colonel Drake and Mr. Bowditch resolved to sink wells at Titusville and were amply rewarded by obtaining from ten to twenty-five barrels a day. Adventurers quickly came to the district and by 1860 oil was known to exist beneath one hundred square miles of country and at a depth ranging from 70 to 500 feet. In 1861 the first large flowing well was struck and yielded about a thousand barrels a day. Between 1855 and 1870 the population of Titusville rose from 245 inhabitants to nearly 9,000.

North American Oil Regions.

The principal oil-bearing districts of North America are situated

along the western coast of California; in Northern Utah; in seven or eight places in Wyoming; in central and western Colorado; in New Mexico; in seven places in Texas; in south-eastern Kansas; in western Missouri; in Illinois; in northern Alabama; but principally in the states of Indiana, Ohio, Kentucky, Northern Tennessee, West Virginia, Pennsylvania and New York. The chain of oil bearing districts running due east and west through New York state crosses into Ontario near Buffalo. Petrolia is some 170 miles straight west of Buffalo.

Amount of Oil Produced Annually.

To give you some idea of the enormous quantity of petroleum pumped from the ground every year, I quote the official returns for 1899: Russia, 66,452,240 barrels; United States of America, 57,070,850 barrels, all others about 6,800,000 barrels. During the same year the United States refined 45,000,000 barrels of oil or over 81 per cent. of the raw product, whilst Russia refined 14,000,000 barrels, or about 21 per cent. of hers.

One year's supply of crude oil would fill a tank one mile square to a depth of fifty feet. How would you like to own it? Up to date, the amount of petroleum obtained in the great republic to the south of us would fill a reservoir the size of the city of Buffalo to a depth of over a thousand feet, or would equal the volume of water flowing over Niagara Falls every two hours.

Some of the Uses of Petroleum.

Some of the advantages of petroleum for steaming purposes are that it gives twice as much heat as an equal weight of coal, that it requires less storage space and that it is entirely free from ash; but it has some rather serious disadvantages such as the difficulty of burning it without much smoke and tarry deposits, the danger attending its use, and its costing three or four times as much as coal. The heavier and thicker flowing varieties give the best results in heat engines, and for a time Baku petroleum was used in the locomotives of one of the railways in the south of Russia.

In metallurgical operations it is far superior to coal, as in the bending of armor plates, etc., the operator being enabled to heat the metal in a much shorter time, and to concentrate the heat on any desired portion of the plate. When hydrogen gas burns it gives an intensely hot flame, and as petroleum is a mixture of hydrocarbon containing a large percentage of hydrogen, it is easy to see why it gives a much more hotter flame than coal or charcoal.

Refining by Distillation.

Being a mixture of many liquid hydrocarbons, each with its own particular boiling point, the petroleum is placed in a large iron boiler or "still" to keep the air away from it when it is heated. The hydrocarbons with the lowest boiling points are vaporized first and the vapors condensed by passing through water-cooled pipes. Then the temperature is raised somewhat, the next portion of vapor condensed, and the fraction-

al distillation proceeds until a thick, tarry substances remains at the bottom of the still. Some of the liquids obtained in this way are known as cymogene, rhigolene, gasoline, naphtha, benzine, maltha, kerosene, and vaseline, whilst the residue in the stills contain solid paraffins, coal tars, bitumens, asphaltum, etc. It must be distinctly understood that the above mentioned substances are not pure chemical individuals. The names are commercial names, each of which applies to a complex mixture of hydrocarbons.

Kerosene, or the so-called "coal oil," is really a mixture of some five or six liquid hydrocarbons, and to be fit for use in lamps should be entirely free from the more volatile gasoline, benzine, etc., as they form explosive mixtures with air, just as marsh gas does. The legal "flashing point," or temperature at which kerosene takes fire, is about 112 degrees Fahrenheit for most places in the United States. In other words, no part of the mixture should vaporize below this, as a mixture of air and hydrocarbon vapors explodes upon the approach of flame.

Standard Oil Company's Exhibit.

Most of the east North American petroleum have a paraffin base and they are light illuminating oils; whereas the greater proportion of the western petroleum have an asphaltum base and are heavy oils adapted principally for fuel and lubricants, the light, illuminating element being much in the minority. At the Pan-American exposition the Standard Oil Company exhibited over 500 of the

products of petroleum and at least 100 more for which no use has, as yet, been discovered. A special room was devoted to the paraffin exhibit alone, and contained all the varieties of paraffin from the ordinary kind used in candles to the kind used to wax the paper in the paraffin tube you use to sip your ice cream soda.

Their exhibit of water-white oils was a splendid illustration of the wonderful perfection of their refining processes, these oils being obtained from any grade of Pennsylvania, crude oil or from the sulphur-laden oils of Ohio. They also exhibited all grades of lubricating oils—engine, car cylinder, valve, dynamo—everything from that required for the most delicate parts of a watch to that used for a heavy steam roller.

Prospecting for Oil.

There are few pursuits after elements of economic value that depend so much upon a thorough knowledge of geology and geological conditions as that of prospecting for oil.

Every new region brings out new and interesting features peculiar to it, or helps to illustrate and verify long accepted theories. An "expert" oil man, trained in the East, and sent to the West to prospect for oil, would find himself confronted by entirely new conditions, and the prospector trained in the West would encounter as many difficulties in the Eastern oil regions. This is because of the vast difference of geological age and position between the Eastern and the Western fields. In the East, oil occurrences are in strata, far more ancient than those in the

West, being confined to the Palaeozoic limestones and sandstones of the Silurian, Devonian, and Lower Carboniferous strata. (In Ontario they seem to be confined to Devonian strata and limestones.) In the West, most of the oil horizons are found in limestone, shales, and other rocks of Mesozoic and Cenozoic age, from the Jura Trias below to the Tertiary above; although there are exceptional cases of oil signs in the Western Palaeozoic rocks; as, for example, in California, where the asphalt and oil deposits are in the unaltered Cretaceous and Tertiary rocks of the coast range, and underlie the Sacramento and San Joaquin valleys, or in Colorado, where the oil horizons are in the Jura Trias and Cretaceous rocks.

In prospecting for oil, it should always be remembered that it cannot exist in granite or metamorphic rocks (those altered by heat) any more than in a limekiln. Attention should be confined to the unaltered rocks, and all streams, pools and other bodies of water, should be carefully inspected. Oil on the surface shows prismatic colors and may be distinguished from certain iron compounds sometimes floating on water by breaking up into rings when stirred and again showing prismatic bands of color when it comes to rest.

All outcrops of stratified rocks should be carefully examined in the banks of streams, gulches, canyons, cuttings and cliffs, and the ground carefully studied for evidence of anticlinal arches and synclinal troughs. These folds have been formed by the pressure of the rocky strata; an anticline having its arch upwards, a syncline down-

wards. Anticlinal arches, are therefore the most favorable for the collection and storing of gas and oil filtering upwards through porous strata until checked by the impervious anticlines. Sometimes these anticlines are long ridges several miles in length, and sometimes are dome-shaped. Unfortunately for us, however, the anticlines are often broken across (or "faulted") near their summits, thus allowing the oil to escape, whilst in other cases the erosive action of streams gradually bites through the impervious cap into the porous oil rock below it. While seeking evidence of the existence of anticlinal arches and quaquaversal domes, a sharp outlook must be kept for tar springs and oil-soaked rocks, as oil often occurs in sandstone and limestone sufficiently solid for building purposes.

As mineral waters always accompany the bitumens, mineral springs are, or the geological evidence of former mineral springs, are, to a limited extent, indications of the accumulation of bitumens. In this connection it should be remembered that "marsh gas" or "carburetted hydrogen" or methane is a much better sign than sulphuretted hydrogen. Methane burns with a yellow flame; sulphuretted hydrogen with a blue flame, blackens a silver coin, and is easily recognized by its unpleasant odor.

Probable Origin of Petroleum.

As regards the probable origin of petroleum and bitumens, the most widely accepted theory is that advanced by the late lamented Professor Joseph Le Conte, (Agassiz's most brilliant pupil) and Mr. A. L. Cooper, (formerly State

Mineralogist of California). Their theory is that "they are principally derived from terrestrial and marine vegetation deposited in sedimentary strata, then changed to carbonaceous matter and afterwards distilled by the heat of metamorphism." In plain English the intense heat due to the pressure of the rocky strata of this old earth has manufactured hydrocarbons from the hydrogen and carbon present in large percentages in all plants, and the anticlinal arches of impervious strata have collected these mixtures of gaseous and liquid hydrocarbons and prevented their escape. When we bore through the top of these reservoirs we "strike oil."

Petroleum has very little to do with coal deposits, which were formed by ancient peat mosses and land vegetation, but occurs, for the most part, in strata and periods of strictly marine origin, and with few or no coal beds. Everyone who has peered into the ocean depths, knows the vastness, size, rampant growth, and great abundance of the seaweeds in those "wild ocean moorlands." Whilst terrestrial vegetation formed the coal beds, the unctious, gelatinous seaweeds, after undergoing various geological and chemical changes and distillations, gave us the petroleum, bitumens and asphaltum we find in the rocks. It is therefore of practical importance to the prospector to become acquainted with the geological occurrence and positions of rocks and strata of periods or groups principally of marine origin, and usually characterized by fossil sea shells, gypsum, and occasional beds of limestone and calcareous matter.

VOCAL MUSIC IN OUR PUBLIC SCHOOLS.

Principal Ernest Smith, King's School, Westmount, P.Q.

A great many people say, and perhaps many more think that music is an art to be learnt only by the "born musician," and that, so far as singing is concerned, the number of persons who will never learn; who can under no circumstances be taught to sing from note, is very great.

That it is impossible to teach everyone in the same length of time, or to obtain the same degree of accuracy from every member of a class in either instrumental, vocal or theoretical music is so apparent as to need no discussion, but that there is anyone utterly destitute of the power to learn some music is difficult to prove. "Music is the effect produced by the union of sound and time," hence it is possible to produce music from such an instrument as a telegraph key, or a typewriter. The former apparatus would be useless were it not for the combination of long and short sounds, in other words take the "music" out of the instrument and you at once destroy its usefulness. There are hundreds of boys who "cannot sing," yet who by very slight practice become fair operators.

Watch the physical exercises of a class of boys or girls who are not inspired by an instrumental accompaniment, and then take the same class (all of whom have declared that they cannot sing), into a room where they are accompanied by some instrument—a kettle-drum, a piano, an orchestra, if you

will, I care not what, and you will at once see evidences of life and interest where before there was apathy and listlessness.

The music has given a language to the calisthenics which has filled the class with animation. Let us watch a group of mere babies in the summer time. An old man with an older barrel-organ is grinding out some dance music, and the little tots immediately pair off and "dance," baby fashion, of course, but in perfect time with the organ. If the group is one of little boys and the old man grinds out "The Men of Harlech," "The Soldiers of the Queen," or any piece written as a march, the most natural thing for the little fellows to do is to get into line, put sticks over their shoulders and parade in "review order."

