duced into the former fistulous tract. Recovery followed.

The internal variety of fistula occurs as the result of the evacuation of an abscess into one of the hollow viscera, and is believed by many to be a most favorable termination to pus formation. To this view I must make very strong objections, for I have seen too many cases where this has occurred and been followed by distressing consequences. In one case there was a fistulous communication with the bladder, which ultimately cost the patient his life; in another the fistulous communication was between the appendix and the dilated portion of the ureter, which permitted the escape of feces through the ureter into the bladder and then to the exterior. In still another the fistula was in communication with the upper air-passages. The most favorable variety of internal fistula and that in which the patient incurs the least risk to life is where the abscess breaks into the cecum or the ascending colon. Where the abscess breaks into an adjacent coil of bowel it has, in a number of instances, been the direct cause of an acute internal intestinal obstruction, and caused loss of life therefrom. Acute intestinal obstruction is caused by the slipping of a knuckle of bowel under the point of adhesion of the fistula.

The constitutional effect of a fecal fistula is evidenced by a more or less rapid loss of strength and impairment of nutrition, due to the loss of the bowel contents containing the elements necessary for nutrition. This is more especially true when the fistula occurs high up in the small intestines, either in the duodenum or the jejunum.

As I have before stated, there are several factors which are the exciting causes of appendicular fistula: abscess formation; migration of micro-organisms into the bowel wall, causing softening; separation of the appendix from the bowel; the introduction of too many sutures or tying the sutures too tight in a softened bowel; the presence of the drainage-tube, and pressure necrosis.

On referring to all these causes we can see how easy it would be to prevent the occurrence of any and all of them by instituting surgical interference directly after the onset of an attack of appendicitis. If the appendix is removed immediately after the attack occurs, i. e., before any serious involvement or impairment in the nutrition of the contents of the right iliac fossa takes place, then it is impossible for abscess to occur, except from some fault in the technique of the asepsis; and it will be impossible to have softening of the bowel and cutting out of the sutures, the introduction of drainage will be dispensed with, the likelihood of adhesions lessened and any of the sequelæ which almost always follow neglect in having the patients operated on at the time of election—at the commencement of an attack—be avoided.

The treatment of appendicular fistulæ of the external variety varies with the individual cases. It is well, however, to permit Nature to attempt a cure. The surgeon's attention should be directed to maintaining thorough cleanliness and to regulating the diet. Frequently a fistulous tract will heal spontaneously if the diet be solid food and the bowel contents be kept rather hard. It is not wise to use a syringe, as it irritates the tract. If the fistula persists after the lapse of a reasonable time, operation offers the only hope of cure.

The operative treatment of the simple fistula should consist in exploring the tract to ascertain whether an infected suture be the cause. If it is, this should be removed and the tract curetted and packed with gauze. This usually suffices to insure a cure. When the fistula or sinus communicates with an unhealed abscess cavity, the mouth of the fistula should be enlarged sufficiently to permit of thorough cleansing and packing. When possible without opening the peritoneal cavity, the mouth of the fistula should be enlarged to a degree to equal the transverse diameter of the abscess cavity at its widest part. This should be followed by thorough cleanliness, packing, etc.

The treatment of fecal fistula necessitates opening the peritoneal cavity, removing the appendix—or its remaining portion, as the case may be—and thoroughly breaking up all peritoneal adhesions. When the fistula is in communication with one or more openings in the intestine, closure, preferably by suture, is to be recommended, but resection, end-to-end union, etc., is frequntly required.

To summarize the points which I desire to make: 1. The fistula is one of the most important sequels of operation for appendicitis. 2. Certain cases of fistula tend to close spontaneously. 3. When the fistula causes marked constitutional effects, delay in operating is a menace to life. 4. It is possible to avoid fistulæ in the great majority of instances if operation is instituted early. 5. Operative cases of fistula are usually curable, rarely requiring a repetition of the operation for its correction. 6. The fistula does not necessarily occur directly after the operation for the removal of the appendix or the evacuation of an appendiceal abscess.

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EDUCATIONAL AND LEGISLATIVE CONTROL OF TUBERCULOSIS.*

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The idea that a known (?) disease like tuberculosis springs from the evolution or rather dissolution of the forces which have to do with our being, that it is an evidence of the variation of the law of harmony to environment, a retrograde movement toward dissolution and death; this idea, I say, of a basic law of degeneracy, which finds its chief expression in this wasting disease, is too profound to be easily grasped, too adverse to our set habits of thought to be easily accepted. Therefore, if I fail to convince the reader in a necessarily curtailed presentation of proof, let me suggest that he simply suspend judgment till the opportunity happily occurs for him to study John Fiske's "Outlines of Cosmic Philosophy," especially the interesting chapters on "Matter, Motion and Force;" "Rhythm;" "Evolution and Dissolution" and "Sources of Terrestrial Energy." Then, I think, he will come to the conclusions here reached and have a clearer understanding of the matter.

