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THE DOCTRINE OF CONTAGIUM VIVUM—FEVER IN A BOTTLE.

ADDRESS DELIVERED AT THE MEETING OF THE BRITISH MEDICAL ASSOCIATION, MANCHESTER, AUG. 7TH TO 10TH, 1877, BY WM. ROBERTS, M.D., F.R.S., PHYSICIAN TO THE MANCHESTER ROYAL INFIRMARY; PROFESSOR OF CLINICAL MEDICINE IN OWENS COLLEGE, ETC.*

GENTLEMEN,—The notion that contagious diseases are produced by minute organisms has prevailed in a vague way from a remote age; but it is only within the last twenty years—since the publication of Pasteur's researches on fermentation and putrefaction—that it has assumed the position of a serious pathological doctrine. In the last decade, startling discoveries of organisms in the blood have given this doctrine the support of actual observation; and its application as a guide in the treatment of wounds by Professor Lister has made it a subject of universal interest to medical practitioners.

The resemblance between a contagious fever and the action of yeast in fermentation—or the action of bacteria in decomposition—is in many points so striking that it is difficult to avoid the impression that there is some real analogy between them. If, for example, we compare the action of yeast with small-pox, this resemblance comes out very distinctly, as the following experiment will show. I filled two pint bottles, A and B, with fresh saccharine urine, and inserted a delicate thermometer in each. A was inoculated with a minute quantity of yeast, but nothing was added to B. Both bottles were then placed in a warm place in my room, at a temperature of about 70° Fahr. In order to get a correct standard of temperature for comparison, I placed beside these a third bottle (C) filled with water, and inserted a delicate thermometer in it. All these bottles were carefully swathed in cotton-wadding, for the purpose of isolating their individual temperatures, and to obviate, as much as possible, the disturbing effects of the varying temperature of the room. For twelve hours no change took place; but, at the end of this time, A began to ferment, and the thermometer marked a distinct elevation of temperature. On the second day, A was in full fermentation, and its temperature was 2·7° above B and C. This disturbance continued for five days, the temperature ranging from

* From Medical Times and Gazette.

two to three degrees above the companion bottles. The disturbance then subsided, and the temperature fell to an equality with B and C, and a considerable sediment, composed of yeast, settled at the bottom. In the meanwhile, B showed little alteration; but on the sixth day it began to ferment, the temperature went up, and for more than a week its thermometer stood about two degrees above A and C. Finally, the temperature in B declined, the disturbance subsided, and the newly formed yeast settled to the bottom of the vessel.

This fever in a bottle resembled small-pox in the following points. A period of incubation intervened between inoculation and the commencement of disturbance; then followed a period of disturbance accompanied by elevation of temperature; this was succeeded by a subsidence of the disturbance and a return to the normal state. Great multiplication of the infective material (or yeast) took place during the process, and, after its conclusion, the liquid was protected from further infection with the same contagium. We likewise notice that the contagium of fermentation, like that of small-pox, may take effect either by direct purposive inoculation or by fortuitous infection through the atmosphere. In both cases the infective material has the power of preserving its activity for an indefinite period. The comparison fails in at least one important point—in the fermented urine, sugar is replaced by alcohol and carbonic acid; but we are not aware that any pronounced chemical changes occur in the blood or tissues during an attack of small-pox. I would, moreover, carefully guard myself against being supposed to suggest that the enhanced temperature in the fermenting urine is a real analogue of the preternatural heat of fever.

Let me direct your attention to another example—a kind of partial decomposition or fermentation which takes place in boiled hay-infusion when it is inoculated with the *Bacillus subtilis*. The *Bacillus subtilis* is a very common bacterium found in vegetable infusions and in curdling milk. I hope you will take note of this little organism; for I shall have to refer to it more than once in the course of this address. I took a flask containing hay-infusion, which had been sterilised by boiling, and inoculated it with a drop of fluid swarming with *Bacillus subtilis*. After the lapse of twenty-four hours the previously transparent infusion became turbid. This turbidity increased, and on the second day a film or crust formed on the surface of the infusion. On the third and subsequent days the crust broke up and fell in pieces to the bottom of the vessel. In about a fortnight the turbidity passed away, and the original transparency of the infusion was perfectly restored, so that it looked exactly as it did before the process began, except that there was now a sediment consisting of the spores of the little organism at the bottom of the flask. In this case, again, there was the same succession of events: a period of incubation, followed by a period of disturbance, succeeded by a period of subsidence, and, finally, restoration to the normal state. There was also great increase of the infective material and immunity from further attack by the same contagium.

The yeast-plant and the *Bacillus subtilis* may be taken as representatives of a large class of organisms in regard to which we are only beginning to realise their vast importance in the economy of Nature and in the life of man. They are, as I shall presently show, the essential agents in all fermentations, decompositions, and putrefactions. We may group them together, for the convenience of description, under the general designation of *saprophytes*, a term intended to include under one heading all the organisms associated with the decomposition and decay of organic matter. The yeast-plant and its allies, and all the numerous species and varieties of bacteria, belong to this group. In size and form they are among the smallest and simplest of living things, but their vital endowments are wonderful.

All the organisms hitherto found associated with infective inflammations and contagious fevers belong to the tribe of bacteria, and we cannot advantageously enter on a study of that association without a knowledge of the origin and attributes of these organisms. This brings us into a field of active controversy. It has been alleged, as you know, on high authority, that these organisms, under certain conditions, depart entirely from the universal law of generation which is expressed in the aphorism *omne vivum è vivo*, and that they may arise spontaneously by a process of abiogenesis. It is also alleged that these organisms are not the actual agents of decomposition, but are merely associated with the process as secondary or accidental accompaniments. I propose to lay before you evidence that both these allegations are unsustainable, and to prove that bacteria, like other organisms, arise from pre-existing parent germs, and in no other way, and that they are the actual agents in all decomposition and putrefaction.

The first proposition I shall endeavour to establish is this: that organic matter has no inherent power of generating bacteria, and no inherent power of passing into decomposition.

I have here placed before you samples of three sets of preparations, out of a large number in my possession, which serve to substantiate this proposition.

The first set consists of organic liquids and mixtures which have been rendered sterile by a sufficiently prolonged application of the heat of boiling water. They are composed of infusions of vegetable and animal substances, fragments of meat, fish, albumen, and vegetables, floating in water. They are contained in oblong glass bulbs, and are protected from the dust of the air by a plug of cotton-wool inserted into the necks of the bulbs, but freely open to its gaseous elements, which pass in and out through the cotton-wool. They are all, as you see, perfectly transparent and unchanged, though most of them have been in my possession for several years.

The second set consists of organic liquids which have been simply filtered under pressure through unglazed earthenware into sterilised flasks. They include acid and netralised urine, albuminous urine, diluted blood, infusions of meat and of hay. As these preparations were obtained by a method which is in some respects new, I will describe it to you. A piece of common tobacco-pipe, about six inches long, served as the filter. This was secured by indiarubber piping to the exit-tube of one of the little flasks used by the chemists for fractional distillation. The flask is first charged with distilled water, and then a tight plug of cotton-wool is inserted into its neck. The flask is next set a-boiling briskly over a lamp. The steam rushes through the cotton-wool plug and through the tobacco-pipe, clearing both these passages of any germs they might contain. When the water has nearly boiled away, the end of the tobacco-pipe is hermetically sealed with melted sealing-way. After a little more boiling, the flame is withdrawn and the neck of the flask is instantly closed with a tight vulcanite cork. The apparatus is now ready for action, and the tobacco-pipe is immersed in the liquid to be filtered. When the flask cools, a vacuum is created within it, and this serves as a soliciting force to draw the liquid through the earthenware into the flask. The process of filtration is very slow; it takes two or three days to charge a flask. When a sufficiency has come over, the apparatus is removed and placed on a shelf for a few days until the pressure inside and outside the flask is equalised. The vulcanite cork is then withdrawn, and the exit-tube is separated and sealed in the flame of a lamp. In this way you obtain a sterilised flask charged with the filtered organic liquid, and protected from outside contamination by a plug of cotton-wool. Preparations obtained in this way, if due precaution have been used in the manipulation, remain permanently unchanged; organisms do not appear in them, and decomposition does not ensue.