There is, then, sufficient ground for the assumption that all children who are sound in mind and body have in them a natural inclination for music in some form or other, and it is necessary only to develop this natural taste in one of the many branches of the science and art of music in order to create a desire to go on in that department.

The great majority of people who "play a little" or "sing a little" have never taken up the matter seriously and know very little indeed about music. This is more their misfortune than their fault and is the result in a great measure of cheap lessons from persons who "play upon the piano," but

are in no sense musicians. The in-born musical talent is never developed by such people and the boy or girl struggles along murdering "show pieces" until the time comes when he feels that he ought to take a few "finishing lessons" from an acknowledged master. For these "finishing lessons" he is willing to pay, and having selected his master, he practices up his last "piece" and finally presents himself at the studio to play it over before his new teacher.

What disappointment awaits him! He is told that he has not learned the art of "fingering"; that his execution is clumsy; that he does not know how to play this piece at all. The real fact of the case is this, he has been attempting to run before he could creep, and must now come back to the first stage and be content for some time to creep very slowly. This only disgusts him, and in the long run he who would have been by this time a devoted student of music is a wreck and a failure.

I have met many such people. I am constantly meeting young boys and girls who are taking lessons in music, but who are practising in the dark. They have looked at me in blank astonishment when I have asked them what "key" their piece was written in, or why the scale of A major has three sharps. I have frequently received the reply, "My teacher only teaches pieces! The question of musical intervals, the construction of minor and major scales, the common key signatures, etc., are beneath consideration.

But what has all this to do with

school music? These are questions outside school work. Pupils in our public schools do not learn the piano, violin, cornet, etc., as a part of their course in school music!

No! they do not, it is true, but they do pretend to study that branch of music known as vocal music. Every pupil in school who has a voice possesses a musical instrument of the most delicate mechanism; an instrument which no amount of money can purchase. It is the free gift of God himself. How are we as teachers playing upon these delicate instruments? Are we training our pupils to express their sentiment in musical sounds? Are we so teaching that those who make music a special study will be able to develop more thoroughly the voices entrusted to them? I am afraid that in many cases vocal music as taught in our public schools to-day is worse than a farce.

Surely there is some aim and object in teaching singing, beyond an annual "show," or an occasional soiree. There is no subject which can be made to raise the moral tone of an institution more than the study of music—and of vocal music in particular—because the voice is a Divine gift.

But we must from the first treat music as a language. We must ourselves be able to interpret it for our pupils; though in many cases, in a dance, a march, a waltz, etc., they will be quite able to do this for themselves.

The matter to be considered next is the kind of music to be taught in our public schools. Here a great difficulty presents it-

self. Are we to select a book of "school songs" or a collection of "patriotic airs" and accept them as suitable pieces for our pupils because we work in a school and are patriotic? or, because "everybody" is singing "There'll be a Hot Time in the Old Town Tonight" or "Hello Ma Baby," are we to drown our boys and girls in every "rag time" bath we meet?

Though it is quite true that music it is not necessarily "classical" to be good, it is equally true that it need not be rubbish in order to be popular.

The tendency of the age is, unfortunately on the side of catchy slang in music, in literature and in daily conversation, and those of us who would cultivate in our pupils a love for music that will benefit them in after years must never for one moment allow trash to defile their ears. There are many homes into which the dime novel has never gained admission, yet whose music racks groan under the weight of that dearest of all trash called "cheap music."

There are many "comic" songs set to music that does not demoralize, but the character of the words will generally indicate the moral tone of the music to which the words are set.

We should never lose sight of the fact that the singing lesson is a means to an end and that the end is an appreciation of what is high and noble and moral. We cannot of course get the boys and girls of our schools to fully appreciate Bach or Mendelssohn or Chopin, or to enjoy the oddities of Gluck. But because they cannot read Shakespeare, Carlyle, Ruskin and Milton with a

lish, are we to prevent them from reading "The Pilgrim's Progress" and Robinson Crusoe?

Compare Barnby's "Sweet and Low," with "Hello, Ma Baby," or "God Bless Our Broad Dominion" with "When Johnny Canuck Comes Home"! It is just as easy to teach one song as the other, but the results differ.

We can only hope to put in a part of the foundation of an education in vocal music during the short time at our disposal. We have no time, therefore, to waste in teaching musical slang. Short as the time is, however, it is long enough for some idea of singing at sight to be gained by the time a pupil enters the sixth year.

The first three years' work in the singing class will be for the most part mechanical, the intervals of the major diatonic scale in all their positions forming the bulk of the work. These are to sight singing what the multiplication tables are to arithmetic, and must be mastered at the beginning. But the monotony of "scale exercise" can be relieved by an interesting story of some event in the life of one or other of the great masters, and important bits of musical history can thus be unconsciously learnt.

Some teachers have complained that they cannot teach "part-singing" to young children. To this objection I have only to say that if a teacher can teach a class to sing the melody or a simple round, he can teach half the class to do the same, and he can divide each half-class into quarters and teach each quarter-class to sing the melody perfectly. When they all know it thoroughly he can ask them to play the game of "Mind

your own business" in song. The melody will be sung as a four-part round, and the first difficulty of "part-singing" will have been solved. In addition to this the pupils will have been interested, and amused in finding how hard it is to "mind your own business." And so I would go on, from the round to the part song, gradually but surely. It can be done, but like everything else, music requires an enthusiastic, competent teacher, all the time. I cannot close this article without referring to the "method", or "system" of teaching children to sing. There are two chief systems:—the "fixed doh, and the movable doh system. The first regards the scale of C major as the normal scale, and gives to its intervals the names doh, re, mi, fah, soh, lah, te. These intervals bear the same names at all times, e.g.:—A is always lah, B is always te, E is always mi, etc., regardless of the key in which the music is written.

The "movable doh" system has one pattern, the scale of C major. Of this pattern, it is necessary to have a perfect mental conception in order to reproduce it without the aid of an instrument. The impression produced upon the mind by singing any major diatonic scale will be the same, whether one begins at the sound of C or E or A, the difference is in the pitch of the voice, not in the impression upon the mind. The intervals or steps are the same in each case.

This can be illustrated by listening to "God Save the King" played on an instrument, in the key of F Major, and afterwards on the same instrument in the key of A Major. The mental impression

is the same but the pitch is different. I would prefer the "movable doh" system, because when one major diatonic scale has been mastered, it can be applied to any piece of music. Again:—

As there are two "systems" of vocal music, so there are two chief notations. The "staff" and the "tonic sol-fa." Many people look upon the "movable doh" and the "tonic-sol-fa" system as one. This is a mistake. The first was old before the second was born.

The "tonic-sol-fa" system is a method of writing letters which represent sound, in such a way as to combine sound and time without the aid of the five lines. It has this to recommend it, that while it is apparently quite simple to those who have learnt it, it is Chinese to the musician who, though he can delight an audience as a vocalist, or as an instrumentalist is unable to read the "Old Hundredth," written in the "tonic-sol-fa" notation, simply because he did not learn that system.

How many of our pupils ever look at a "tonic-sol-fa" book after they leave school, unless they belong to a "sol-fa" choir?

Could one in fifty recognize at sight, either the "Old Hundredth" or "God Save the King," written, say in the key of C Major, and B Major, respectively? I am afraid the number would not be much greater than one. If this be so, the main object of "tonic-sol-fa" music has been missed, viz., to teach its students to sing at sight.

In a future paper I propose comparing the staff notation with the "tonic-sol-fa" system, using of course, the "movable doh" in the case of the former.

RELIGIOUS INSTRUCTION IN OUR SCHOOLS.*

The subject of the religious education given in our schools has been discussed during the last few months in the periodical literature of our society, and in a sitting of the yearly meeting. In the face of this concern, it seems right that the professional opinion in the society should make its voice heard; for unquestionably the teachers have this subject at least as much at heart as anyone, and to them belongs the practical solution of the problem in the very life and work of the schools.

As to its supreme importance there cannot be two opinions. In an age when we are realizing more and more clearly that the aim of education is the formation of a strong, sensitive, and balanced character—the attainment of a developed and complete life—it would be strange indeed if religion should fall into a subordinate place.

But this very view of education—a view that is broad and deep and practical—will have important effects upon the teacher, which may cause him to part company with his critics on some points: and these we think it desirable to indicate. It will lead him, for instance, to regard the acquisition of learning as an instrument, and not an end; again, he will hold throughout a strong belief in the unity of the human consciousness and as a consequence, the unity of education.

The teacher's subjects are not mathematics, nor latin, nor scripture, nor quakerism—they are

boys and girls. The information imparted is, in a sense, a minor matter: the growth of the mind that assimilates it is all-important—growth in keenness, efficiency and power. Now it is clear that this growth of power is itself a vital part of the religious education of the school; it is also clear that the degree to which this is attained, and still more the direction which it takes, will be the outcome of the whole tone and spirit of the place. A deficiency will not be met by adding on an extra hour in church history. It is a question of the type of life embodied in the school community, and it is mainly by the greatness or meanness of this type that the religious education of the school should be judged.

With this proviso we would hasten to add that we have no thought of under-estimating the importance of what we may call religious instruction. It is round this that the discussion has largely centred, and it is with this that we wish chiefly to deal.

We may take it for granted that, alike in the society at large and among the teachers in our schools—and it is to both that we wish to address ourselves—there is some dissatisfaction with the present state of things, and a unanimous desire for improvement and progress. There follows, therefore, the question of the direction in which we are to move, and on this head there are several points on which it is necessary for profes-

*A letter, issued by the Executive of the Friends' Guild of Teachers.

sional opinion to express itself clearly and emphatically.

The writer of a striking article in the pages of "Present Day Papers" urges: "They (the schools) generally fail to supply the definite religious teaching of the character that is needed." This charge he repeats again and again, and the supply of such "definite religious teaching" is put forward as an urgent need in the interests of quakerism.

Now, with the spirit of the writer's words, calling as they do for quickened progress and greater excellence, we are in cordial agreement, and with his broad reference to the years before and after school life, as well as to that period itself; and we are in especial sympathy with him when he goes on to urge the primary and pressing need of qualified teachers.

But nevertheless we think his words are liable to be seriously misunderstood, and to be likely to lead to results which many of us would deplore.

What is meant by "more definite religious teaching"? It is just here that we need to step with caution. Those within the profession have again and again, it would seem, to remind their lay brethren that if they wish to enter into the mind of the child they must put themselves back through a long course of growth—by no means a simple or obvious task: and this difference of capacity is of the greatest import in the present connection. Let us bear in mind and insist in season and out of season, that general ideas and statements, phrases and dogmas, based upon data of ex-

perience which the child has never had, are to him a mere nothing; nay, they are worse than nothing—if fed upon them he will become an intellectual and spiritual sham, incapable of clear and honest thinking. Let us remember always, that unless interest is aroused the mind of the young child does not and cannot work; that what the boy does not intelligently attend to cannot by any possibility be educating him. To impart what is merely verbal knowledge is an educational crime.