There is a deeper and more fundamental source of knowledge than that which the microscope with its wonderful delineation and detail can supply, and the liability of being side-tracked by that instrument's findings should be recognized, that we may not fail to grasp the true origin and evolution of our degenerative diseases.

An important fact in evolution is that, all the way up to man, the beings evolved have had no voice, save instinct, in deciding their destiny. With the advent of man, however, something was added to the law of the survival of the fittest, that is, a deciding brain. This

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higher order of life—the soul of man with its God-like attributes—involves not only equivalent responsibility but the liability to mistakes because of that responsibility. I am not a preacher to expound and lament man's moral errors, but of all his physical ills, the profoundest and most far-reaching mistake which we now have to analyze is known through its results in tuberculosis, the lately termed "white scourge" of the race.

Let us try to free our minds from preconceived beliefs, and, rising above the details of bacillary evidence, attempt to determine how far man himself is to blame for his miseries, and then endeavor to learn how the punishment of this scourge is as it should be in the Divine order of our creation and our evolution. Thus we may come to realize that tuberculosis springs from the mistaken adaptation of man to his environment, i. e., is chiefly due to the faulty civilization of the present time.

The instinct of the Rocky Mountain beaver teaches him to build his winter hut in conformity to his environment, and wonderfully so with regard to the severity or mildness of the approaching season. A shrewd weather prophet interprets these findings and prognosticates the future for his fellow-men. Who will prognosticate the probabilities of life and death from the character of our own habitations? Are they a healthy outgrowth of man's conformity to his environment? No, it is right here, as I hope to show, that the greatest nonconformity lies. The question of the suitability of man's abode and life to his highest development may be studied better through the subject of ventilation than in any other way.

There was a man in our town who was much annoyed by the constant dinging of a piano in an adjoining apartment of his lodging-house. So he rigged up a gong run by electricity and his improvised music was made to accompany the piano until the latter stopped. If an automatic ventilator could be invented, built into a window pane or into the outside walls of a room, which would sound a gong whenever ventilation was imperfect —by reason of excess of carbonic acid or any organic impurity above an established healthy standard—and if such a device could be used in all living-rooms, there would be so much noise in every town that nothing else could be heard. The racket would probably bring relief in perfect ventilation, and the readjustment of the hearing organs to suit this noisy environment would be accompanied or rather attended by a great decrease in the degeneration which induces tuberculosis. The reward for the successful inventor of such an automatic ventilator should be great, for the good results would be almost inestimable. A visual index of atmospheric purity and impurity might be substituted for an alarm or gong.

This would not be a more wonderful discovery than many that have been made of late, as, for instance, the thermostat or heat regulator, which automatically controls the heat of a building within one degree of a desired point, but what a salutary correction it would be of the defects of our living-rooms! Let us take an average living-room, fourteen feet square and ten feet high, with one door and two windows—the usual condition. In such a room half a dozen may sleep, or one person may occupy a room of three or four times this space. This 2000 cubic feet represents about the average of the hundred thousand living rooms there are in a city of that population. The total window-space is one-half covered with curtain, and as the sun can shine into only one side of a house at a time, and as one-half the time he is usually shut out by clouds, little of the sun's direct rays can get into this average room. This room also has no fireplace, the door is shut nine-tenths of the time, and the windows are not open one-tenth of their area for one-tenth of the time.

This room has been evolved in the progress, and is one of the results of, our civilization. We must admit its necessity because it is here; but the evolution of its ventilation is as yet an unsolved problem to over 90 per cent. of humanity.

What then is sufficient ventilation for the maintenance of health? It is not merely that the carbonic acid which is thrown off from the lungs shall be replaced by its equivalent of oxygen from the outer air. So perfect are the joints the builders make, in this day of advanced art in architecture, that a guest-room, although aired and then unused for weeks, may need ventilating again before a new occupant enters, because it has lost the natural qualities of the out-door air.