The third set of preparations are, in some respects, the most significant of the three. They consist of organic liquids which have been simply removed from the interior of the living body, and transferred, without extraneous contamination, into purified glass vessels. I will not detain you with the methods employed to obtain them; it is sufficient to say that, by the use of proper precautions, it is possible to convey blood, pus, urine, ascitic fluid, pleuritic effusion, blister serum, or the contents of an egg, into sterilised glass vessels without contact with any infecting agency. Preparations thus obtained are exhibited in these flasks; they are protected from air-dust by a simple covering of cotton-wool. All of them are absolutely free from organisms and from any sign of decomposition.

What meaning can we attach to these preparations? You all know that liquids and mixtures such as these speedily decompose and swarm with organisms when left to themselves exposed to the air. They are of most varied composition, and the most apt of all known substances to breed bacteria and to become decomposed. They have been exposed to the most favourable conditions in regard to warmth, moisture, and air. Many of them have been in my possession several years, and all of them for several month, yet they are wholly barren and without sign of decomposition. I venture to say that these preparations substantiate in a positive manner the proposition with which we started—namely, *that organic matter has no inherent power of generating bacteria, and no inherent power of passing into decomposition.*

A second proposition is likewise established by these preparations —namely, *that bacteria are the actual agents of decomposition.*

In all the preparations, the absence of bacteria concides with the absence of decomposition. If I were to cause bacteria to appear in them, either by purposive infection or by exposing them to the unfiltered air, decomposition would infallibly follow. The filtration experiments supply a new and telling argument on this point. Some of the liquids became decomposed and full of bacteria, while the filtration was going on, but the part which came over into the flasks remained without further change, showing that decomposition cannot go on without the actual contact of the living organisms.

We have next to ask ourselves, What are the sources and what is the nature of the fecundating influence which causes organic liquids, when abandoned to themselves without protection, to become peopled with organisms? In regard to their source, the answer is not doubtful. If I remove the covering of cotton-wool from any of these preparations, and admit unfiltered air, or a few drops of any ordinary water, however pure, or anything that has been in contact with air or water, organisms make their appearance infallibly in a few hours. As to the nature of the infective agents, we can say positively that they must consist of solid particles, otherwise they could not be separated by filtration through cotton-wool and porous earthenware. Is it not a most natural inference that they are the parent germs of the brood which springs up at their impact? They are, however, so minute that we cannot identify them as such under the microscope; but Professor Tyndall has demonstrated that air which is optically pure—that is, air which is free from particles—has no fecundating power.

It is contended in some quarters that these particles are not living germs of any sort, but simply particles of albuminoid matter in a state of change which, when they fall into an organic liquid, communicate to it their own molecular movement, like particles of a soluble ferment, and so produce decomposition, which, in its turn, provides the conditions necessary for the abiogenic generation of bacteria. Filtration through porous earthenware furnishes a complete answer to this theory, for I found on trial that the soluble ferments passed with ease through the porous earthenware. If, therefore, this theory were true, the filtered liquids, if already commencing to be decomposed, would go on decomposing, and would develope bacteria after filtration; but instead of that they remain unchanged and barren. We are absolutely driven to the conclusion that these particles are living germs; no other hypothesis squares in the least degree with the facts of the case.

We may formulate this conclusion in a third proposition as follows:—*The organisms which appear as if spontaneously in decomposing fluids owe their origin exclusively to parent germs derived from the surrounding media.*

But how, you will ask, has it been possible, in the face of this evidence, to maintain, with a show of success, the contrary opinion that bacteria can and do, exceptionally at least, and in certain media, arise spontaneously? This opinion is based on two undoubted facts, which, taken together, seem at first sight to stand in direct contradiction with the propositions I have enunciated. The first fact is that bacteria are invariably killed when exposed to a temperature of about 140°Fahr., or any higher temperature. The other fact is that certain liquids, such as neutralised hay-infusion and milk, often produce bacteria after having been boiled—sometimes after having been boiled for two or three hours—and when there was no possibility of subsequent infection. It seemed at first sight a fair inference from these two facts that the apparition of organisms in boiled liquids was due to spontaneous generation, or abiogenesis. It does seem difficult to believe that any living thing can survive a boiling heat for several hours—and yet such is undoubtedly the truth. When I published on this question in 1874, I advanced more than one line of proof which appeared conclusive that germinal particles of some sort did, under certain circumstances, survive a boiling heat; and that the instances referred to were examples of such survival, and not of a *de novo* generation. But I was not then able to explain the apparent contradiction involved in these experiments.

Since then, a new and surprising light has been thrown on this subject by the researches of Professor Cohn, of Breslau, and we are now in a position to offer a complete solution of the riddle. All the confusions has arisen from our having failed to distinguish between the growing organism and its seed or spore. You are all familiar with the immense difference in vital endurance between the seed and the growing plant. The same difference exists between a spore and its offspring. Some spores have an extraordinary power of resisting heat. Mr. Dallinger and Dr. Drysdale, in the course of their inquiries into the life-history of septic monads, demonstrated that while the living monads are killed by a heat of 140° Fahr., the spores of one variety, which are so minute that they cannot be seen, except in mass, by the highest powers of the microscope, are capable of germinating after being subjected to a heat of 300° Fahr. for ten minutes! If the spores of monads can resist this tremendous heat, there is no reason why the spores of bacteria should not be able to survive the feebler heat of boiling water. The development of bacteria in hay-infusion, after having been boiled continuously for several hours in hermetically sealed vessels, seemed to furnish the very strongest attainable evidence in favour of the abiogenic origin of these organisms; and yet, by a singular fatality, the investigations of Cohn have shown that this evidence, rightly interpreted, supplies a crowning argument against that view.

Cohn had the curiosity to examine the organisms which arose under these extraordinary circumstances. Did he find a new birth? On the contrary, he recognised a familiar form: none other than our old acquaintance the *Bacillus subtilis*. He followed it through all the stages of its development. It first appeared some twenty four hours after the boiling, in the form of innumerable short moving rods. On the second day these rods shot out into long threads; on the third day there appeared on the threads, at perfectly regular intervals, strongly refractive oval bodies, which he identified as spores. Finally, the threads broke down and the spores were set free. In many hundred observations he saw this one organism and no other, and witnessed the successive stages of its development occurring with the constancy of a physical experiment.

Now, let me ask if this looks like an act of abiogenesis. The evolutionist demands, for the transformation of one organic type into its next descendant, myriads of generations, and I know not what lapse of ages. But here, if this be a case of abiogenesis, we see accomplished at one leap, in a single generation, and in seventy hours, not merely the bridging over of the gulf between the dead and the living, but the development of a specifically distinct organism, with definite form, dimensions, and mode of growth, and furnished with a complete provision for the reproduction of the species! I need scarcely say that such a feat would be, not only without parallel in the history of evolution, but would be wholly contradictory to that theory.

The only group of bacteria, so far as is known, which forms spores are the *Bacilli;* and Cohn remarks that in all the various cases in which he had observed organisms to arise in boiled liquids, they belonged in every instance to the *Bacilli.*

Before leaving this part of my subject, I wish to suggest certain considerations in regard to the nutrition and function of saprophytes, which appear to me to render it in the highest degree improbable that spontaneous generation should ever be discovered in this quarter. If it be assumed that the occurrence of abiogenesis, at some time in the past history of the globe, is a necessary postulate in science, then I see nothing unscientific—looking to the law of continuity in the operations of nature—in the supposition that it is occurring at the present day somewhere or other on the earth's surface, but certainly not in decomposing liquids.