The elements of all spiritual experience are possible to the child, and to develop these is the essence of religious teaching; but there are many religious expressions which are in reality abstract and theological, and these he may easily come to use without any realization of their meaning. Such conceptions are not to be prematurely thrust upon him; they can only be of value if personally reached by personal experience and inference. It is the teacher's task to lead from experience to judgment and reflection; but it is his bounden duty to shun like poison the inculcating of reflections where the data are unknown or cannot be appreciated.

If there is a desire then to press dogmatic teaching upon us—anything of the nature of abstract theology or portions of church history whose interest lies almost exclusively in the same direction—let us hold fast to these root principles of education.

The thought is before us that many leave school with but a superficial entrance into quakerism, and little enthusiasm for its ideals. But it is possible that quaker occ-

trine may become distasteful just because it is doctrine. Surely it is better that this "spiritual view of life" should be taught both in secular and scripture history, in the consideration of national life, and individual biography, and taught as the natural point of view, as indeed we believe it is. We need have no fear of losing our members through lack of "definite" doctrinal teaching at school. It is not doctrine that either attracts or holds the ordinary man to a section of the church. Where our people feel that they get the spiritual food which they need for the activities of life (a different type of food at different stages) there they will stay.

This leads us naturally to another side of the question: to what extent and in what fashion is it our duty to manufacture "Friends?" It has been urged that we ought to equip our boys and girls with ideas which shall last them for life. The practice of the Jesuits has been held up, not exactly as an example, perhaps, but certainly as an object lesson.

Now as educators we must look at this with caution. If it is meant that by moral atmosphere of the school, by the spirit in which great questions are treated, by the standing influence of example, and by the uplifting of a pure and simple ideal, the quaker attitude towards life may find a place in the children's minds; or if it is suggested that quakerism past and present can be made of practical interest and value to some of them,—then we are in hearty accord.

But it is most important that we should resist anything which could

by any chance hamper the free action of intelligence and judgment. Alike upon those who advise a course fraught with this danger, and upon those who would hinder the free and modern treatment of the scriptures, we would urge very seriously that the fostering of a spirit of free and careful and reverent inquiry is not the function of "secular" teaching alone, but that in biblical work too, and in all religious instruction, it is of the utmost importance. It is one of the first principles of education that it is our duty to arouse the spirit of investigation, and if we fail to do this in these biblical matters we shall be false to a plain requirement, and our teaching will be unreal and inadequate and unfruitful, just as it would be in any other subject unintelligently taught.

It would seem to us then that progress will come, not in an increase of quality, but in greater attention to educational quality, looked at from a wise and practical standpoint. We must treat our subject in such a way as to invest it with importance and with interest. We must bring to it the best intelligence and make it the instrument of the best training that we can supply. Does anyone sufficiently realize the vast importance of the attitude of the teacher, whether as to his intellectual interests or his spiritual vision? Carlyle says that soul is kindled by soul, and that to teach religion the one thing needful is to find a man who has religion: and this is a profound truth. And it is here that we should grasp the serious consequences of any step which would

prevent the teacher from dealing with his subject in the way he thinks nearest the truth in the light of modern knowledge. By so doing the door will be shut upon a wealth of positive truth and influence. When freedom is gone, there comes a touch of paralysis upon the teacher's work and the loss cannot be measured.

In "A Memory of Edward Thring," J. H. Skrine says: "Often I have thought that of more value to us than the positive knowledge imparted was the emotional emphasis with which he invested what we had not yet grasped as knowledge. The emotion was stored in the mind as a blank form, a vacant mould to be fitted later with the matter for thought. . . . Unconsciously he was following the true order of the higher teaching, making the passion for truth prepare the way for its possession."

We know well that the greatest of all religious influences are silent and secret; they may work in ways we know not of, and in hearts where we should least expect it: but we may well see to it that those who tend these influences and help them where they can, may be fitted and zealous for the work.

In conclusion, therefore, we would urge the members of our profession to realise the greatness of their duty, to hold fast to a belief in these silent influences of school life, and to yield no jot of educational principle for any seeming advantage that may be desired. We would ask them also to seek strenuously after the free development of their boys and girls

to feel a liberty of treatment in religious matters which shall enable each to give out the best that is in him, and to strive to make their teaching vigorous, enlightened and thought producing. Surely a wealth of problems lie to hand in the Old and New Testaments, and in the religious activities of history or the present day, to which boys and girls may well be introduced.

To the society at large we would put forward the view that the principles urged above are deserving of careful consideration in making any forward move. The quality of the teaching given in our schools is in measure in the hands of friends; they have raised admirable buildings in many places—these are a small matter compared with the character of the staff. The freedom of the teacher, which is an indispensable condition of excellence, is a gift they can grant or withhold. And that we who are responsible for the term of school life may have the best chance and the best reward, we would press upon friends the need of laying foundations and awakening interest in the days of childhood, and of turning to best account the powers of those who go forth from our schools.

Finally, in spite of the criticisms we have felt it right to offer, we would express our gratitude to those who have roused the mind of the church to the importance of this question, and our hope that, as a consequence, new power may come into our schools, and into all the life of the society.

PROFESSIONAL READING FOR TEACHERS.

By Hon. Channing Folsom.

"Reading maketh a full man; conference, a ready man; and writing an exact man."

The reading of teachers may readily be classified under three heads:

1. Reading for recreation and general culture.

2. Reading relative to the subject-matter of the several branches to be taught.

3. Pedagogical reading.

No one of these three lines can properly be held up to a body of teachers as the most important; no one of them should be recommended to the exclusion of others.

1. It would seem to need no argument that teachers, above every other class, should be men and women of culture.

Having charge of the intellectual training of the rising generation at the most impressionable period, it seems self-evident that the teachers of our public schools should be persons of such literary taste as will have a lasting influence for good upon the minds and characters of their pupils.

But reading must be practised as much for the teacher's self as for its influence upon the school. The good teacher is always a growing teacher, and intimacy with the makers of the world's literature is essential to the broadening of the teacher's intellectual horizon. Many of the most cultivated people of every community have become such from their reading

habits; this is true as applied to teachers as well as to those of other ranks. Not only does the reading habit supplement a liberal education; it goes far to supply the lack of educational advantages. But it must be remembered that a taste for good reading is not usually an inborn but an acquired one. Having been once acquired it increases with indulgence.

One writer says: "No man having once tasted good food or good wine, or even good tobacco, ever turns voluntarily to an inferior article." In general, this is true as applied to a choice of reading.

Every teacher should aim to acquire a taste for the best literature that mental growth may be constant, and that culture and power be ever increasing.

The private library of the teacher should receive some accession every year. The public library is invaluable, but it cannot take the place of your own collection, however small it may be, of the books you love.

This general or miscellaneous reading for which I plead may follow the taste and inclination of the individual. Most of us find a satisfaction in following some particular line of study. But whatever be the preference—science, history, politics—do something systematically. In this course you will find pleasure, recreation and growth.

2. I have indicated as the second line of reading necessary for the improvement of teachers, the reading of works relative to the subject-matter taught.

Too often teachers are satisfied with the meagre knowledge of a particular branch of study that may be gained from the use of the text-book. This is especially noticeable in such branches as history and geography.

The teacher who entertains precisely the same view of almost any topic, and of the best presentation of it, that he held five years ago, probably falls short of being a first-class teacher. If his scope has not been broadened by collateral reading; if his views have not been modified by new light gained from acquaintance with additional authorities; if he continues year after year asking the same questions and content with the same answers; he is probably more machine than teacher.

"Reading maketh a full man." And the teacher, above all others, must be "full." To teach any subject well, he must know vastly more of that subject than he expects or even desires to teach. Not only is this knowledge necessary to insure successful, enthusiastic teaching, but it must be an ever-increasing knowledge. Thorough knowledge of a subject on the part of a teacher is the first requisite for a proper presentation of it to the pupil.

This line of reading, then, is inferior to no other as an influence for improvement in teaching. If my position is correct, that a taste for good reading, is an acquired

one, it follows that teachers should have such knowledge of books as will enable them to inspire their pupils with a desire to read the good, and to guide them in their selection. You may destroy the "dime novel" of which you have dispossessed its stealthy reader, but unless you substitute something better, and train him to a liking for it, your lecture on cheap literature will be wasted. Now that our public libraries are working in close sympathy with the school, it behooves every teacher to know books.

Enlarged privileges to the pupils in the use of the library bring enlarged duties to the teacher in directing that use. A good reading habit is invaluable to every pupil, and the acquisition of this habit, with the large majority of pupils, is dependent upon their training in the public schools.

"The extent to which pupils are interested in the books from the library will be measured by the extent to which you help them to understand and appreciate them." And the extent to which you help them must of necessity be measured by your own understanding and appreciation.

I have sometimes been misunderstood by teachers in the application of my advice as to a course of reading calculated to enlarge the knowledge of some of the branches found in the school curriculum. For a teacher of United States history, for example, I would not advise a daily study of the topic under consideration by the class, merely. But rather a course of reading in history which would

tend to fill the teacher's mind with the historical spirit; and an adherence to this course, even to the extent of limiting the time devoted to the daily lesson as such. A note-book, or better still, a text-book interleaved for notes, will go far towards taking the place of this daily study of the lesson. When a teacher has taught the same subject for a term of years, more improvement will result from increasing the general knowledge of the subject than by confining himself to details. And the maxim so often laid down, "Never conduct a recitation without making a thorough and special preparation for it," may be best honored by a little thought upon method of presentation. And time, otherwise used in mulling over petty details already familiar, may be far better used in reading some reliable, standard book which will help to saturate the teacher with the spirit of the subject.

3. Let us now consider the third division of my subject, viz., the improvement of teachers by reading the literature of pedagogics.

We have heard, and read much for many years, relative to "teaching as a profession." No occupation can properly be dignified as a "profession," entrance to which has no test but the preference of a school board, and the requirements of which are only the satisfaction of the people.

Only a small percentage of our teachers are, or are likely to be, of college education. Only a few, comparatively, have taken a Normal School course, and the proportion is not likely to change

materially for the better until a different public sentiment prevails, and different legal requirements of the would-be teacher have been enacted.

The public school teachers of a state should be leaders of public sentiments respecting this matter; instead, we are quietly acquiescent in legislation affecting our position and standing in the community. To lead public sentiment or to influence it, teachers must first prove their worthiness to be leaders. They must be in touch with educational leaders of the country. They must understand educational principles. They must know somewhat of the history of education. They must be able to distinguish between science and empiricism.

To this end teachers must read pedagogical works. What results have we to expect from such reading?