A man exhales 400 volumes of carbonic acid to every two to four volumes he inhales; he must then have 4000 cubic feet of air an hour, according to Parks, and 1800 according to Briggs, lest the carbonic acid in a room exceed 6 to 10,000 and 8 to 10,000 parts respectively, which these investigators respectively considered to be the limits beyond which impurity should not be allowed to go. It is estimated that two candles give off as much carbonic acid as does one man, a lamp as much as two men, and an ordinary gas burner as much as do nearly six men; so, in addition, these sources of impurity must be considered. Ventilation necessitates the recognition of the fact also, based on the consumption of a pound of coal per hour, that for heating a room, 2072 cubic feet of air will be required for fourteen hours in the day. A thorough knowledge of ventilation necessitates, likewise, an appreciation of the various activities of persons in a room; also of the extra equivalent space in a room needed to offset the rarefaction of the air at great altitudes; also the estimation of various diseased states—as when, during fever, additional poisons are thrown off into the air—and also the determination of the chemical and organic changes which take place in laboratories and workshops.

Although all these are important, there is still something more needed to secure perfect ventilation. It is my purpose to show not only that the air-change in a room of this size is inadequate, but that there are other faults about this room, even were it twice as large, which seem not to have been generally, if at all, recognized. This will be plain when we consider the life of the air. We will see that there is a vitalizing principle whose force is annulled by the imprisonment of the air through defective ventilation.

How shall we express our conception of this vitalizing principle so that we may recognize its dissolution under absence of ventilation? We might do this had we some simpler way of giving to the sun its due credit as the source of all the heat, light and motion of life manifested on the earth than has Fiske[1], who says: "The difference between the tropical heat of India and the cold of the Arctic regions is simply the measure of untold millions of tiny differences in the rates of oscillation of countless atoms of atmospheric gases, determined in turn by innumerable oscillatory movements propagated *from the sun to the earth.*"

The life of the air exists chiefly in its motion, which, with its light, heat and electric or magnetic power, comes from the sun. If the absence of this life—here denominated as "dead air"—is represented as a perpendicular line, and "live air" is represented as another straight line

at right angles thereto, then the gradations from live air to dead, under the subtle influences in which we human beings live and die, can be truthfully represented as a curved line which gradually leaves the horizontal line and comes down to the perpedicular. This deficient-ventilation curve is not the same, but is much like Angus Smith's curved line (see illustration) which indicates, at times, the measure of the light of a candle when gradually extinguished by being confined in a closed space.

This receding flame can be fanned into life by opening a window, but let the previous stillness continue and the perpendicular line of extinguishment is surely reached. I wish to call attention to the important fact of the proportionate and gradual loss of light, and by it to illustrate the proportionate loss of vitality in a degenerative

Where on our imaginary deficient-ventilation curve, is the room we have described? Do I controvert the judgments of physicians who have so often felt like smashing the scanty windows of the sick-room or sleeping-chamber in order to let in some pure air, by saying that its imperfect ventilation places it 20 to 40 per cent. along on the downward extension of the curve? Admitting this you see the whole force of my argument. We must judge by contrast, and our sensations are only partial guides. The purest air, and therefore the liveliest air I know of,is found when you stand on some eminence in the rays of the rising sun, with the air coming to you from the hills or mountains beyond, sifted through pines and firs; with your feet upon the dry but negatively electrified ground, while your head or perhaps your whole