Saprophytes are, as is well known, destitute of chlorophyll and, like all such plants, they are unable to assimilate carbonic acid. They obtain their carbon exclusively from more complex compounds which have been prepared for them by pre-existing living beings. It is, therefore, manifestly impossible that the primordial forms of life could have belonged to this group; for if we throw ourselves back in imagination to that remote era when life first appeared on the globe, we should find ourselves in a purely inorganic world—amid conditions in which saprophytes could not possibly live nor obtain nourishment. The special function of saphrophytes in the order of nature is to destroy, not to create, organic matter; and they constitute the last, not the first, link in the biological chain. For if we regard the order of life as it now proceeds on the earth's surface, we may describe it as beginning with the chlorophyll body, and ending with saprophyte. The chlorophyll body is the only known form of protoplasm which obtains all its nutriment from inorganic sources; here integration is at its maximum, and disintegration at its minimum and the resultant of the nutrative operations is increase of organic matter. The saprophyte, on the contrary, feeds on nutriment prepared for it by other beings: here integration is at its minimum, and disintegration at its maximum, and the resultant of the nutritive process is decrease of organic matter. What takes place in a decomposing liquid, under the action of saprophytes, is progressive disintegration, and finally a breaking-up of all organic compounds it contains into carbonic acid and amonia; and the process ends with the mutual destruction of the organisms themselves. Organism could not, therefore, begin in this way. The primordial protoplasm must have been either the chlorophyll body itself, or a body having a similar mode of nutrition.

If the search for contemporary abiogenesis is to be continued—as doubtless it must be, for science is insatiable—it appears to me that the enquirer should endeavour to realise the conditions under which abiogenesis must have occurred in the first instance. For, if the process be going on amongst us at this day, it may be assumed as probable that it still proceeds on the original lines laid down at the dawn of life. If ever I should be privileged to witness an abiogenic birth, I should certainly not expect to see a saprophyte: I should rather expect to see a speck of protoplasm slowly formed, without definite shape or dimensions, and nourishing itself, like the chlorophyll body, on a purely mineral diet. The more one reflects on this subject, the more clearly does it appear that the spontaneous origin of saprophytes is logically impossible. Speaking as an evolutionist, I should rather infer that saprophytes were a late development—probably a degradation from some algal forms which had found their profit in feeding on waste organic matter, and which gradually lost their chlorophyll through want of use, and with it their power of feeding exclusively on mineral diet.

We now approach the more practical side of our subject—that which concerns us as practitioners of medicine and students of pathology. I have already directed your attention to the analogy between the action of an organized ferment and a contagious fever. The analogy is probably real, in so far at least that it leads us to the inference that contagium, like a ferment, is something that is alive. We know of nothing in all our experience that exibits the phenomena of growth and self-propagation except a thing possessed of life.

This living something can only be one of two things: either it is an independent organism (a parasite) multiplying within the body or on its surface, or it is a morbid cell or mass of protoplasm detached from the diseased body and engrafted on the healthy body. Possibly both these conceptions may have their application in the explanation of different types of infective disease. In regard to the latter conception, however (the graft theory), which has been so ably developed by my friend Dr. Ross, I will only say that it has not, as yet, emerged from the region of pure speculation. It lacks an established instance or prototype, and it fails to account for the long-enduring dormant vitality so characteristic of mana contagia, which conforms so exactly with the persistent latent vitality of seeds or spores, but which contrast strongly with the fugitive vitality of detached protoplasm.

If, then, the doctrine of a contagium vivum be true, we are almost forced to the conclusion that a contagium consists (at least, in the immense majority of cases) of an independent organism or parasite; and it is in this sense alone that I shall consider the doctrine.

It is no part of my purpose, even if I had time, to give an account of the present state of knowledge on this question in regard to every contagious disease. My object is to establish the doctrine as a true doctrine; to produce evidence that it is undoubtedly true in regard to some infective inflammations and some contagious fevers. In an argument of this kind, it is of capital importance to get hold of an authentic instance; because it is more than probable—looking to the general analogy between them—that all infective diseases conform in some fashion to one fundamental type. If septic bacteria are the cause of septicæmia—if the sprilla are the cause of relapsing fever—if the *Bacillus anthracis* is the cause of splenic fever—the inference is almost irresistible that other analogous organisms are the cause of other infective inflammations and of other specific fevers.

I shall confine my observations to the three diseases just named—septicæmia, relapsing fever, and splenic fever; merely remarking that, in regard to vaccinia, small-pox, sheep-pox, diphtheria, erysipelas, and glanders, the virus of these has been proved to consist of minute particles having the character of micrococci; and that in regard to typhus, scarlet fever, measles, and the rest of the contagious fevers, their connection with pathogenic organisms is as yet a matter of pure inference. For further details I must refer you to the able reports of Dr. Braidwood and Mr. Vacher on the Life-History of Contagium, made on behalf of this association, and published in the *Journal* in the course of the past and present years.

Septicæmia.—We will first inquire how it stands with this doctrine in regard to traumatic septicæmia and pyæmia. You are all aware that foul, ill-conditioned wounds are attended with severe, often fatal, symptoms, consisting essentially of fever of a remittant type, tending to run on to the formation of embolic inflammations and secondary abscesses.

The notion that septicæmia is produced by bacteria, and the *rationale* of the antiseptic treatment which is based thereupon, is founded on the following series of considerations:—

1. It is known that decomposing animal substances—blood, muscle and pus—develope, at an early stage of the process, a virulent poison, which, when injected into the body of an animal, produces symp-

toms similar to those of clinical septicæmia. The poison is evidently not itself an organism; it is soluble, or at least diffusible, in water, and it is capable by appropriate means of being separated from the decomposing liquid and its contained organisms. When thus isolated, it behaves like any other chemical poison; its effects are proportionate to the dose, and it has not the least power of self-multiplication in the body. To this substance Dr. Burdon-Sanderson has given the appropriate name of pyrogen. It is the only known substance which produces a simple uncomplicated paroxysm of fever—beginning with a rigor, followed by a rise of temperature, and ending (if the dose be not too large) in defervescence and recovery.

2. We know further, from the evidence I have laid before you, that decomposition cannot take place without bacteria, and that bacteria are never produced spontaneously, but originate invariably from germs derived from the surrounding media. We are warranted by analogy in regarding pyrogen as the product of a special fermentation taking place in decomposing albuminoid mixtures, but we cannot name the particular organism nor the particular albuminoid compound which are mutually engaged in the process.

3. In the third place, we know that when a wound becomes unhealthy, as surgeons term it, the discharges become offensive—in other words, decomposed,—and when examined under the microscope they are found to swarm with organisms resembling those found in all decomposing fluids. Meanwhile the patient becomes feverish, and suffers from the train of symptoms which we call septicæmia.

It is a natural inference that what takes place in decomposing blood or muscle in the laboratory, takes place also in the serous discharges and dead tissues of the wound. These become infected from the surrounding air, or from the water used in the dressings, with septic organisms; on that follows decomposition and the production of the septic poison, or pyrogen; the poison is absorbed into the blood, and septicæmia ensues.

It was the distinguished merit of Lister to perceive that these considerations pointed to a means of preventing septicæmia. He argued that if you could prevent the access of septic organisms to the wound, or destroy them there, you would prevent decomposition, prevent the production of the septic poison, and thus obviate the danger of septicæmia. It is not within the scope of this Address to describe the means by which Lister attained this object, still less to pass judgment on his practice, but I may be permitted to express my belief that the principal on which the treatment is founded is unassailable.