A professional spirit will result from pedagogical reading. Lawyers, physicians and clergymen read the literature of their respective professions. The member of any of these, professions regarding whom there is a doubt in this respect very soon loses the confidence of the public, and deservedly so.

The worker in wood, the worker in metals, the collector of postage stamps, each has his special periodical which he reads faithfully, and by which he profits. But many a teacher would laugh to scorn a suggestion that his work and his influence might be increased by his subscription to, and his regular reading of an educational journal.

Some plead that they cannot afford it. They cannot afford not to do it.

When teachers are familiar with the best educational literature of the day; when they read regularly some educational journal; when their knowledge of educational matters stamps them as experts in their business; then indeed may we expect them to be leaders of public opinion in all matters educational, then will every teacher be a nucleus around which will gather a local sentiment which will raise the teachers to the position of trusted public officials.

This line of reading will keep the teacher in touch with different theories of education; with the claims of the advocates of new branches of study, or of old branches in new places, will keep him informed as regards the rights and duties of teachers, as limited or defined by new laws or recent decisions; and in many such ways will advance him toward the position of a member of a "profession."

Again, it will make better teachers. The untrained and unexperienced find this the only path open to them for the study of the art of teaching and the science of education.

What shall such a teacher read? That in which she is interested; that which she understands and appreciates. Descriptions of class exercises, illustrations of methods, devices, matters that appear practical, will naturally appeal to such. But she must remember that a good teacher is more than a copyist of another. What is read must

be assimilated; the underlying principles understood; and when practised in the class room, adapted to conditions and circumstances.

That reading will prove of value which makes the teacher a thinker rather than an imitator. That reading which makes of the reader simply a copyist of devices without any study of the philosophy of the devices is not desirable. That many teachers get nothing more from pedagogical reading does not argue against the reading. The young teacher who reads thoughtfully and understandingly what seems to be most helpful will thereby advance to an appreciation of a higher grade of "professional" reading.

Reading begets reading.

The trained, the educated, the experienced, the successful teacher needs this kind of reading equally with those of less advantages, and to such it is no less valuable.

"Everybody knows more than anybody." The person who thinks that all knowledge will die with him is an uncomfortable person to do business with. And the teacher who has nothing more to learn is past his best days. Only the growing learning teacher should have a place in the ranks.

There are no past masters of education. There is none so wise or so successful that he can afford to say that he has no use for the opinions of others. Moreover, no matter how thoroughly one has studied the principles and science of education he needs to keep them fresh in mind by occasional re-reading.

To be a reader in educational matters, the teacher must be familiar with the current changes in the educational world.

This kind of reading will inspire and maintain enthusiasm for the vocation of teaching. It is by reason of loss of enthusiasm that old teachers fall to the rear of the procession, having been outstripped by the younger generation. As long as the physical and mental powers remain unimpaired, a teacher should not become a "back number."

It is not years that name a teacher old, but rather the dallying of sympathy, neglect of the signs of the times, failure to observe progress about him, narrowness, cynicism, and self-satisfaction. Many a teacher, young in years, becomes cynical, looks with scornful pity upon the enthusiasm of the beginner, and dolefully prophesies,—
"She will soon get over that."
"She will learn better by experience."

Pedagogical reading will go far towards preventing this tendency, it will prevent him from becoming a worshipper of his own style of work.

We all know teachers, men and women, who in spite of accumulated years, are as progressive, as ready to learn, as earnest students of methods and principles, as any of their younger brothers and sisters. These, while health and power remain, will never be too old for service.

No one can object to a course of reading of this character on the score of lack of variety or lack of kind and grade desired.

Journals are published weekly, monthly and quarterly, adapted to all teachers, from the kindergarten to the college; from the young girl of limited education to the scholar of rare attainments, and of profound acquirements; from the copyist of device to the student of a philosophy. Publishers are constantly publishing books of equally wide range.

Among the contributors to these journals and the authors of the books, are numbered some of the brightest intellects of the age—successful, practical teachers, who have worked their way to eminence without the advantages of previous training; normal school graduates and principals; presidents and professors of colleges, themselves college trained.

Some teachers tell us that much of the pedagogical writing of the day is beyond their understanding and appreciation. I confess to a feeling of sympathy with them. But the fact that some of the educational philosophers are beyond our comprehension, need not prejudice us against such reading as we do not understand, nor deprive us of that which interests us. And perhaps we may find the very discipline that we need, in a grapple with the theories that seem beyond our comprehension.

It is urged by some that they have not time for such a course of reading; a large part of the time devoted to mere drudgery,—to the marking of examination papers and the correcting of slate work, occupying in the case of many teachers every spare hour of sunlight and often extending far into the night, might be more usefully

employed in improving the mind by reading. In my judgment, better teaching would result. Pupils would be better taught by thinking, well-informed, cultivated men, and women, than by marking machines.

I close with the words of another, a superintendent in another state:

"I never write a recommendation for any teacher who has not been a subscriber for a good educational journal before she asks for my recommendation. She owes it to herself to keep in sympathy with

the progressive members of the profession, as she cannot without reading regularly the best thought which only finds timely expression in the best journals. She owes it to her school, which she cannot teach to the best advantage without knowing promptly all the best methods which find earliest expression in those journals. She owes it to the profession to take and pay for a journal and have it all her own, instead of stealing, begging, or borrowing it from some one who does pay for it."—*Educational Record.*

THE TEACHING OF PHYSICAL GEOGRAPHY.

By W. M. Davis, Professor of Physical Geography in Harvard University.

A report made two years ago by a Committee on Physical Geography to the Natural Science Department of the National Education Association offers many texts on which to write articles of a practical nature. In the following discussion high-school teacher of physical geography may perhaps find helpful suggestions.

It may be strongly urged that physical geography should be defined as "the physical environment of man," using the words adopted in the report of the famous Committee of Ten, some years ago, and quoted by the committee above named. Thus limited, physical geography would treat all those features of the earth which determine man's way of living—mountains that repel him, valleys that attract, continents that col-

lect races, and seas that divide them—while it would exclude certain interesting, but irrelevant topics, such as purely astronomical matters, the classification of plants and animals, and tables of the geological periods.

Physical geography can never be developed to full strength until it attends strictly to its own business. The subject becomes thinner if it is allowed to spread over too much ground; it gains disciplinary and educational strength when it is held more closely within reasonable bounds. Even when most carefully restrained, its several parts lead inevitably to a liberal consideration of other subjects. Under the earth as a globe a good understanding of some important geometrical and astronomical prin-

ciples may be imparted, particularly if observational methods are used. Under the atmosphere and the ocean abundant reference to physics may be made. Under the lands, those actual processes of change which are the common property of the present and the past, of the earth as it is and as it has been, of geography and of geology, cannot to-day be omitted by any teacher who is imbued with the new life of the subject. Under all these headings constant reference must be made to the living things, and many an interesting item of a biological nature will thus be encountered; these references must not, however, be made with the object of teaching systematic structure and classification of plants and animals, but with the object of showing how habits of life and way of doing things submit to or take advantage of physical surroundings. It is a great mistake to set apart all these organic problems in a final chapter. They may be summarized there, if desired, but they should be introduced all through the study from beginning to end. As has been well said of geometry, the object is not to learn a proof, but to learn to prove. So here the object is not merely to learn the physiographic features that control organic life, but to learn that physiographic features control life.

Inorganic facts that have organic consequences are thus seen to constitute the main stock of physical geography. While I would not advocate too arbitrary an adherence to this principle, it is, nevertheless, a guide of great practical importance in selecting facts to be

taught—a guide that will aid the teacher in interesting his class and in impressing his lessons upon them. It is closely correlated with another guide of equal importance, relating to the manner of treatment of the facts thus selected. The treatment of all parts of the subject should be explanatory and rational. It is rather curious to note that, while such treatment has long been allowed to certain parts of the subject, such as winds and currents, it has until recently been denied to many other parts, particularly those which may be grouped under such a heading as "The forms of the lands." A different method of treatment for different chapters of the subject is indefensible. There was a time, to be sure, up to a score of years, or perhaps half a century ago, when land forms were not well enough understood to be brought within elementary explanation; but that time is now past, and its methods ought not to dominate the teaching of to-day. The subject should be rationally treated throughout.

The selection and treatment of topics, as here advocated, may be tested by the simple touchstone, "causes and consequences." We may follow the dictum of Guyot. "To describe, without rising to the causes, or descending to the consequences, is no more science than merely and simply to relate a fact of which one has been a witness."

One of the best guarantees for the rational treatment of wisely selected topics in physical geography is found in the introduction of observational methods as an essential part of a good high-

school course. The need of practical exercises, in addition to the intelligent study of a text, is to-day so generally admitted that it hardly need be urged on the acceptance of teachers. The introduction of observational exercises no longer turns on their value or their desirability, but on the various practical difficulties that stand in their way. For example, a well-ordered series of exercises must include a good variety of indoor tasks, conducted in an appropriately furnished laboratory with well-selected materials; but we have yet to learn of an entirely satisfactory series of exercises of this kind. Many teachers are working earnestly to devise such a series, many useful exercises have been planned, much good work is being accomplished, and the outlook is in every way encouraging; but there is not as yet any generally accepted "standard list" of fifty or sixty exercises, from which a teacher may select a well-distributed series of thirty or forty for a year's work. Progress in the next few years will turn largely on the detailed specification of this kind of work and on the preparation of laboratory manuals and of sets of ready-made materials for laboratory equipment. This problem is too large to be dealt with here; my remaining space must be devoted to the allied problem of field excursions.

As with practical exercises indoor, field work is now generally approved as a desirable element in teaching; but there are many difficulties in the way of introducing it. It is felt by some teachers that field excursions are out of their

reach. Distance, transportation, time, discipline, and expense make a formidable array of obstacles in the way; yet it is a fact that systematic field work is now a successful and valued part of the course in physical geography in a number of schools, and I believe that a way will be found by which such work will be much more generally introduced ten or twenty years hence than it is now. A difficulty not mentioned in the above list is the diffidence that many teachers confess about leading a class outdoors because of their own want of familiarity with the observational study of nature. But this is the sort of difficulty that attends all changes from old to new methods and that will be overcome in good time. Teachers who are experienced in other lines of their work must be aided to acquire experience in this portion of their duties as well. New teachers of physical geography should be required to show a reasonable proficiency in field observation. Superintendents and masters can bring about field teaching if they set about it, but it should be brought about gradually and gently, with the aid of an encouraging sympathy, not of a disheartening condemnation.