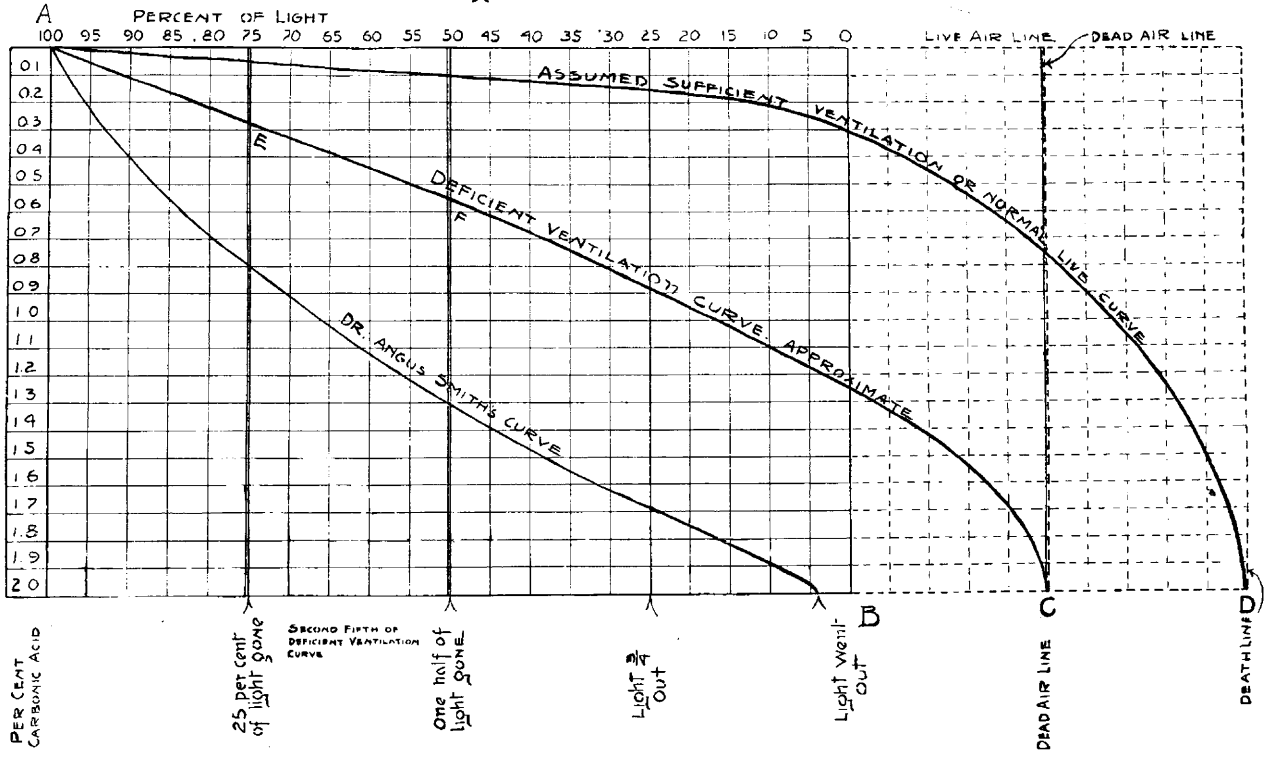
DIAGRAM ILLUSTRATING VENTILATION

A-B DR ANGUS SMITH'S EXTINGUISHING CANDLE LIGHT WITH INCREASING PERCENT CO_2

A-C ASSUMED DEFICIENT VENTILATION CURVE FOR COMPARISON WITH NORMAL LIFE LINE

A-D APPROXIMATE NORMAL LIFE LINE CURVE UNDER HEALTHFUL CONDITIONS OF VENTILATION

E-F ASSUMED POSITION ON THIS CURVE WHERE HUMAN BEINGS ORDINARILY LIVE IN HOUSES



disease. Both these losses are so gradual in the beginning that they are unrecognizable. The line of life of the human being who is dying or to die of tuberculosis has a similar curve. So gradual and imperceptible to his comprehension are its graduations that he does not know where he is on the bend of the curve, but he knows quite as much about it as he does about the deficient-ventilation curve, represented by the graded line from live to dead air. We do not apreciate our individual positions on this ventilation curve, as to the respective confinements of our bodies in closed spaces and the resultant imprisonment and dwarfing of our respiratory and circulatory systems; and it becomes a pertinent question to each one of us: Will we be exterminated by these conditions or will the final extinguishing act be transferred to our children, handicapped as they will be by our present ignorance?

body is in the strongly positively electrified atmosphere. You breathe into your uttermost air-cells this ozonized air, the cast-off carbonic acid goes from you the instant it is exhaled and every nerve in your body is stimulated to normal life.

The deadest air, I think I ever breathed was in the mammoth cave of Kentucky. I found there little 12 by 6 by 8 ft. rooms constructed of stone,with one door and a 16-inch square window in each. They had been built for the supposed climatic effect of the equable temperature, always 58 F. I was told that they took sixteen consumptives down there for one month. Four died there, one a week after coming out, and none were benefited. In comparison with the positive effects of live air cited above, such negative conditions, such deadness of atmosphere and ignorance of the requirements of human beings give the mind an ineffaceable shock.

Should a further illustration of dead air be needed, let us consider the lead chamber which Angus Smith constructed for his experiments[3], in which no possible interchange of air with that outside could occur. Imagine Dr. Angus Smith remaining therein, rebreathing its atmosphere as he did till candles went out, and you will have a good idea of what I mean by absolutely dead air, the effects of which, as described by this faithful investigator, I have no time here to dwell upon[4].

Previous to this experiment, Dr. Angus Smith had thought the real evil was from organic substances in the air, but afterward he concluded that carbonic acid, even in small amounts, had an injurious influence. In this connection it is interesting to note that Lavoisier and Saguin found that the human limit of the possible rebreathing of air was when the carbonic acid had reached 10 per cent. and that "was bearable only for a short time," while Angus Smith says "it seems to be impossible to endure 4 per cent. for any length of time."