We should probably differ less about the antiseptic treatment if we took a broader view of its principle. We are apt to confound the principle of the treatment with Lister's method of carrying it out. The essence of the principle, it appears to me, is not exactly to protect the wound from the septic organizations, but *to defend the patient from septic poison.* Defined in this way, I believe that every successful method of treating wounds will be found to conform to the antiseptic principle, and that herein lies the secret of the favourable results of modes of treatment which at first sight appears to be in contradiction to the antiseptic principle. Take, for example, the open method for treating wounds, which is sometimes compared in its results with Lister's method. What is this treatment but another way (only less ideally perfect than Lister's) of defending the patient against septic poison? Because, if the surgeon succeeds in providing free exit for discharges that there is no lodgment of them in the wound, either they pass out of it before there is time for the production of the septic poison, or, if any be produced, it escapes so quickly that there is not enough absorbed to provoke an appreciable toxic effect.

Before we can understand the pathology of septicæmia, we must have clear ideas on the relation of septic bacteria to our bodies. We see in our laboratories the dead animal tissues, when exposed to ordinary air or ordinary water, invariably breed septic organisms; in other words, contact of the septic germs with the dead tissues never fails to produce successful septic inoculation. But it is quite otherwise with the same tissues when alive and forming part of our bodies. You cannot successfully inoculate the healthy tissues with septic bacteria. It has been proved over and over again that these organisms, when separated from the decomposing medium in which they grow, can be injected in quantity into the blood or tissues of a healthy animal, or applied to a sore on its skin, without producing the least effect. The healthy living tissues are an unsuitable soil for them; they cannot grow in it; or, to put it in another way, ordinary septic bacteria are not parasitic on the living tissues.

This fact is of fundamental importance in the discussion of the pathology of septicæmia. We have a familiar illustration of its truth in the now common practice of subcutaneous injection. Every time you make a subcutaneous injection you inject septic germs into the tissues. I had the curiosity to test this point with the morphia solution used for this purpose in the Manchester Infirmary. I injected five drops of this solution into four flasks of sterilised beef-tea, which had remained unchanged in my room for several months, taking care to avoid any other source of contamination. In forty-eight hours they were all full of putrefaction. But we know that no such effect follows when similar injections are made into the bodies of our patients.

It seems also probable that septic organisms enter constantly into our bodies with the air we breathe and the food we take; they pass, presumably, like any other minute particles, through the open mouth of the lymphatics and lacteals, and penetrate some distance into these channels: they certainly come in contact with the accidental cuts, sores, and scratches which so often bedeck our skins. Notwithstanding all this, our bodies do not decompose; indeed, if ordinary septic organisms could breed in the living tissues as they do in the same tissues when dead, animal life would be impossible—every living creature would infallibly perish. How these organisms are disposed of when they do enter our bodies accidentally, as it were, in the various ways I have suggested, we cannot say; we can only suppose that they must speedily perish, for we find no traces of them in the healthy blood and healthy tissues. (*)

Bearing in mind, then, that ordinary septic organisms cannot breed in the living tissues, unless, at least, they are reduced to near the moribund state; bearing also in mind that there is a sharp distinction to be drawn between the septic poison and the organisms which generates it, we are in a better position to consider the course of events in a wound which leads on to septicæmia and pyæmia. What probably takes place is this. An unprotected wound receives infection from the septic organisms of the surrounding media. If the discharges are retained in the sinuosities of the wound, decomposition of them sets in with production of the septic poison. This is absorbed into the blood, a toxic effect follows, and septicæmia is established. As this effect increases with the continuous absorption of the poison, the vitality of the system is progressively lowered, and especially the vitality of the tissues bordering the wound, which may be topically affected by the poison which percolates through them. These tissues at length become moribund or die outright; the septic organisms then invade and breed in them, more septic poison is produced and absorbed; the toxæmia becomes intense, embolic centres of inflammation and suppuration are formed, and the end comes. In all this history there is no necessity to assume, nor even a probability, that septic organisms invade, or at least multiply in, the blood. They may do so at the near approach of death, but scarcely before that period.

In the course of traumatic septicæmia there sometimes occurs an event of great importance which imparts a new feature to the disease; I mean *infectiveness*. How this arises is a matter of speculation. To me it appears probable that, under a certain concurrence of conditions in and about the wound, a modification takes place in the vital endowments of the septic organism, whereby it acquires a parasitic habit, which enables it to breed in tissues of degraded vitality, or even in the healthy tissues, and in this way to produce the infective endemic pyæmia which we sometimes witness in the wards of our large hospitals.† I shall develope the idea more fully by-and-by.

Before leaving the subject of septicæmia, I may allude to the possibility of wounds being infected with septic organisms from within. As a rare occurrence, I am inclined to think that this is possible, and that it may account for the occasional infection of protected wounds.

(*) Exception must apparently be made in regard to the tissues and organs in the immediate vicinity of the absorbent surfaces. Both Kiebs and Bourbon-Sanderson found that portions of the liver and kidneys removed from the body without extraneous contamination produced bacteria, contrasting in this respect with blood and muscles.—*British Medical Journal.*

† Such a modification or 'variation' might be correlated with a modification of the ferment action, whereby a more virulent septic poison is produced. Would not such a view explain the sudden intensification of the infecting virus which was found by Chauveau and Dr. Sanderson in there experiments on infective inflammations?

From an observation by Chauveau, it may be inferred that septic organisms, when injected directly into the blood, are able to survive for two or three days, although unable to breed there. It is conceivable that occasionally a septic germ, entering the body by some of the ways which have been suggested, may escape destruction and pass into the blood, and lurk there awhile, and finding by chance some dead tissue or liquid within its reach, may multiply therein and produce septic effects. Such a contingency, if it ever occur, must be very rare, and would not appreciably detract from the value of the antiseptic mode of dressing wounds.

Relapsing Fever.—In 1872, Dr. Obermeier, of Berlin, discovered minute spiral organisms (spirilla) in the blood of patients suffering from relapsing fever. This discovery has been fully confirmed by subsequent observations. The organisms are found during the paroxysms; they disappear at the crisis; and are absent during the apyrexial periods.

These little parasites consist of spiral fibrils of the most extreme tenuity, varying in length from two to six times the breadth of a blood corpuscle. In the fresh state they move about actively in the blood. They have not been detected in any of the fluids or secretions of the body except the blood, nor in any other disease than relapsing fever. In form and botanical characters they are almost identical with *Spirochaete plicatilis*, of Ethrenberg (*Spirillum* of Dujardin), a species of bacteria found in dirty water, and occasionally in the mucus of the mouth. Cohn designated the variety found in the blood *S. Obermeieri*, in honour of its discoverer.

In the beginning of the current year, Dr. Heydenreich, of St Petersburg, published an elaborate monograph on this subject, which, I think, goes to reconcile the conflicting statements, and opinions put forth by previous writers in regard to the connection of the spirilla with relapsing fever. It is based on forty-six cases; those cases were studied with the most minute care; the blood was examined, and the temperature observed from two to six times each day. Altogether, over a thousand examinations of the blood were made.

Relapsing fever still prevails extensively in certain districts of Germany and Russia, but it is almost a forgotten disease in this country; and probably the majority of those in this room have never seen a case. It will, therefore, not be amiss if I remind my hearers, and myself, of its principal features. It is a contagious epidemic fever, characterized by a sharp paroxysm of pyrexia, which lasts about a week, and ends with severe critical sweating. This is succeeded by an intermission, also of about a week, during which the patient is apyrexial; then follows a second paroxysm, or relapse, which lasts four or five days, and ends, as before, in a critical sweating. Recovery usually follows the second paroxysm, but not unfrequently a third paroxysm occurs, and sometimes a fourth.

The paroxysms are occasionally broken by remissions or pseudo-crisis; and the apyrexial periods are sometimes interrupted by slight temporary rises of temperature.