Field work with high-school classes is usually limited to autumn and spring. In the autumn, outdoor observation is best directed to the study of those various activities of the lands by which its surface forms are slowly developed. The weathering of rocks and the washing of rock waste are the most important matters. In order to teach them well, a series of definite field exercises should be plan-

ned, so as to hold the class close to the work in hand when the special locality for study is reached. All sorts of other questions may be asked and answered on the way to and from the special locality, so long as they do not interfere with the prime objects of the excursion. A ledge of bare rock serves as a good beginning. Its surface is more or less decayed and loosened in contrast to the firmer and less-altered interior, as shown on a fresh broken surface. The difference between the two is explained by the action of the weather on the outer surface. Fragments weathered from the ledge are often found at its foot or on the slope beneath it: they are slowly moved down hill by frost, rain, and snow. From this simple beginning the teacher may lead up to a series of inferences. If processes like those of to-day have been long in operation, the ledge must now be smaller than it used to be; if they continue long into the future, it may be still further worn away. If the rock is of stratified structure, a comparison with the sawed-off end of a board may lead to the belief that the rock mass must once have had a much greater extent than it now has, and hence that a long time has elapsed during its erosion. If it is of coarse crystalline texture, it may be explained that such rocks are formed deep underground, under conditions of temperature and pressure that do not obtain at the surface; and hence that their appearance at the surface to-day implies the removal of the great mass, perhaps thousands of feet thick by which they are covered. A

knowledge of geology is no more necessary here than is a knowledge of astronomy when some elementary explanation is given of the distance to the sun. If the teacher is well persuaded of the verity of these simple facts, so that all her explanations are natural and easy, the pupils will not find any difficulty in following her.

Let a stream be next visited. Examine its current, its bed, and its bank. Consider the transporting action of running water and its different behavior with respect to coarse and fine waste. Let the pupils seek to learn where the waste in the stream bed comes from and where it goes to. Illustrate the difference between the direct action of the stream in wearing down its channel and thus deepening its valley, and the action of wasting and washing on valley sides. The waste from the valley sides creeps slowly down hill to the stream; then it is more rapidly washed down the valley along the stream channel. Then lead the pupils to infer something of the changes that are now in progress by the action of the stream, and exercise their imaginations by asking what changes have already taken place in the past and what are yet to come in the future. If the field does not furnish examples by which this sort of thing may be studied, it is still possible to imitate natural processes very effectively with a sprayed stream fed from a hose and turned on a heap of sand and gravel in the school yard. Far from being silly play with mud-puddles, such an illustration may be made highly educative. It has

not yet become a stock experiment in our schools, but there is no good reason why it should not come to be such, and indeed, regarded as indispensable. Various important principles concerning land sculpture may be thus impressed; and if they are well connected with the leading matter of the text they must become very serviceable in explaining it.

Having thus in the autumn laid a simple foundation for further work, a return to field excursions may be made in the spring, with the winter's gain in mind; and then land forms, as a consequence of sculpturing and other processes may be studied. These vary with every school district; some are very elementary, as the hills and valleys of the dissected coastal plain of the southern Atlantic states, or the

Allegheny plateau; others are more advanced, as the old mountains, worn down, uplifted, maturely dissected and glaciated, of Southern New England; but the expert teacher can draw a useful lesson from every field. The variety of land forms open to local observation may be small; but the experience and understanding that are gained in the observational study of only a few forms constitute the necessary beginning of a broader intelligence and a larger experience in later years, when travel enlarges opportunity. Every encouragement and facility should be given to well-planned outdoor work by which a better understanding and appreciation of physical geography are gained.—The Text-book Bulletin. Ginn & Co.

SCHOOL VENTILATION.

By Edith M. M. Bendeley, Montreal and London, Eng

Among the many difficulties which beset the teacher in his career, there are none which call for more tact, firmness and knowledge than the question of ventilation. Everyone who has had the charge of a class-room is familiar with the parental message: "Mother says, 'please don't open the window, because I caught cold yesterday'", or something less polite and to the same effect. Every visitor to an average public school is likewise familiar with the hot, heavy, atmosphere of the class-rooms after an hour or so of occupation and with the consequently anaemic looking

teacher and catarrh suffering children. Many people are not aware of the fact that children vitiate the air of any given space far more quickly than the same number of adults, in an equal area. The reason for this is that all the vital processes in childhood are more rapid than in the adult life. Children breathe quicker, oxidize more, eat more than adults. Provision has to be made for this fact, also for the condition of the children's clothes, which are often far from clean, and consequently apt to be unsavoury.

The wide spread horror of fresh

air is a hard prejudice to overcome. It will yet be some generations before it is generally recognized that close shut houses and consequent lack of pure air is the cause of much needless suffering and of nearly all the consumption in our midst. In England, notwithstanding climatic difficulties the open air treatment is being carried out in many institutions and with such marked success that it has become the only recognized method of dealing with the disease. Here in Canada, with less crowded population, more sunshine, and drier air, we are realizing the urgent need of a hospital for consumptives to check the spread of the disease, which, as far as nature is concerned, need never have been known in the Dominion. It is an undoubted fact, that if the disease is not actually contracted at school, the delicacy of constitution which render it susceptible to infection is begun in many cases in stuffy classrooms. This circumstance is more the fault of the parents than the teachers. It is possible, however, to keep the school ventilated without incurring much trouble with ignorant parents, and every principal and teacher who realizes that health is of far more consequence to the nation than mental accomplishments will see to it that the children under his or her care do not suffer from vitiated air while under the school roof. I propose to deal with this subject in two parts: 1. The Physiology or Theory of Respiration. 2. The Practice of Ventilation as Applied to Schools.

THE PHYSIOLOGY OF RESPIRATION.

It has been proved possible for the human body to exist without food for a few weeks, and for a few days without drink, but no notoriety hunter has yet attempted to win fame by abstaining from air. Five minutes' experiment of that sort would suffice to carry him beyond the possibility of benefiting by his exhibition. Asphyxia and death would be his only reward.

The function of respiration is the most vital and important of all, and the organs which carry it on are wonderfully constituted and protected for their work. The lungs and heart are situated in the thorax, a bony and muscular enclosure with the spine at the back, the sternum or breast bone in front, and the ribs with their double coats of muscle uniting the two. The function of the heart is to distribute the blood, sending it to the lungs for purification and then pumping it into the main channels or arteries for distribution through the system. The lungs consist of the closed, dilated ends (air cells) of myriads of bronchial tubes. In each lung these tubes converge into one large bronchus. These bronchi join, forming the trachea or wind-pipe. This communicates with the exterior through the larynx pharynx and nose. The air cells always contain air and dilate more or less with each respiration. Their walls are extremely thin, and on the other side is a close network of capillaries. The blood which comes to the lungs after having circulated through the body, is dark in color (venous) and laden with much carbonic acid gas. If

the air inspired is pure it contains much oxygen. By the process of gaseous diffusion an interchange takes place through the thin walls of the air cells and capillaries. The blood gives up carbonic acid and takes up all the oxygen possible, returning to the heart to be again sent on its travels through the system. Besides carbonic acid a considerable amount of water and some organic particles pass off in the breath. One man at rest, will give off about 1,200 cub. in. of carbonic acid in one hour. Air which has been breathed until it has gained more than .05 per cent. of carbonic acid is dangerous, not only on account of the presence of this gas but on account of the poisonous organic matter which has been given off. In one hour a man by quiet respiration will vitiate 3,000 cub. ft. of air to this extent and a child the same or more. Thus the air in a room 18x12x10 should be changed every hour if occupied by one person. How much more it dwelt in by several! Air does not become obviously stuffy till it has far passed this limit of purity. If we smell the air it is bad indeed. To keep the air of any room at the maximum of impurity compatible with health it is necessary to allow 3,000 cub. ft. per head per hour. The best method for maintaining this standard will be dealt with in the next article. Let us now consider how the work of the lungs affects the constitution. They have a double function, for besides purifying and renewing the blood by effecting the interchange of gases mentioned before, they are also excretory organs, getting rid

of waste matter both in gaseous and solid form. Upon the quality of the blood depends the health of every organ, nerve and muscle in the body. At all times, but especially during exercise of body or mind, oxidization is going on rapidly. Tissues are breaking down and giving to the blood their waste products and being built up again with the oxygen. The same interchange of gases goes on in the tissues as in the lungs. Carbonic acid is given up to the blood and oxygen absorbed. If the blood is sent through the body well laden with oxygen the process of renewal keeps pace with the process of decay or breaking up of tissue. Health is maintained and the happy possessor of a body so nourished (other things such as food and exercise being equal.) stands a good chance of length of life and good days. If, on the other hand, the air taken into the lungs is deficient in oxygen, tainted with the waste products of its own or other systems the whole body suffers. We may, and often do, eat our proverbial peck of dirt without obvious consequences and it is a forlorn fact that external dirt while it injures, takes a very long time to kill, but the consequences of breathing dirty air, are sure and deadly. There are too many ills accruing therefrom to mention in a short article, but the general consequence is a weakening of the whole system, which renders it susceptible to infection of every sort, and the development of any latent disease or weakness, inherent in the constitution. Head-ache, dulness, chronic catarrh and anaemia are among the lesser

evils. Consumption and death are the usual end of a body in which the accumulation of waste organic matter and poisonous gases have been allowed free course. Poor and vitiated blood deficient in oxygen makes degenerate tissues. Death ensues after its unhappy victim has become a centre of infection to all around.

The sentimental poesy of a past generation created a halo of romance around the dying consumptive. Modern science and common sense see nothing lovely in decay; nothing holy in needless suffering and death. The physiology of our bodies is a romance of surpassing wonder and beauty, but the conditions of many lives make it rather a horrible tragedy. ;

It takes a long or short career of crime against Nature's laws to kill, according to the hereditary constitution and the manner of life led.

Dwellers and workers indoors, suffer most; children who might have lived die by hundreds, not only of consumption but as often as not owing to chills and all their attendant consequences. Here we come to that staple argument against free ventilation. The very young, the old, and the weakly catch cold on the slightest change of temperature. Why is this? It is simply a question of balance and of the adaptability of the body to meet and resist the attack of external forces. Contact with cold air causes a sudden contraction of the pores of the skin, and until normal action is restored by exercise their function is partially in abeyance. During the hours spent indoors, breathing

more or less vitiated air, the lungs, skin and kidneys have been taxed to their utmost to get rid of the waste matter generated in the system. When the skin ceases partially to do its share of the work, it devolves on the lungs and kidneys and they are unable to cope with it. The phenomena called a chill or cold is the result.

A low temperature in itself is not the cause of illness; it is due to imperfect resistance through debility, local or general. Dr. Newsholme says that the tendency to catarrhs is greatly increased by living in a vitiated atmosphere. A "cold" most commonly results on leaving a tainted atmosphere, which has disordered the nervous system and rendered its control over the circulation in the skin and internal organs incomplete. This was abundantly proved during the Crimean War. When the soldiers lived in tents in the severest weathers, colds were unknown, but when some of the men were put in tents in which the air was warmer and less often renewed, the sick rate increased and catarrh became common. The lungs and kidneys usually suffer chiefly. Pains in the limbs point to the accumulation in the muscles of poisonous acids and the delicate mucous membrane of the bronchial and nasal passages become inflamed and discharge the watery mucus which is the common sign of an ordinary cold. Worse complications often follow. Dr. Abernethy was once talking to a friend whom he noticed seemed unwell. "What is the matter?" said the doctor. "Oh, nothing," his friend replied. "just a cold, that's all." "A cold," growled the

irate physician, "would you have the plague?" Such was the dictum of the most famous physician of his generation upon the significance of a cold.