The life of the air consists, to a greater extent than has been heretofore recognized, in the molecular motions of its atoms caused by the sun's influence. The diffusibility of the air, the easy motions due to changes of temperature in different strata, and the fact that light and sound depend upon the wave-motions of ether, are all forms of molecular activity which probably impart the life-giving principle to our atmosphere. This motion is always present till meddlesome man interferes. For instance if a narrow beam of light is thrown into a closed dark room in which the air is apparently still, every particle of dust is seen to be in constant motion. From the fact that there are varying states and amounts of electricity in the different strata of the atmosphere, the conclusion is justified that finer forces govern the life of the atmosphere than merely its composition of oxygen, nitrogen, moisture and carbonic acid. Nor should we forget the contribution of vitality vegetation brings through its constant interchange of oxygen for carbonic acid. This, with the qualities of atmospheric electricity and molecular motion, is all in restraint if not annihilated in poorly ventilated rooms.

This restraint of molecular motion and consequent limitation of vitality are in direct proportion to the deficiency of ventilation. Herein I conceive lies the great mistake of our civilization in relation to healthful human life. Here is to be seen the need of education that this cause of disease may be understood.

Let us try to elicit analagous evidence of vitality in the growing media of other products of Nature than those of the dwellers above the surface of the earth. The ground in our latitude becomes dead earth to vegetable growth as the cold of the Fall and Winter gradually annuls its vitality; but the warm penetrating rays of the sun in Spring and Summer transform it into live earth for the wonderful fructification of plant and animal growth. Plants too have their life-curve, which depends upon the vivifying and transmitted influence of the sun's rays. Shut out that influence and the life-curve becomes immediately abbreviated.

Again, let us consider the fish class, a medium creation depending upon air and water for its atmosphere and food. They constitute its life-giving agency and can not be greatly changed without its extinction. How wonderful is the effect of the fish's environment upon its life-curve, and upon its distinguishing characteristics, as shown by the eyeless inhabitants of dark caves, the big-eyed sunfish of the open pond, the sluggish sucker of the mud creek and the lively grayling of the rapids.

The livest water I have ever seen was when, within view of a snowbank in the Rocky Mountains, a cold dashing stream lashed itself, by its perpetual motion over rocks and stones, into a fit abode for the mountain trout, that creature full of ozone and vim, which life elements he transmits even to the fisherman who joyously captures him.

Note the difference in the life quality of that trout and of another of the same species pulled sluggishly up from 100 feet below the surface of a still lake. The higher the order of evolution, i. e., the more delicate and special the development of the nervous structure, the more susceptible to and influenced by the changes in environment are all created beings.

Applying this principle to the human family, we see that a limit of civilization can be reached where delicate or slight changes of environment may cause dissolution as well as evolution; where extinction from lack of conformity may take the place of evolution because of conformity to our environment.

We may argue against the cramped chest and round shoulders of the bicycle rider; but the bicycle is doing a world of good in getting people out of doors, in addition to the improved aeration of the blood which results from its use.

We admit the "visiting the iniquities of the fathers upon the children unto the third and fourth generation," meaning, in these days, syphilis and like hereditary evils; but this law of transmission likewise works itself out to the extinction of the users of defective and deficient ventilation.

We discuss the inhalation of irritant powders and poisonous gases in certain hazardous occupations; but defective ventilation, considered in conjunction with such causes of disease, increase their injurious effects manifold.

We may reason that the tubercle bacillus being the constant accompaniment of the decaying process in tuberculosis is consequently the cause and source of all this evil; but the very lateness of its appearance shows it to be rather the result than the cause. Its absence in many forms of scrofula, adenoid growth, wastings and catarrhs which surely eventuate in mature tuberculosis show that the pre-tubercular stage and perhaps the first stage of tuberculosis are already established presumably in advance of the germ. These conditions have been proved by the tuberculin test to be a part of the real disease before the microscopic or any other ocular demonstration of the bacillus is possible. The Widal test for typhoid fever now joins the tuberculin test in showing a dyscrasia which we know to be due to the presence of latent tuberculosis. This occurs before any ocular evidence of the mature germ is possible.

The destructive influence of sunlight upon the tubercle bacillus is now generally admitted[5]. If, in addition, the contention of Frankel,[6] that it is a facultative anaerobic germ, is sustained, then the claim of a predisposing cause in defective ventilation is strengthened by the favorable conditions furnished for such germination in the unventilated lung.