Bearing these characteristics in mind, we shall be able to understand the significance of Heydenreich's observations. He found that every rise of temperature, whether that of the true paroxysm, or that following a pseudo-crisis, or those occurring during the intermission, was invariably preceded by the appearance of spirilla in the blood. They disappeared entirely shortly before the crisis, and remained absent during defervescence and the subsequent apyrexial periods. During the whole of the main paroxysms spirilla were usually to be found in the blood, but their number varied in the most puzzling manner from day to day. One day they were abundant, the next day they were scanty, and the day after again abundant; they even varied at different hours of the same day; sometimes they vanished altogether for a time, and then reappeared in vast numbers a few hours later. Throughout these variations the temperature remained steadily high, or with only slight or moderate oscillations.

These discrepancies had been observed by previous inquirers, and had led some to doubt whether the spirilla had anything to do with the virus of relapsing fever; but a happy idea suggested itself to Heydenreich which seems capable of explaining them.

He found that when a little blood containing spirilla was abstracted from the patient and kept at the ordinary temperature of the room, the organisms lived in it for several days; but if the blood was placed in an incubator and maintained at the normal temperature of the body, they died in from twelve to twenty-four hours; and if the temperature was kept up to fever heat (104° Fahr.) their life was still shorter—they only survived from four to twelve hours. This led to the conjecture that, during the main paroxysm, not one, but several successive generations of spirilla were born and died before their final disappearance at the crisis. He surmised that, in the usual course, the broods would overlap each other more or less, the new brood making its appearance before the last survivors of the old brood had passed away. This explained the variable number of spirilla found on different days and different hours of the same day. Sometimes the old brood would have altogether perished before the new brood reached maturity; this explained the occasional temporary absence of spirilla from the blood; it also explained the remissions, or pseudo-crisis, sometimes observed in the course of the paroxysms. So precise was the correspondence found that to be between the appearance of the spirilla and a subsequeut rise of temperature, that Heydenreich was also able to predict with certainty, during that apyrexial periods, the approaching advent of a transient rise of temperature from the reappearance of spirilla in the blood, although at the time the patient presented no indication of what was about to happen.

If these observations are to be relied on—and they appear to have been made with the most scrupulous care—we are led to the conclusion that the spirilla are the actual virus of relapsing fever.

The same conclusion is also strongly indicated by the results of innoculation experiments. Relapsing fever is easily communicated to a healthy person by innoculation with the blood of a patient suffering from the disease. Experiments made in Russia on individuals who voluntarily submitted themselves to this practice, show that the blood is only infective during the paroxysms, but not at the crisis or during the apyrexial periods. None of the fluids or secretions of the body except the blood are infective. All this shows that the virus is intimately associated with the spirilla, and is absent or present in exactly the same circumstances as the latter.*

The occasionally observed vanishing and reappearance of the spirilla during the paroxysm, without a possibility of new infection, seems to indicate that when the spirilla disappear they leave behind them something in the nature of seed or sphores, from which the new brood springs forth. Occular evidence of such germs is, however, still wanting. Several observers have noticed minute particles in the blood of relapsing fever which might pass for sphores, and Heydenreich observed that some of the spirilla had a dotted appearance. But hitherto all efforts to cultivate the spores out of the body have failed, and their power of developing spores is more an inference than a demonstration.

Splenic Fever.—The first trustworthy observation of the presence of organic forms in an infective disease was made in splenic fever. This formidable disorder attacks sheep, cows, and horses, and is not unfrequently fatal to man. In 1855, Pollender discovered minute staff-shaped bacteria in the blood of splenic fever. This discovery was confirmed in a very extensive series of researches by Brauell, and has been corroberated by Davaine and other inquirers in France.

The bacterium of splenic fever is a short, straight, motionless red, about as long as the breadth of a blood corpusele, and, so far as is known, it exists in no other form in the living body. It is found, besides the blood, in the spleen, in the lympatic glands, and in some other tissues. That this organism is the true virus of splenic fever has long been probable; and the labours of Davaine, Bollinger, Tiegel, Klebs, and, most of all, of Koch, have removed the last doubts on the subject. The work done by Koch is not only valuable as a triumphant demonstration of a disputed pathological question, but is noteworthy as a model of patient, ingenious, and exact pathological research.

We here come across an example of scientific prescience on the part of two distinguished men which is worth notice. It had been remarked by several observers that the contagium of splenic fever, as

* See a paper by Motschutoffsky, in the *Centralblatt fur die Medicinischen Wassenschaften*, 1876, p. 193. During the paroxysm the blood was infective whether spirilla were detected in it or not. This agrees with Heydenreich's theory, that their occasional apparent abscence during the paroxysms is due to their being incompletely developed, or immature, and therefore unrecognisable under the microscope.

it existed in the blood, was comparatively short-lived and fugitive, but that, under some unexplained circumstances, the contagium was very persistent, and lurked for years in stables and other places where cattle were kept. Dr. Burdon-Sanderson, writing in 1874, inferred from this circumstance that the organisms of splenic fever must have two states of existence; namely, that of the perishable bacteria found in the blood, and some other more permanent form, like seeds or spores, in which they were capable of surviving for an indefinite period. In like manner, Professor Cohn, guided by the botanical characters of the rods found in the blood, classed them in that group of bacteria named by him *Bacillus;* and, as he had observed that all the *Bacilli* produced spores, he inferred that the *Bacillus anthracis*—for so he named the bacterium of splenic fever—would also be found to produce spores. These previsions were proved by the researches of Koch to be perfectly exact.

The following is a brief abstract of those points in these researches which chiefly concern us .—

Koch found that mice were peculiarly susceptible to the virus of splenic fever. The minutest particle of the fresh blood or spleen of an infected animal infallibly produced the disease when brought into contact with the living tissue of the mouse. He found further that he could cultivate the organism artificially outside the body. He proceeded in the following manner. He placed a speck of the spleen containing the rods on a glass slide in a drop of the blood-serum of the ox, or a drop of the aqueous humour of the eye of the same animal, and covered it with a piece of thin glass. He then placed the slide in an incubator maintained constantly at the temperature of the body, and examined the preparation from time to time under the microscope. In a couple of hours he observed that the rods began to lengthen, and in a few hours to grow into long threads. These threads, after growing to twenty or a hundred times the length of the original rods, began by and by to assume a dotted appearance. The dots gradually increased in size and distinctness, until, after the lapse of fifteen or twenty hours from the beginning of the experiment they acquired the appearance of strongly refractive oval bodies, which were placed at regular intervals along the threads. Finally the threads broke down, and the oval bodies, which could be nothing else than spores, were set free and sank to the more depending parts of the drop. If the supply of nutriment were then exhausted, the process ended here, and the spores remained permanently unchanged; but, if additional nourishment were provided, the new spores were seen presently to elongate into rods, exactly resembling those originally existing in the blood or spleen. If the condition were favourable the new rods, after a period of rapid multiplication, in their turn entered on the formation of a new generation of threads and a new generation of spores. The figure shown represents the successive phases of this short and simple, but perfectly definite, life-history as they were actually seen to occur under the lens of the microscope.

The next point was to test the pathologenic activity of the rods and spores cultivated in this artful manner. This was done by introducing minute quantities of the rods, or of the spores alone, into a small incision made in the skin of a mouse. Speedy death from splenic fever occurred in every instance. Koch found, without exception, that if the tested material produced threads and spores in the incubator, it also produced splenic fever when innoculated into the mouse; and, on the contrary, if no such growth and development took place in the incubator, the tested material produced no effect when innoculated into the mouse. Proof could go no further: the infection absolutely followed the specific organism; it came with it, it went with it. These observations were repeated with the strictest precautions at the Physiological Institute at Breslau, under the eyes of Professor Cohn and other competent observers, who fully corroborated their exactness.