In our schools we have many children who come from homes where the laws of health are little known and less practiced, we have to be careful to not to imperil the lives of these little ones by adopting measures of ventilation which are too drastic for debilitated constitutions to bear. At the same time we must remember that vitiated air, while slower in its effects

is more fatal in the long run than cold fresh air, *per se*. When we have got the children safe in the hospital we can wash and ventilate as much as we like, but we wish to avoid sending any child there as a consequence of school life. In the next article, therefore, we will discuss the various methods of ventilation now in vogue and see how best the air of every school-room can be kept within the limit of purity. science has laid down as needful for the maintenance of health.

THE REACTION OF HAND WORK ON THE MIND.

Let us limit our question from the start to the direct contribution of a motor act to intellect and character, leaving one side the possible indirect influence due to the acquisition of technical skill, the preparation for a trade or profession, the relief from the harm that might result from idleness, etc. What we are talking about will become clear enough as we progress.

When a boy drives a nail or bends a bit of iron to a right angle, he has certain feeling for the situation involved, of the position of his hands, the nature of the material he is working on, of the tool he is working with; as he works, new sensations come from the tools, and material, and from his own movements. As a medical student learns about the body he is dissecting, by dissecting it, so the hand worker learns about the stuff he works on. He acquires knowledge in psychology the same way as the observer of ani-

mals or the experimenter in a chemical laboratory. The difference is in the kind of knowledge, his being about certain material substances, tools, and movements of his own body. There is, however, another possible difference. The student of chemistry or biology may, the student of history or literature often does, satisfy his teachers with only vague, verbal, moribund acquaintance with the facts in question, while the hand worker cannot satisfy his teacher unless he has acquired real, living feelings of things which are operative in directing his movements aright. He is more likely to gain real knowledge.

On the other hand, the knowledge gained by hand work is likely to be too narrow and trivial. The hardness of woods or metals, the capacities of tools, the feelings of one's fingers in drawing—these are not the sort of facts whose possession gives insight into men and things. Their value is not for

general intercourse, but for certain special dealings with one small part of nature.

But our boy drawing the straight line may acquire, besides this direct information about material, tools and his own movements and secondary ideas about his procedure. He may get a notion of accuracy, of the possibility of doing a thing precisely, or of thoroughness, of doing everything that should be done in a certain task. He may learn that to do a thing well you have to be patient and cautious and attentive and to know beforehand what you are trying to do. Of course, there is a chance to learn all such lessons in connection with a page of the spelling book or an example in arithmetic or a game of marbles. But it is easy to avoid all or some of them in most studies, whereas the teachers of hand work tell us that it is hard to do one of their tasks satisfactorily without learning them. It would, at least, seem harder than the other studies.

The mistake must not be made, however, of supposing that there is any necessity or even high probability that these most valuable general ideas will come from acts of manual skill. But there is an opportunity for them which teachers of hand work may improve. As to the claim that hand work excels other studies in this particular, there is little evidence. On a priori grounds one would perhaps surmise that for young children it did. On the other hand, one would perhaps surmise that the idea of industry or accuracy or order gained from hand work would be less likely to transfer itself to other fields and be operative in other

connections than would the same idea gained from work in science.

The scholar who takes a course in manual training under wise guidance acquires from the work not only the special information and, possibly, the general ideas so far described, but also a lot of habits, perseverance, orderliness muscular control, etc. There has been a tendency to confuse the habit, say of perseverance, in particular sorts of tasks, which does accrue as a result of hand work, and the habit in general, which neither manual training nor any other school study does much to advance. We do not reform the mental constitution and moral habits of children, by courses in hand work or in anything else, and it is time to stop making believe that we do. The habits acquired do not extend far beyond the particular sorts of circumstances in which they were formed. The same is true of the powers, such as adroitness, executive ability, artistic appreciation, which manual work may develop. They are narrowly confined to the particular sort of data with which the student has worked. Appreciation of design, yes, perhaps, but appreciation of poetry or music, no!

The scholars experience with hand work may further provide him permanent interests of a desirable sort, interests in construction, design, technical skill, the lives and conditions of artisans and manual workers of all sorts.

We have said nothing of any "energizing of the brain centers," "strengthening of the will," or "beneficial reaction of the body on the mind." We have not invoked as the triumph of participation

in manual work any mysterious transformations of personality due to the connected training of body and mind, movements and thought. And for the very good reason that all such talk would be rhetoric, not science. What happens to the person who performs intelligently an act of manual skill is a simple matter summed up in the words harmless occupation, technical skill, knowledge of material, movements and tools, general ideas and ideals, habits, powers, and interests. Nothing more wonderful happens to him than when he speaks or writes or reads or plays. Comprehension of the effects of hand work upon the worker has been hindered by the failure to see that in their general nature and influence movements of the hands in the manual training class work were nowise different from movements of the eyes, throat, muscles and legs, from movements of the hands in writing, or playing the piano, or juggling. The physical and mental processes involved in a piece of hand work are in their general constitution precisely similar to those involved in reading, writing or arithmetic. In all cases there is control of movements by feelings, and acquisition of feeling through the movements. In all, movements occur as expressions of the person's mind and as agents which provide new experiences for it. No generally different sort of result will come from one that doesn't come from another. The differences will be in the particular skill, particular knowledge, particular habits, etc. In the olden time it was fashionable to adore those forms of life where the body was little

in evidence. Now we are zealous to have as obvious bodily expressions as we can. But the bodily expression was and is always present, the mind never worked apart from it. We require no separate and new psychology for manual training.

So much for the reaction upon the mind of the hand work process taken by itself alone. It is, however, generally a process that is engaged in making something which shall express some knowledge or feeling gained elsewhere. The boy does not draw lines or nail nails; he draws a canoe or nails together a house. The act of thus constructing a presentation of some idea or feeling tends to clarify the idea, make it permanent and vigorous, and to show in high lights any obvious inadequacies or errors in it. But we must not forget that children can know things without being able to draw or model them and they can often draw or model them excellently and know little about them. We must not forget that many a pupil can learn far more of an object in an hour spent over other people's drawings than by drawing for an hour himself. Drawing, modelling, etc., as a means of expression of the ideas and feelings acquired in other courses are not panaceas, but specific drugs, to be used only under certain conditions. They are excellent servants but very bad masters.

Let no one think that this entire analysis of ours implies anything in the least derogatory to hand work. If we find that, after all, the process is in line with all of mental life, has no mysterious private

brand of excellencies, it should strengthen our confidence in its fitness as a school subject. Hand work does as much as the other

school subjects for general mental development and needs no eccentric hypotheses or extravagant claims.—Teachers College Record.

NEW YEAR'S MOTTOES.

I asked the New Year for some motto
sweet,
Some rule of life with which to guide my
feet;

I asked and paused. It answered soft
and low:
"God's will to know,"

"Will knowledge then suffice, New Year?"
I cried,

But 'ere the question into silence died
The answer came: "Nay, this remember
too—
"God's will to do."

Once more I asked: "Is there still more to
tell?"

And once again the answer softly fell
"Yes, this one thing, all things above—
"God's will to love."

EDITORIAL NOTES.

Deliver not the tasks of might
To weakness, neither hide the ray
From those, not blind, who wait
for day,
Though sitting girt with doubtful
light

That from Discussion's lips may fall
With Life, that working strongly,
binds—
Set in all lights by many minds,
So close the interests of all.

Education report 1901, with the Statistics of 1900. The Minister of Education gives to the House of Assembly and to the public the usual items of information regarding the education of the Province for the year 1901, and in the same report includes the statistics of the year 1900.

The most noteworthy fact is the continued decrease in the school population of this province. The decrease for the year 1900 is given as 6,245; while in the registered attendance the figure given is 9,130. In reading these numbers we have to remember that we are dealing with the part of the population between the ages of five and twenty-one years, viz.: 580,105.

It seems to us that it would be a decided improvement in the Minister's yearly report if it contained the number of pupils in the province between the ages of seven and fourteen years, both years inclusive.

Beyond the age of fourteen and under twenty-one years a very large number of our people must go to work and ought to go to work in every country, and therefore, this part of our people is very variable in so far as school attendance is concerned. We hope, therefore, that the Minister will be able, in his next report, to give the country this desirable item of information.

The population of Ontario, according to the latest report of the Census Commissioner, has not increased much during the last ten years, but notwithstanding all the blundering of ignorance, the population of the province has increased during the last ten years. Why, then, this constant decrease in the school population? Can it be that our young people over fourteen and less than twenty-one years, urged by the spirit of British enterprise, which burns so fiercely in the inexperi-

enced youth, move in larger proportion than any other part of our people, and to the new and fertile Canadian West? Another reason why the Minister should give a little more detail about our school population. We shall not venture into this field of inquiry, and are the more content not to do so; because the churches are addressing themselves to this important question. The decrease in the registered attendance, in the public schools, is becoming serious; the difference in the attendance between the years 1899 and 1900 is placed at the startling figure of 9,130, almost double what it was the previous year. This is a result not likely to encourage the supporters of gratuitous education,

The amount expended upon public schools for salaries last year (1900) was \$2,809,246, being an increase of \$32,605 upon the same expended in 1899. The total increase for all purposes was \$208,484.

The number of teachers in these schools was 8,666, increase, 97; men, 2,539, decrease, 73; women, 6,127, increase, 170. The decrease in the number of men teaching in our public schools continues year by year, and the increase in the number of women teaching in the schools more than counterbalances the loss in numbers. The school authorities in Massachusetts affirm that they have proved by experience that if the number of men teaching in the schools be less than twenty-five per cent. the children suffer on account of the inferior management of the schools. We, in Ontario, are now very near the danger limit. It is gratifying to notice that there is a slight increase in the salaries of the teachers.

The Minister of Education has

the following to say about our secondary education:—

“When High Schools were first established in the Province, their primary object was to prepare pupils for the learned professions, and especially for the University. Although their original purpose has not been ignored, the course of study has been enlarged so as to meet the aims of pupils who intend to follow the ordinary pursuits of life. It is in the High Schools that most pupils who desire to become Public School teachers receive their non-professional training. This is a valuable function of those institutions and one that has done much to commend them to the general public. Many young men also who intend to follow mechanical pursuits, or prepare themselves for mercantile life or for agriculture, take advantage of the High Schools. The superior culture which is thus received proves a valuable investment. In 1872 the number of High School pupils entering mercantile life was 486. In 1900 the number had increased to 1,331. In 1872 300 pupils left the High Schools for agricultural pursuits, and the number in 1900 had reached 757.