We thus go back of the tubercle germ to conditions which are bound, under favoring circumstances, to eventuate in it, and the following important statement is warranted, which controverts the trend of scientific thought of this decade as to the prevention of tuberculosis—namely: If all of Koch's bacilli of tubercle on this earth were instantly destroyed, in due time, under the same conditions, our world would again have an ample supply. It is not for me to pretend to know the

exact time which would elapse, under such a supposed temporary dispensation of Providence, until the terrible intensity of the "white plague" would be again as great as at the present time. The old times would come back soon enough. Undoubtedly, some of us, even those who are now incubating the germs, would live longer and be much wiser for such experience. We would, however, surely see the wave of bacillary domination sweep back over the human race, bringing the equivalent of the present time, when, as Osler says, 2 per cent. of the people living have the disease, and when, as it seems to me, ten times as many are getting ready for it.

Tuberculosis has come here to stay until we, the thinking masters of creation, acquire the education to understand and abolish it. It will not "down" in response to any edict against street expectoration, the disinfection of rooms occupied by dying consumptives, or even the slaughtering of tuberculous cows, although these measures of prevention are most important.

The drift of this reasoning is to this conclusion: Tuberculosis springs from, or is the outgrowth of, some unified cause which will account for its existence in cattle and horses, birds and other animals, as well as in man.

I wish to refer to the excellent paper presented by Dr. Charles Gresswell to the National Live Stock Association at its late meeting in Fort Worth, Texas.[7] From his considerable experience as a veterinarian in Colorado he shows that it is entirely unnecessary to use the tuberculin test with the "plains" cattle in the Rocky Mountain region, because even those previously infected, and transferred to the plains, there outlive their tuberculosis, and it does not appear in the next generation. In proof, he instances the surviving members and the progeny of a very badly infected herd of overbred Shorthorns, inbred and closely housed, of which I myself was cognizant. If also you bear in mind the great mortality from phthisis, etc., of the French and English cavalry horses under close stabling, which was quickly prevented by open-air stabling[8]; if also you are acquainted with the corroborative evidence of the close domiciling of cows, the confined caging of birds, monkeys, guinea-pigs and other animals, the crowding[9] of human beings in ship-holds, prisons, [10] alms-houses, [11] and places of public detention, or the civilizing and housing of savages, as of the American Indian, you then have to come to the conclusion that tuberculosis results either from a species of autoinfection from rebreathing the body's own exhalations, or from the fact that the air of these confined spaces becomes a source of infection from the loss or annulment of its life-giving principle.

Thus we are brought back to our sample room, the abode of a human being, the meagre size of which, and its deficient sunlight and air circulation, afford a sufficiently marked degree of deficient ventilation to constitute it a glaring fault of our civilization. This now seems to be the initial cause or starting-point of tuberculosis, which probably kills more people than war together with any other one form of disease known.

The study of the remarkable diffusibility and penetrability of gases, even through glass windows and brick walls, not to mention wooden doors with the many cracks around them, gives us some hope through what is called "insensible ventilation."[12] But the fear is that even this much of protection will be annihilated through the perfection of carpentry. The education which the people need, even the common people, and we doctors too, *must* be obtained and the architects and builders are not exempt from this necessity.[13]

A more thorough study of this intricate question would lead the architect, whose usefulness is too much limited by the demands of an ignorant public, to be an upbbuilder of people's health as well as of their houses. It is to be hoped that he will thus arrive at a more encouraging conclusion than did James A. Greenlief, C. E. , in his "How Much Ventilation?" when he said "For the ordinary private house a systematic air allowance per individual is almost an absurdity—for many of them a thorough systematic plan of ventilation is unnecessary, even were it not debarred by reason of the expense inseparable from it."

Whether ventilation, suited to the size and purpose of a building, the climate and the exposure, shall be by natural or artificial means, whether by propulsion or extraction, and how it shall be modified by the artificial aid of heat, steam and electricity, I have not time to consider in detail. My object now is to emphasize the need of ventilation of our living and working rooms. Lack of ventilation leads to the pale face, sallow skin, weak pulse, cold hands and feet and sluggish bowels; the feeble powers of digestion, assimilation and nerve energy—all proofs of a flagging vitality. This lethargy is due to enfeebled and poisoned blood-corpuscles, and a probable autoinfection, but especially to deprivation of food for the blood, i. e., oxygen from the air. In addition, the dead air, which marked deficiency of ventilation implies, compels inactivity and limited use of the lungs, and this, in turn means the gradual clogging of out-of-the-way air-cells with the products of combustion. In this manner, carbonic-acid poisoning and the species of autoinfection, heretofore described, are most naturally located and more or less permanently establshed.