The variable duration of the activity of the contagium of splenic fever was now explained. Koch found that the rods had only a comparatively fugitive vitality; they lost their infective power generally in a few days; at the most, in about five weeks. But the spores retained their infective activity for an indefinite period, in spite of all kinds of maltreatment. They could be reduced to dust, wetted and dried repeatedly, kept in putrefying liquids for weeks, and yet, at the end of four years, they still displayed an undiminished virulence.

Cohn calls attention to the fact that the organism of splenic fever is identical in form and development with the *B. subtilis*. The only difference he could detect between them was, that the rods of *B. anthracis* are motionless, while those of *B. subtilis* exhibit movements. The figures you see before you might be indifferently labelled *B. subtilis* or *B. anthracis* and yet one of these organisms is a harmless saprophyte, and the other a deadly contagium. We have likewise seen that the spirilla of splenic fever are morphologically similar with the *Spirochaete plicatilis*. We have further seen that there is ground for the assumption that the infective agent in contagious septicæmia is the common bacterium of putrefaction, but modified in such a way as to have become endowed with a heightened capacity for growing in the healthy tissues. Do not those remarkable coincidences point to a natural explanation of the origin of contagia? If contagia are organisms, they must necessarily possess the fundamental tendencies and attributes of all organised beings. Among the most important of these attributes is the capacity for 'variation' or 'sporting.' This capacity is an essential link in the theory of evolution; and Darwin brings forward strong grounds for the belief that variation in plants and animals is not the result of chance or caprice, but is the definite effect of definite (though often quite obscure) causes. I see no more difficulty in believing that the *B. anthracis* is a sport from the *B. subtilis* than in believing, as all botanists tell us, that the bitter almond is a sport from the sweet almond—the one a bland, innocuous fruit, and the other containing the elements of a deadly poison.

The laws of variation seem to apply in a curiously exact manner to many of the phenomena of contagious diseases. One of these laws is the tendency of a variation, once produced, to become permanent and to be transmitted ever after with perfect exactness from parent to offspring; another and controlling law is the tendency of a variation, after persisting a certain time, to revert once more (under altered conditions) to the original type. The sporting of the nectarine from the peach is known to many horticulturists. A peach-tree, after producing thousands and thousands of peach-buds, will, as a rare event and at rare intervals, produce a bud and branch which ever after bear only nectarines; and, conversely, a nectarine at long intervals, and as a rare event, will produce a branch which bears only peaches ever after. Does not this remind us of the occasional apparent sporting of diptheria from scarlet fever? My friend Dr. Ransome, who has paid so much attention to the laws governing the spread of epidemics, relates the following instance:—A general outbreak of scarlet fever occurred at a large public school. One of the masters who took the infection exhibited diphtheritic patches on the throat. This patient was sent to his own home in Bowdon. Six days after his arrival, his mother was attacked, not with scarlet fever, but with diphtheria; though there were no cases of diphtheria at the time, neither at the school nor in Bowden.*

Take another illustration. Cholera suddenly breaks out in some remote district in India, and spreads from that centre over half the globe. In three or four seasons the epidemic dies away, and ceases altogether from among men. A few years later it reappears and spreads again, and disappears as before. Does not this look as if the cholera virus was an occasional sport from some Indian saprophyte, which by variation has acquired a parasitic habit, and, having run through countless generations, either dies out or reverts again to its original type? Similarly, typhoid fever might be explained as due to a variation from some common saprophyte of our stagnant pools or sewers, which, under certain conditions of its own surroundings, or certain conditions within the human body, acquires a parasitic habit. Having acquired this habit, it becomes a contagious virus, which is transmitted with its new habit through a certain number of generations; but finally, these conditions ceasing it reverts again to its original non-parasitic type.

In regard to some contagia, such as small-pox and scarlet fever, it might be said that the variation was a very rare one, but also a very permanent one, with little or no tendency to reversion; while others, like erysipelas and typhoid fever, were frequent sports, with a more decided tendency to reversion to the original type. In

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* Complex cases of mingled scarlet fever and diphtheria are sometimes seen. Similarly the peach-tree will occasionly, among a multitude of ordinary fruit, produce one fruit of which one half has the peach character, and the other half the nectarine character.—*Darwin.*

regard to some pathogenic organisms, it might be assumed that the parent type had disappeared, and the parasitic variety only remained—just as the wild parents of many of our cultivated flowers and vegetables have disappeared, leaving behind them only their altered descendants.

How aptly, too, this view explains what used to be called the 'epidemic constitution,' and the hybrid forms and sub-varieties of eruptive and other fevers.

I must not pursue this vein further. I have said enough to indicate that this conception enables us—if it does nothing else—to have coherent ideas about the origin and the spread of zymotic diseases.

In applying the doctrine of pathogenic organisms—or *pathophytes*, as they might be termed—to the explanation of the phenomena of infective diseases, we must be on our guard against hard-and-fast lines of interpretation. So far as our very limited knowledge now extends, the pathophytes hitherto discovered all belong to that group of the fungi which are called bacteria. Now, fungi have two marked characteristics—namely, the tendency to assume the parasitic habit, and the possession by some of them of a special ferment action. Both these characteristics may bear a part in the action of pathogenic organisms. In the complex phonomena of septicæmia such would appear to be the case—a poisonous ferment-product first intoxicates the system, and then the organisms themselves prey upon the dead or moribund tissues.

There is, as Dr. B. Sanderson has pointed out, a marked distinction to be drawn between those common processes of infective inflammation which are shared in by animals generally—such as septo-pyæmia, erysipelas, and the diphtheritic process—and those specific contagia which are strictly confined, like ordinary parasites, to particular species. There is nothing in all nature more wonderful than the intimate and subtle nexus which unites a parasite to its host. A hundred examples might be given. Even different varieties or races of the species have different and exclusive parasites. It would seem as if this nexus depended on some delicate shade—a *nuance*—something like an odour, or a savour, or a colour, rather than on differences of structure or chemical composition. The same minute correlation is seen in specific contagia—all are strictly confined to one or a few species. Vaccinia is confined to man, the horse, and the cow; scarlet fever is confined to man, and perhaps the swine; most of our specific diseases are absolutely confined to man. The human and ovine small-pox, although so wonderfully similar, are not intercommunicable. I am, therefore, inclined to believe that, in regard to specific contagia, we shall find more guiding analogies in parasitism than in fermentation. Our information at present is, however, so defective that it is not wise to enter into further speculations on this subject.

Gentlemen, I have brought my task to a conclusion. I believe that the doctrine of a contagium vivum is established on a solid foundation; and that the principle it involves, if firmly grasped in capable hands, will prove a powerful instrument of future discoveries. And let no man doubt that such discoveries will lead to incalculable benefits to the human race: our business in life is to do battle with disease, and we may rest assured that the more we know of our enemy the more successfully we shall be able to combat him.

DOMESTIC ECONOMY CONGRESS.

The first annual congress on this subject was held in Birmingham the 17th, 18th, and 19th July, 1877. The congress was opened by a *conversatione*, at which Professor Huxley, at the request of the chairman, delivered an address. He said he was very glad on that occasion to have the opportunity of saying a few words upon the objects of the congress and the expediency of arousing public feeling in regard to the importance of the objects which it had in view, because that particular subject of domestic economy was one which had always possessed a very great amount of interest for him, and as far back as the year 1868, when it was his business to address a working-men's college upon the subject of what constituted a liberal education, he said, 'If anyone is interested in the laws of health it is the poor workman, whose strength is wasted by ill-prepared food, whose health is sapped by bad ventilation and bad drainage, and half whose children are massacred by disorders which might be prevented.