Owing to the organization of Continuation Classes in Public Schools, there has not been much increase of late years in the establishment of additional High Schools. As Continuation Classes are really doing High School work, it may be seen that there is a steady progress in the support given to secondary education. In 1867 only 1,283 pupils, or 23 per cent. of the whole number, studied commercial subjects, such as bookkeeping. In 1900 this subject was taken up by 9,712 pupils, or 45 per cent. of the total attendance. In 1867 5,171 pupils, or 90 per cent. studied Lat-

in. In 1900 the number taking Latin was 18,073, or about 83 per cent. In 1867 15 per cent. studied Greek, while in 1900 only 4 per cent. were engaged in studying this subject. In 1867 38 per cent. of pupils studied French, and none studied German. In 1900 the number taking French had increased to 58 per cent., while 18 per cent. were engaged in studying German."

The decrease in the attendance at these schools is put at 737 for the year 1900. The number of Continuation Classes we make out from the report to be 431, but the number attending those classes in the Public Schools we fail to find in the report. Very likely the attendance at the Continuation Classes accounts for the decrease in the attendance at the High Schools.

These Continuation Classes have been a subject of interest to school men since they began. Chiefly in two respects. Firstly, efficiency, and secondly, their effect on the attendance at the High Schools. The opinion of those best qualified to judge is adverse to their efficiency, and particularly so in languages. The knowledge in language is so defective that the High School Masters feel that it is necessary to review all the work done in the Continuation Class; the report seems to throw some light on the second point. In regard to the character of the work done, or rather not done, by these Classes, it would be a matter of wonder if it should happen to be of a satisfactory kind.

The only way to meet this difficulty is to have on the staff of the school a graduate, or one of equal attainments to a graduate, and put him in charge of the class and then the country will have some reasonable guarantee that the work can be

properly attended to. If this is not done, then, from the reports which have come to us, we are compelled to say that the Continuation Class is a failure. We need not refer to what every teacher is fully aware of, the injury which a beginner, in languages, receives if not properly taught from the commencement of his studies in these subjects. We heartily sympathise with parents in their desire to have their children at home, but we are sure that they will not have their desire gratified at the permanent injury of their children. We consider this question of great importance to the education of Ontario, and will be glad to have an expression of the opinion of our readers.

Sir William C. MacDonald has again shown his insight into the wants of the times and our Province of Ontario by his placing at the disposal of the Government \$125,000 to be used in erecting buildings at Guelph in connection with the Agricultural College, for the purpose of giving instruction and training to teachers in order that they may be the better able to open the eyes of their pupils to the beauty of life on our farms, Mr. MacDonald has been well advised, when he has devoted such a handsome sum to this important purpose. There is much need of emphasizing the life of our people in the fields and in the homes of rural Ontario.

People are too easily deceived by the glamour, which the smoothness seen in city and town life casts over the thoughtless observer. To get the riches in rural life requires of the beholder intelligence of a high order, much higher indeed than our public schools have been giving

during past years. Hence, one sense in which the gift of Mr. MacDonald is most timely: we hope the utmost benefit will be gotten from it by the

province. The intention of the donor is obvious and praise-worthy, may the administration of it be equally commendable.

COMMENTS.

GREAT TRAVELLERS.

We are great travellers however fond we are of home. Every twenty-four hours we travel twenty-four thousand miles, without a jolt or jar. The fare is not costly in comparison with our railway fares. And how carefully the Conductor presents us with scenes of loveliness; welcome interchanges of light and dark, dawn, daylight, gloaming, murky midnight. The darkest night is sometimes the most splendid with its star-sown spaces. Our 24,000 miles per day is not our only exploit in the way of travelling. A thousand miles an hour is a brisk pace. It ought to be, it often is, decidedly exhilarating. But we do more than that—a very great deal more. We have to make a long journey through space, among planets, stars, meteors, keeping as closely as we can to the sun—a tremendous journey of more than five hundred millions of miles! That is the race you run, the space you traverse every year of your life. If you are sighing at your stay-at-home lot, just recall the fact that your annual journeying exceeds five hundred millions of miles. What is your pace per hour in order to complete this long race in 365 days? How many miles do

you travel every hour of the day and night? Roughly--(very roughly)--speaking, the number of miles is about 60,000. Think of that--60,000 miles every hour! Your pace of 1,000 miles an hour sinks into insignificance beside the tremendous stride of 60,000 miles an hour.

But there is really more to tell of your travels. The sun, as everybody now knows is a fixed star; but the fixed stars do move---every one of them. Some move at a swift pace---swifter, perhaps, than a meteor, or moon or planet. But what the centre is around which the fixed stars are moving, none can yet tell with certainty, and what the pace is of our sun with its great retinue of planets must be settled by star-gazers of to-day and to-morrow, or some day to come. Of this, however, we are quite sure, we all enjoy these three mighty movements around the earth's axis, around the sun, around the remote unknown centre of the sun's far-reaching orbit---Ours is a vast world---a wondrous universe---and we travel through it, making our little rounds in our allotted years, feeling all the while that our universe with its complex motions is in the Hand of the Omnipresent God who guides all wisely and well---Pres. Witness.

CURRENT EVENTS.

**NEW IRON MINES AT MICHIPICOTEN,
CANADA.**

By W. Frank M'Clure.

That the vast iron ore resources of the Lake Superior districts of the United States should find their counterpart just across in Canada is not altogether an unlooked-for development. It has long been a matter of wonderment in this country that Canada has been so slow to investigate the mineral resources of Algoma, in view of the favorable topography of the land and the existence of the great ore bodies as near as Minnesota and Michigan.

To-day the same capital from the United States that is building up the giant industries about Sault Ste. Marie, including the water-power canals, is opening rich mines at Michipicoten. This will result in Canada becoming the location of her own steel and iron industries. Already this evolution is rapidly progressing, and the Midland, Hamilton and Buffalo furnaces are using ore from the Helen mine, the first of the newly-discovered properties. The new steel mill at the Sault St. Marie, when completed, will use the Canadian product exclusively, and four vessels of the Algoma Steamship Company are bringing Helen ore to Ohio ports, from whence it reaches the Pittsburg furnaces. Some 350,000 tons have already been shipped to the United States at a profit in spite of the duty of four cents a ton.

For shipping the product of these new mines a harbor with extensive dockage has been established at Michipicoten, twelve miles from the Helen mine, and about 130 miles from Sault Ste Marie.

The Helen iron mine is situated on Boyer Lake. The ore deposit has been exposed to the extent of 28,000,000 tons and the limit has not yet been found in two directions. The Josephine mine, more recently opened, is in the same belt but on Park Lake. This mine is also very promising. Then there are the Frances and Brotherton mines, on the same range. The output of the new Canadian mines is about 5,000 tons daily, but this will be greatly increased next season. The mining facilities are of the best.

Mr. E. V. Clergue, a brother of Francis H. Clergue, the promoter of all the giant industries in Algoma, is in charge of the ore mining. He found, early in the mining operation, that the bulk of the ore taken from the Helen mine contained an average of about 61 per cent. metallic iron, and 0.08 phosphorus, also that at the point where the ore body comes to the lake a Bessemer ore is found running as low as .02 to .03 per cent. in phosphorus and in sulphur from a trace to .05 per cent. The ore has a high grade in the market, also, on account of its low percentage of water.

The following from a report of Dr. Bell, of the Canadian Geological Survey, concerning the Helen mine, is comprehensive: "The

ore is a hard, but somewhat porous or spongy, red hematite, with a specific gravity of about 5. The ore body, from which a layer of muck or peaty moss has been removed, forms a point dividing the head of the lake into two small bays. It has a lumpy surface, with a dark bluish-grey color. Small quantities of brown hematite (limonite) and yellow ocher appear in joints and cavities, but they do not form any appreciable portion of the mass.

"The horizontal dimensions of the exposed ore are about 500 feet in every direction, and its greatest height above the lake is 100 feet. The ground rises steeply all around the head of the lake, so that the ore lies at the bottom of an amphitheater, open on the west, or lake side. A drift has been run at the level of the general surface of the ore, southward into the hill, and this penetrates similar hematite for 250 feet, thus giving a known breadth of 750 feet from north to south. During the winter of 1899-1900, by taking advantage of ice on the lake, a number of holes were bored in the bottom along a north and south line, which passed the extremity of the point of ore at a distance of 250 feet to the westward. On this line and abreast of the point the lake had a depth

of 100 feet, including ten feet of soft mud, and at 150 feet below the bottom, where the boring ceased, the drill was still in hematite, like that on the dry land. A bore-hole from the surface of the exposed ore was sunk to a depth of 188 feet below the level of the lake, without reaching the bottom of the hematite. The ore-mass has thus been proven to have a continuous depth of 300 feet, and as this follows the plane of the bedding, which is vertical, the probability is that the depth is very much greater. The general strike is parallel to the axis of the pond, which is about east and west. The railway approaches the mine from the west along the foot of the hill on the south side of the lake."

It has been figured by experts that at a shipment of 3,000,000 tons a year it would require a decade to exhaust the ore above ground at the Helen mine. Mining men from Minnesota are taking a great interest in the new territory. They are of the opinion that the deposits there are equal to those of Minnesota.

At Michipicoten harbor, vessels are loaded with ore at the rate of 1,000 tons per hour. Each ore pocket has a capacity of fifty tons. In all there are 500 feet of chutes, and more building. — *Scientific Am.*

SCIENCE.

By J. B. Turner, B.A.

SCIENCE TEXT BOOKS.

The question as to whether we should use text books in the teaching of science is one that has caused a great deal of discussion among

those who have given attention to the matter. For the present, it seems to be generally admitted that some text book must be available for the use of our students,

but while this is true, it must always be remembered that text books in the sciences are meant to be supplementary to practical work, and not to supersede it. One thing, however, with regard to such text books, is conceded by everyone and that it is that they should keep abreast of the progress that is being made in the sciences which they represent. Not only should they contain the latest verified facts of the science, but they should also set forth the latest developments in the methods of teaching the subject. It is not intended by this that our text books should be undergoing continuous revision, but merely that they should keep within measurable distance of the advances of the times.

A glance at the text books at present in use, will show that the situation in this respect could be improved. In physics, as far as the senior work at least is concerned, the subject has largely become mathematical. If this is the present trend of the study of physics then let the subject be transferred to the mathematical department, where it would appear to properly belong; but if as many yet believe physics is one of the experiment sciences, then the subject should be treated from that standpoint.

In botany the same text book has been in use for the last fifteen years and who will say that in this period great changes have not taken place in the treatment of this delightful subject? One has only to examine some recent work on the subject such as "Bergen's Foundations of Botany," published

by Ginn & Co., to understand how great the changes have been. Aspects of botany that were scarcely thought of ten years ago, now occupy a first place.