I will not pretend to say what the details of a law of ventilation should be, but there should be such a law, enforced by proper legislation. That detail will be an outgrowth of the education which is essential to right legislation. In general, however, it should determine the minimum ventilation allowable in every assembling-place or habitation for human beings, and for dairy cows, horses, etc. The limitation should be adjusted to the various lives and their activities, with which the law has to do. If law can protect life by fire-escapes, the necessity of stand-pipes, the abatement of the smoke nuisance, the ventilation of sewers, and the non-pollution of drinking water, certainly this more subtle and ever-present cause of degeneration and death, defective ventilation, even in its slighter degrees, should come under its fostering care.

I suggest that an effort be made to establish and maintain the equivalent of the following: For a living apartment, a minimum space of 1500 cubic feet per individual, and a minimum ventilation or change of air of 2000 cubic feet per hour per person. If this is not afforded in new houses, then transoms over outside doors and windows, preferably opening inward at the tops, should be required.[14]

A course for the study of ventilation should be made a prominent feature in all advanced schools and colleges, and the government should carry out the many investigations which will help to determine both the best means, and the proper and necessary limits of ventilation. This is one of the ways in which a national bureau or board of health, properly established and supported by our general government, could prove itself one of the most useful and worthy of all the different departments which are represented by secretaries in the President's Cabinet. Until such a national board is established, the government ought to found and liberally maintain a commis-

sion on ventilation of houses, public halls, schools, factories and mines. Properly conducted, such a commission could do incalculable good.

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1. Fiske: Outlines of Cosmic Philosophy.
2. The table explaining the Angus Smith curve gives regular periods of time till the light goes out, and the extinguishment is divided into gradations from .1 per cent. carbonic acid up to 2 per cent. when the light goes out. It took .8 per cent. carbonic acid for the first quarter of extinguishment, .5 per cent. for the second, .4 for the third and .3 per cent. additional carbonic acid for the last quarter and total extinguishment.
3. Angus Smith: Air and Rain.
4. Dr. Angus Smith, in his "Air and Rain," in describing his sensations when confined in his experimental "lead chamber" containing 170 cubic feet, says of the chemical actions going on in the body: "They may take ten years to gather impetus to make their movements strong enough to produce sensations, and disease may be generated unknown to the individual, although it may kill him in the eleventh year, but if the chemical action began at first so violently as to produce decided sensations, he might be able to avoid it at once before it produced any abiding impression." After remaining in his chamber 100 minutes he found a reduction of oxygen to 20 per cent. and "the air had an unpleasant flavor or smell," and on entering it again after a minute he found "it extremely bad." He says "it took about four hours for the lungs to recover their tone."
5. Koch: International Medical Congress, Berlin, 1890.
6. Sternberg's Manual of Bacteriology.
7. Greswell: The Elimination of Tuberculosis Out in the Open. THE JOURNAL Feb. 3, 1900.
8. Parkes, in his Practical Hygiene, refers to the experience with horses in the French cavalry service and says that in ten years an annual loss of 190 per 1000 was reduced to 68 per 1000, by giving them more room in their stables, while in the English cavalry service, the change for the better by similar treatment was even more striking till the annual mortality was reduced to 20 per 1000.
Parkes, in his Practical Hygiene, notices the relation of increased mortality to density of population and adds that "its main concomitant condition is impurity of air from over-crowding,"—"especially among children whose delicate frames always give us the best test of the effect both of food and air."
10. Dr. de Chaumont's analysis, in Parkes' "Practical Hygiene," of the air in 11 barracks and hospitals showed an average excess of over 6 volumes carbonic acid per 10,000 and nearly twice that in the cells of four different prisons. Other and extreme analyses of air in rooms (in orphanage dormitories and detention places), with space per head all the way from 51 to 150 cubic feet, gave from 31 to even 72 volumes of carbonic acid to 10,000. The ratios were constantly greater, the more confined were the persons or animals.
11. Carmichael found in the Dublin House of Industry, crowded with children, that "the only causes for the excessive phthisis were the foul air and want of exercise."
12. In illustration, take notice of the dark lines on the plastered ceiling of a much used room. They are the interspaces between the laths where the dirty air has been sifted through.
13. That this education needed must be mainly directed to the ventilation of closed habitations is beyond any doubt; for Angus Smith's calculations, made in the cities of London, Manchester and Glasgow, showed so small a difference in the percentage of oxygen, as well as of carbonic acid, in the open places that we may conclude it is not so much the size of the city or the number of rooms in it, as it is the character of the rooms themselves. Parkes says "the colliers of Durham and Northumberland, where the mines are well ventilated, do not appear to suffer from an excess of lung disease, or to do so in a slight degreee." While as to "metal miners," he says that among them there comes to be, in advanced life, for males aged from 45 to 75, five times as many deaths from pulmonary disease "as for males exclusive of miners in Yorkshire." This latter evidence bears upon the quality of the dust in crowded places and rooms, which is organic to no small degree. Tichbone (Parkes' "Practical Hygiene") in a Dublin street, found it from 30 to 45 per cent. organic, and Chalvet, in a hospital ward in Paris, found the dust to be 36 to 46 per cent. organic matter. The sickening headache which some sensitive persons experience in, or after being in, a crowded theater, is probably wholly due to the rebreathing of excessive carbonic acid. "Crowd poison," as this air of crowded halls is sometimes called, undoubtedly contains much organic matter thrown off in the exhalations of the people there assembled. Even the moisture of these exhalations is not inconsiderable. Parkes averages an estimate of 211 cubic feet of air needed to maintain, in a state of vapor, the 25 to 48 ounces of water which a human being gives off in twenty-four hours' time, and he adds that when carbonic acid in the air has reached 7-10000 the smell of organic matter is generally perceptible, and it is "very strong" when 10-10000 is reached.
14. The variation of a proper law may be needed to suit the assembling of large bodies of people in halls, churches, etc., where occupancy is limited to a short time and a less space per capita seems to be allowable, or again where additional air is required, as in hospitals and certain work-rooms. But the building inspector, properly working with or under the Board of Health, should not only be possessed of a spirit of the law's righteousness, but should be a man of high intelligence and force.