Mr. Chadwick next spoke upon 'Head to Foot Washing,' which he advocated as a means of promoting health and strength in the first place; and, in the second place, as a safeguard against infectious diseases. Most doctors who had large practice in connection with epidemics had come to that conclusion. If he were connected with a board of health, on the approach of an epidemic, the first thing he would do would be to issue a general order, and try to get the machinery for its execution, to have the whole of the population washed as a defence. He would almost go the length of having penalties for non-washing, as they had in the case of vaccination, which was enforced to prevent small-pox. It was a fact that in an epidemic the tub people had had a remarkable exemption. As to the means of having this washing, he mentioned that in a prison in France it was the custom to wash all the prisoners by throwing spray over them, and then making them soap themselves and have another shower of spray. He thought that some system might be applied to schools where the children were unwashed, and which often were the centres of epidemics. If they had compulsory attendance at schools, and thus compulsorily exposed children to contagion, they ought to provide means of protection for them. A league for cleanliness was of just as much importance for the population as a temperance league, because filth and intemperance went together, as also did filth and idleness and vice.

The Rev. T. D. C. Morse read a paper by the Rev. Harry Jones on 'Washing.' The writer of the paper alluded to the bathing practised by the Romans of former times, and by the Chinese and Japanese in the present day, whereas the average Briton rarely washed himself. He pointed out that disease was often taken into the mouth by eating the food with dirty hands. Swimming baths and swimming should be encouraged as an integral part of education. This was a matter which might be taken up by every teacher, and where possible, the addition of a bath to the equipment of a school might be made with the provision of a playground. He strongly advocated washing on sanitary grounds.

Professor Huxley read a paper on 'Elementary Instruction to Children in Physiology. He said the chief ground upon which he ventured to recommend that the teaching of elementary physiology should form an essential part of any organized course of instruction in matters pertaining to domestic economy was, that a knowledge of even the elements of the subjects supplied those conceptions of the constitution and mode of action of the living body, and of the nature of health and disease, which prepared the mind to receive instruction from Sanitary science. It was eminently desirable that the hygienist and the physician should find something in the public mind to which they could appeal, some little stock of universally acknowledged truths, which might serve as a foundation for their warnings, and predispose towards an intelligent obedience to their recommendations. Listening to ordinary talk about health, disease, and death, one was often led to entertain a doubt whether the speakers believed that the course of natural causation ran as smoothly in the human body as elsewhere. Indications were too often obvious of a strong, though, perhaps, unavowed and half unconscious undercurrent of opinion, that the phenomena of life were not only widely different in their superficial characters, and in their practical importance, from other natural events; but that they did not follow in that definite order which characterised the succession of all other occurrences, and the statement of which was called a law of nature. He was not quite sure whether the idea that disease and death were direct and special interferences of Deity, did not lie at the bottom of the minds of a great many people, who would vigorously object to give a verbal assent to the doctrine itself. However that might be, the main point was, that sufficient knowledge had now been acquired of vital phenomena to justify the assertion that the notion that there was anything exceptional about these phenomena received not a particle of support from any known fact. On the contrary, there was a vast and an increasing mass of evidence that birth and death, health and disease, were as much parts of the ordinary stream of events as the rising and setting of the sun, or the changing of the moon, and that the living body was a mechanism, the proper working of which they termed health; its disturbance, disease; its stoppage, death. The activity of this mechanism was dependent upon many and complicated conditions, some of which were hopelessly beyond our control while others were readily accessible, and were capable of being modified by our own actions. It was the business of the hygienist and physician to know the range of those modifiable conditions and to direct the public how to influence them for the maintainance of health and the prolongation of life. An intelligent assent to such directions on the part of the public must be based on knowledge, and that knowledge meant an increased acquaintance with the elements of physiology. Although the depths of physiology might baffle the researches of the most highly trained and well furnished intellect, its elementary and fundamental truths could be made clear to a child. A knowledge of the elements of physiology was not only easy of acquirment, but it might be made a real and practical acquaintance with the facts as far as it went. The subject of study is always at hand in oneself. The principle constituents of the skeleton and the changes of form of the contracting muscles might be felt through one's own skin. The beating of one's heart and its connection with the pulse might be noted; the influence of the valves of one's own veins might be shown; while the wonderful phenomena of sensation afforded an endless field for curious and interesting self-study. Of course, there was a limit to that physiological self-examination. But there was so close a solidarity between ourselves and our poor relations of the animal world, that our inaccessible inward parts might be supplemented by theirs. A comparative anatomist knew that a sheep's heart and lungs, or eye, must not be confounded with those of a man; but so far as the comprehension of the elementary facts of the physiology of circulation, and of respiration, and of vision, was concerned, the one furnishes the needful anatomical data as well as the other. Thus, it was quite possible to give instruction in elementary physiology in such a manner as not only to confer knowledge which was useful itself, but to serve the purpose of a training in accurate observation, and in the methods of reasoning of physical science. He did not want to make physiologists of all the world, and notwithstanding the adage, which he regarded as a very dangerous one, about a little knowledge being a dangerous thing, he really saw no harm which could come of giving our children a little knowledge of physiology. The instruction, however, must be real, based upon observations, eked out by good explanatory diagrams and models, and conveyed by a teacher whose knowledge has been acquired by study of the facts, and not the mere catechismal parrot-work which too often usurped the place of elementary teaching.

Mrs. F. E. Hogan, M.D., read a paper on 'The Substitution of Scientific Subjects for Fancy Work in Girl's Education.' The speaker laid great stress on the importance of teaching botany and physiology in middle-class girls' schools, and said she considered that a microscope should be considered as indispensable an article in a school-room as a piano. She believed that physiology, intelligibly taught, fostered in children many a dormant faculty, strengthened the powers of observation, stimulated healthy and natural curiosity of the young, and brought children into relationship with the beautiful facts of nature.

Mr. E. Chadwick, C.B., directed attention to the practical improvement which was goiug on in the teaching of physiology in Germany. In consequence of the enormous losses on the field in the Franco German War, resulting from want of information as to how to treat wounded persons, a new system of instruction had been instituted. Companies were assembled, and certain members were supposed to be wounded in various parts of the body. The men were instructed on the spot how to apply bandages, and take other measures to stay the mischief which had been done. This was a very important practicable application of physical knowledge.

Mr. H. W. Hart (Professor of Dietetic Pathology) spoke in reference to errors in diet. He said that they could not have a greater illustration of the errors of diet than in the widespread dyspepsia throughout the country, and he would suggest that medical men who took an interest in their fellow creatures should combine together with a view to inform the public as to what was proper diet. He was prepared to prove, after years of study and experience, that the dietetic reform advocated would greatly benefit the nation, and especially our soldiers and sailors, whose profession demands physical ability of no common order. Proper food should be capable of sustaining and invigorating every organ of the human body, and maintaining uniform health for any length of time, without the assistance of stimulants, tonics, or aperient medicines. Meat was supposed to be the most nourishing of food, but it was not so. It was more stimulating than nourishing. There was a certain amount of nourishment in it, and it could be partaken of with advantage as well as relish, but it did not supply all that was really necessary for the sustentation and growth of the various parts of the human body. Milk, ripe fruit, vegetables and farinaceous foods would sustain life more or less perfectly; but to obtain this desideratum to perfection recourse must be had to wheat, as used by our ancestors a hundred years ago, before the invention of 'sifting' and 'dressing,' by which the grain was deprived of all its most important properties. The value of bread made of the entire grain, and without fermentation, would, if freely and constantly used, and excluding starchy foods, effect a speedy and marked improvement in the physical and mental condition of all who partook of it. The great disadvantage of Scotch oatmeal was that it was unduly heating to the human system, by reason of the excessive proportion of phosphate of lame which it contained, which really rendered it most unsuitable as food for adults, and when eaten by children made them feverish and irritable, and if constantly used caused skin and other diseases hitherto unaccounted for.—*Sanitary Record.*

A New Function of the Liver.—Dr. B. F. Lautenbach, as the result of 283 experiments made in Schiff's laboratory at Geneva, has come to the conclusion that the liver has for one of its functions the office of destroying certain of the inorganic poisons; and further that a poison is being constantly formed in the system of every animal, which it is the office of the liver to destroy.—*The Doctor.*

IMPORTANCE OF A KNOWLEDGE OF THE LAWS OF HEALTH.