In chemistry, also, much the same state of affairs exist. Since the publication of the present authorized text book there have been not a few changes in this subject. More and more chemistry is becoming a study of the changes which matter undergoes and the causes which influence these changes. These new aspects of the subject have obtained such prominence as to require recognition in any course in chemistry no matter how elementary it may be.

There has recently been issued from the press of Edward Arnold, of London, a text book on chemistry, by W. A. Shenstone, of Clifton College, which fairly sets forth these latest ideas on the study of chemistry. The following extract from the author's preface, is a concise statement of the object of the work. "I have endeavored to provide a book which begins with a course of experimental work for quite young students, and develops at the later stages into a text book suitable for those who are older, that is, a text book containing fewer facts than these written solely for senior students, and in which the powers of the young workers are more carefully kept in view in the earlier and middle parts than is necessary in the case of books written for students of a different type." The author has also prepared a laboratory companion for use along with the text. This, in the opinion

of the writer, is an excellent text book for Form IV work, and at the same time it contains valuable suggestions for the work of Form III. A book of a similar nature but for advanced students only, is one by Roscoe and Harden, published by MacMillans. The same ideas prevail in this book as in the former one, and they are representative of the best thought on

this difficult subject, among British educationists.

That we should have an annual revision of any of our text books, is for obvious reasons out of the question, but nevertheless, it is desirable in view of the important interest involved that our science text books be kept as well abreast of the times as circumstances will permit.

SCHOOL HYGIENE.

Helen MacMurphy, M.D.

DEATHS FROM VEHICLES.

According to a report published by the Prussian Government, the number of persons killed last year by vehicles was 2117. In Berlin alone 103 persons lost their lives in this way. Most of the people were killed by railroads, tramways, automobiles and cycles. More than one-fourth of those killed were children under 15.

from the effect of wood dust; 111 cases from the effect of wool dust; 126 cases from the effect of various kinds of dust.

These facts suggest to hygienists and inventors the necessity of devising dust-consumers and dust-preventors for factories, workshops, etc. This is a fact that legislators should bear in mind.

DUST AS A CAUSE OF PULMONARY TUBERCULOSIS,

according to the report of the Imperial Health Office at Berlin, is clearly shown in the statistics of the patients treated at the sixty institutions of the Empire for the cure of tuberculosis. In 1,095 cases, or more than the half of the 2,161 persons under consideration, the origin of the disease was alleged to be due to the continuous inhalation of dust involved by their employment, as follows: Four hundred and thirty-one cases from the effect of "dust" without more exact designation; 182 cases from the effect of metal dust; 129 cases from the effect of stone, coal or glass dust; 116 cases

THE MORTALITY OF DONOTHING-ISM,

according to insurance statistics, is much higher than that of men with serious occupations. It is well known that in certain occupations the death rate is very high, brewers and saloon-keepers, *e. g.*, dying about twice as fast as the average; and butchers, workers in the building trades, glassworkers, miners, chemists and druggists, being much above the average. Yet, take these and those of all occupations together, and the occupation of the "gentlemen of leisure" is the hardest on life, reported to exceed that of the average by 132%. There is at present perhaps not great danger of an increase of the unoccupied ir

our country, as our restless energy would prevent it if it were not the fashion of the day to be busy. The truth may be of service to the rich, and shows that poverty and even

the most injurious work is less dangerous than wealth and idleness. Time has a wise way of ironically killing the time killer.

American Medicine.

BOOKS AND MAGAZINES.

To accommodate readers who may wish it, the publishers of THE CANADA EDUCATIONAL MONTHLY will send, postpaid, on receipt of the price, any Book reviewed in these columns.

The Treasury of American Sacred Song, selected and edited by W. Garrett Horder, Oxford University Press, London, England.

Usually in collections of religious verse aspiration is abundant and inspiration not so easily discovered. But the patient searcher, wearied with the dead forms of poetry and enamoured of its living spirit, will not be disappointed in this volume. The perfect blending of poetic art with religious feeling is to be found in such old favorites as Whittier's "When on my day of life the night is falling," Longfellow's "There is a Reaper whose name is Death," Emerson's matchless "Thanody," consoler of how many sorrowful souls, Bryan's "Thanatopsis," Holmes' "Chambered Nantilus," Mrs. Howe's "Battle Hymn," Jowell's "Present Crisis," Walt Whitman's "Last Invocation," and John Burrough's "Serene I fold my hands and wait." But there are many other poems less known deserving perhaps of equal fame, such for instance, as John B. Tabb's "Alter Ego :"

"Thou art to me as is the sea
Unto the shell ;
A life whereof I breath, a love
Wherein I dwell"

Or Emily Dickinson's "The Fold of Death "

"There is the stillest night,
Thine the securest fold ;

Too near thou art for seeking thee,
Too tender to be told."

Or Mrs. Whitney's "Behind the Mask :"

"Behind grey hairs and furrow'd brow,
And wither'd look that life puts on,
Each, as he wears it comes to know
How the child hides, and is not gone.

For while the inexorable years
To sadden'd features fix their mold,
Beneath the work of time and tears
Waits something that will not grow old."

Or this unerring shaft from E. R. Sills' "The Fool's Prayer :"

" 'Tis not by guilt the onward sweep
Of truth and right, O Lord, we stay ;
'Tis by our follies that so long
We hold the earth from heaven away,"

Or Helen Gray Cone's "The Torch Race," or Emma Lazarus' "The Gifts," perhaps the most powerful poem in the collection, with the exception of Edith Thomas' "The Quiet Pilgrim," or Alice Brown's "In Extremis." The poems have been chosen with care and good taste, and although there are in this, as in all anthologies of the sort, occasional examples of religious platitudes smoothly rhymed the devout lover of poetry is not disappointed. How intimately appealing is this question of W. D. Howell's "What Shall it Profit ?"

"If I lay waste and wither up with doubt
The blessed fields of heaven where once
my faith,

Possessed itself serenely safe from death;
 If I deny the things past finding out ;
 Or if I orphan my soul of One
 That seemed a Father and make void
 the place
 Within me where He dealt in power and
 grace,
 What do I gain by that I have undone?

Instructions for the Prevention of Malarial Fever, for the use of residents in Malarious Places. Price 2s. University Press of Liverpool. By Major R. Ross, F.R.C.S., D.P.H., F.R.S.

Report of the Malaria Expedition to Sierra Leone, 1890. By Ronald Ross, D.P.H., M.R.C.S., H. E. Annett, M.B., D.P.H., and E. E. Austen. Being a full account of the first expedition of the school, and containing besides much matter relating to the parasites of malaria, to the gnats which carry them, and embodying some previous observations of Major Ross in India. Illustrated by four maps and five full-page collotypes. Quarto. Price 10s. 6d. University Press of Liverpool.

NOTE.—As only a few copies of this important work are left in stock, and as the plates cannot be renewed, the price of the remaining copies has been raised to two guineas.

Report of the Malaria Expedition to Nigeria (1900). by H. E. Annett, M.D., D.P.H., J. Everett Dutton, M.B., B.Ch., and J. H. Elliott, M.D. Part I. Malarial Fever, etc. Price 7s 6d. University Press of Liverpool.

Report of the Malaria Expedition to Nigeria (1900). By the same authors. Part II. Filariasis. Price 10s 6d.

First Progress Report of the Campaign Against Mosquitoes in Sierra Leone (1901). By Major R. Ross, F.R.C.S., D.P.H., F.R.S. Price 1s. University Press of Liverpool.

Mosquito Brigades, and How to Organize Them. By Major R. Ross, F.R.C.S., D.P.H., F.R.S. A campaign against mosquitoes. 8°. Price 3s. George Philip & Son, 32 Fleet Street, London.

Report of the Yellow Fever Expedition to Para (1900). By I. E. Durham, M.D., and the late Walter Myers, M.B. (Dr. Myers died of Yellow Fever whilst serving on this expedition.) Price 10s. 6d. University Press of Liverpool.

Malaria and Mosquitoes. A discourse delivered at the Royal Institution of Great Britain by Major R. Ross, D.P.H., M.R.C.S., 1900. (Printed by permission of the Institution), giving a full history of the solution of the malaria problem.

Notes on Sanitary Conditions obtained in Para, by The Yellow Fever Expedition.

These important publications, which may be had, (except "Mosquito Brigades") from the Honorary Secretary of the school, show how great a work has already been done by the founders of the Institution, and the men who have pursued the researches of which these publications give some account. Life and health in distant parts of the Empire or the world are safer because of the work of the Liverpool School. We are glad to see that a Hall of Residence in connection with the School has recently been opened free of debt.

A first book of modern Geography; founded on the geographies edited by Messrs. Tarr and Mc-Murray, revised and adapted for Canadian Schools by W. A. Campbell; George N. Morang and Company, Toronto. We read this first book of Geography with much pleasure. The geographies of

Messrs Tarr and McMurray we had received a short time before. The connection between the two is quite obvious and Mr. Campbell very frankly acknowledges his indebtedness. It is our opinion that he has improved on his original in several important particulars. We think it would be an improvement, with the teachers in Canada if the review questions were omitted. The good teachers will pay no attention to the questions, the lifeless teachers will become more lifeless by using them. The firm of George M. Morang and Company is deserving of very high praise for the public spirited effort they are making to place within the reach of our teachers first class text books.

The Training of Teachers and Methods of Instruction:—By S. S. Laurie, A. M., LL.D., Cambridge, at the University Press, 6s., Professor Laurie, of Edinburgh, a great authority on education has done well to publish his selected papers on "The Training of Teachers and the Methods of Instruction." S. S. Laurie believes that educators can change the face of the world and under this conviction, the writer throws his strong personality into every one of the papers. He sets before his readers a high ideal of teachers work. "If the teacher can be led to rise to the full conception of his task, to understand that he is in truth one of the great moral forces of society, one of the conservators of civilization, he will be among the first to resist all attempts to divorce his daily work from the ethical and religious life of his time." S. S. Laurie has had special advantages to judge of the trend of modern methods of training teachers of late years, as he has been the secretary and advisor of the Educational Committee of the Church of Scotland. "We prefer,"

he says, "university institutions for the training of every grade of teacher to specialised training colleges, simply because they are not specialised." "There is, in truth, a radical error in the conception of an exclusive seminary for the education of members of a profession. Teachers, least of all, should be set apart from their fellow citizens prematurely. They should breathe the invigorating air of an institution where all manner of men meet." These papers are of special interest and value to teachers in charge of classes in normal schools and inspectors and head masters. All teachers will be benefited by reading them if for only the high ideal, the proper ideal which Dr. Laurie has of the teachers' office and therefore of his responsibilities.

No one can read these papers without feeling that he is lifted above the utilitarian, the mere bread and butter system of education. Dr. Laurie never lets his reader forget that the chief end of education is the formation of character. It is not only to illumine the mind, but also to purify the heart and elevate the soul.

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