DISCUSSION.

DR. PHILLIPS, of Washington, in the discussion, called attention to the experiments of Dr. B. W. Richardson[1], which served to confirm this contention for the life of the air. Richardson confined under glass, so they could be watched, four warm-blooded animals—a cat, dog, rabbit and pigeon, also two frogs—and gave them forty gallons of pure oxygen. He proved that the passing of the electric spark through the once used oxygen—which had killed or was killing the warm-blooded animals although only one-eighth of the oxygen had been consumed or was lost—restored the lost life or vivifying power. To quote Dr. Richardson:

Oxygen, when breathed over and over again, although freed entirely from carbonic acid and other known products of respiration, loses its power of supporting life; the process of life ceasing not from the introduction of a poison, but as by a negation or a withdrawal of some principle extant in the primitive oxygen which is essential to life[2].

Whatever explanation we give for this, whether that there is a possible rearrangement of the molecules of oxygen due to respiration which makes it afterward unsuitable to respiration, or, as Dr. Phillips suggests, that our accepted molecular divisions of matter are possibly not ultimate, we are entitled, I think, to assume this experiment to be the strongest possible proof of the main argument of this paper, i. e., that the chief vitalizing principle of the atmosphere is annulled by deficient ventilation.

1. Preventive Medicine.

THE DIAGNOSIS OF APOPLEXY UNACCOMPANIED BY MOTOR PARALYSIS.*

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Apoplexy unaccompanied by motor symptoms is often overlooked by the general practitioner, or its manifestations are not understood, while even the specialist is at times in doubt in the more obscure cases. It is not, however, a very rare occurrence, although in most of the general and special text-books but little space is given to it. It seems, therefore, worth while to draw attention to these cases and to point out the symptoms and the method of diagnosis. This may best be done by briefly reporting a few cases of apoplexy where the motor symptoms were either very slight or absent.

CASE 1.—J. B., a man 67 years old, born in Ireland, now living in Boston, having previously been in good health, though somewhat worried, had on Aug. 13, 1889, a sudden attack in which he turned blue in the face and seemed as though he were about to suffocate. He was raised up in his bed and shortly recovered. There seems to have been no marked loss of consciousness. The next day there was no paralysis of the limbs, no pain, no headache, but since the attack he has partially lost the power of speech and his mind seems confused. He complains of sense of weight on his head and his head feels heavy. He was seen on August 19, six days after the attack, and has stayed in bed most of the time since the latter, but can and does get up at times. Physical examination showed no paralysis anywhere. His mind was somewhat confused and there was some loss of memory and aphasia.

In this case the attack was evident and there could be little room to doubt the diagnosis. It seems doubtful as to how much loss of consciousness existed during it. While in the larger proportion of these cases there is a marked loss of consciousness accompanying the initial attack, this does not seem to be a necessary accompaniment. Attacks may occur which are not specially recognized at the time either by the patient or his friends.

The next case is typical of the more severe, and in many cases the most easily recognized, form of this trouble.

CASE 2.—G. L., a male, 30 years old, clerk, was seen

2. See also "Composition of Expired Air and Its Effects on Animal Life": Smithsonian Contribution to Pathology, by Billings, Weir Mitchell and Bergey.

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