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—FROM THE *Sanitary Record.*

1. On an average, one-half of the number of out-patients treated by a hospital surgeon suffer from diseases due primarily to a want of knowledge of the laws of health and cleanliness. The ignorance of hygenic laws, which affects so disastrously the health of the rich as well as the poor, exists chiefly in regard to dress, ablution and ventilation. This statement may, at first, appear startling, but an enumeration of the diseases that can be constantly traced to the above causes will show upon how sound a basis the statement rests. The following are examples : Varicose ulcers from dress ; skin diseases from want of cleanliness ; chest diseases and fevers from defective ventilation. The vast number of ulcerated legs treated in the out-patient departments of hospitals, in workhouse infirmaries, and in private practice, arise from varicose veins. Now, a varicose ulcer is caused by a distended condition of the veins of the leg, which have to sustain the pressure of the blood caused by gravitation. In varicose veins the valves which help to support the column of blood are, to a great extent, destroyed, through the veins having been distended by mechanical obstruction to the free return of the blood from the extremities, thereby distending the lower veins and separating the edges of the valves. Thus, the weight of an uninterrupted column has to be borne by the veins. This, of course, causes further distension, giving rise to congestion of the capillaries of the skin, and causing swelling, eczema, and ultimately ulceration. This is the varicose ulcer so common in the labouring classes. It is always difficult to heal, and often impossible, except by prolonged rest in bed. Hence it is the dread of the surgeon, and the cause of misery to thousands. Varicose ulcers are seldom admitted into general hospitals, so that hundreds of poor families are driven to the workhouse, and such cases form a majority in the workhouse infirmary. The most frequent and flagrant cause of obstruction is the ordinary elastic garter. Children should never wear them at all, as the stockings can be perfectly well kept up by an attachment of elastic straps to the waistband. If garters are worn, it is important to know how to apply them with the least risk of harm. At the bend of the knee the superficial veins of the leg unite, and go deeply into the under part of the thigh beneath the ham-string tendons. Thus a ligature below the knee obstructs all the superficial veins, but if the constriction is above, the ham-string tendons keep the pressure off the veins which return the blood from the legs ; unfortunately most people, in ignorance of the above facts, apply the garter below the knee. Again in nine out of ten labouring men, we find a piece of cord or a buckled strap tightly applied below the knee, for what reason I could never learn. Elastic bands are the most injurious. They follow the movements of the muscles, and never relax their pressure on the

veins. Non-elastic bands during muscular exertion become considerably relaxed at intervals, and allow a freer circulation of the blood.

2. The habit of tight lacing again predisposes to varicose veins, in consequence of the abdominal viscera being pushed downwards into the pelvis, causing undue pressure on the veins of the lower extremities when they enter the pelvis. Physicians also have reported cases of heart and lung disease caused by this pernicious habit.

3. The use of dress is often misunderstood; most persons evidently study and practice it with regard to appearance, or only to keep out wet or cold. The hygienic use of clothes, however, is not so much to keep out cold as to keep heat in. The mistake is often made of taking great care to put on extra wraps and coats when preparing for out-door exercise. This is not at all necessary in robust persons. Sufficient heat to prevent all risk of chill is generated in the body by exercise. The care should be taken to retain sufficient clothing after exercise, and when at rest, to prevent the heat passing out of the body. Indeed, persons very often catch chills from throwing off extra clothing after exercise, or from sitting about in garments, the material of which is not adapted to prevent the radiation of heat from the body. Linen and cotton underclothing, when moistened with perspiration, parts with heat very rapidly, whereas flannel and silk, being non-conductors, prevent the rapid loss of heat.

4. The most recent offence against the laws of health is the habit of wearing false hair. The perspiration of the scalp is prevented by the thick covering from evaporating, thereby causing a sodden and, weakened condition of the skin, which predisposes to baldness and other diseases of the scalp. Again, it produces headache and confusion of the intellectual faculties. We all know what a relief it is, during hard mental work, simply to raise one's hair by running the fingers through it.

5. Ablution is another subject of paramount importance to health. Mr. Urquhart, the introducer of the Turkish bath into this country, is one of the benefactors of the age, and it is to be hoped some day there will be a bath in every town and village in England. Doctors are very much to be blamed for allowing themselves to be prejudiced against it. The usual opinion given by medical men to their patients is that it is debilitating, and only to be borne by the robust. The reverse is really the case; it is stimulating and strengthening, it is a preventive as well as curative in disease. The effect of the Turkish bath on the skin is to cause an active condition of its functions of elimination, by removing the hardened epithelial scales, by removing the fat from the pores, and by causing the sweat glands to maintain the activity of their functions, giving a general stimulus to the vital power of the skin. Again, it keeps the body in a state of perfect cleanliness, which is so essential to robust health; but these are not its only virtues, it promotes purity of mind and morals. The man who is accustomed to be physically clean, shrinks instinctively from all contact with uncleanliness.

6. There are, however, certain precautions to be observed in the

use of baths. Persons who are apoplectic, or suffering from fatty-degeneration of heart, should not venture to disturb the circulation by the excitement of baths. The first effect of Turkish baths is to stimulate the circulation, the second to cause active congestion of the skin, the third to produce profuse perspiration, the fourth to keep down the temperature of the body by rapid evaporation. On leaving the Turkish bath the body should be douched with cold water; the capillaries are thus emptied of their blood by contraction, but immediately after the stimulation causes them to resume a state of activity, and produces vigorous circulation through the skin.

7. In taking a cold bath in the morning the same conditions should be present. The surface of the body should be warm and moist; therefore, the bath should be taken immediately on rising from the bed, and before the surface of the body has had time to cool or the capillaries to contract. The shock of the cold water should cause them suddenly to contract, then quick reaction will take place in the same way as after the Turkish bath. Unless this reaction occurs after the bath, there is great danger of getting a chill, at any rate the full benefit of the bath is not obtained. Persons with weak circulation who cannot take an ordinary morning bath, often derive great benefit from a Turkish bath. It opens the pores and improves the circulation of the skin so that the shock of cold water can afterwards be borne. The same persons can generally bear a cold bath if they get for a few minutes into a warm bath first, and then immediately plunge into cold water. By these means an active reaction is brought about. Warm baths should, in my opinion, never be taken on rising except under the above conditions, but warm baths at night are often desirable. They should be taken just before going to bed, when they have the effect of relaxing the muscular system and of promoting sleep by soothing the activity of the brain by the withdrawal of blood from it. I do not think warm baths at night are weakening, as the depression of vital energy which may occur is recovered during sleep. In river and sea bathing, persons should be careful not to remain in the water too long, nor should they exert themselves sufficiently to cause exhaustion, as the power of reaction is much impaired thereby; neither should persons get into cold water when cooling. The old-fashioned idea that persons should wait to cool before plunging into the water is a fallacy. There is no danger in plunging into the coldest water in a state of profuse perspiration if the heart and arteries are in a heaithy state. Of course it would be unwise to do so after a full meal, as the action of the heart might be impeded by the distended stomach.

8. Many persons complain of always getting up tired in the morning. This is very often due to defective ventilation of the bedroom or from using an undue amount of bed-clothes and bedding. Feather beds are too soft and yielding, and partially envelope the sleeper, thus producing profuse prespiration. The habit of lying two much under blankets is also very pernicious, by reason of the carbonic acid

exhaled by the sleeper being respired. Again, it is a common error to suppose, that by simply opening a window a little at the top a room can be ventilated. People forget that for proper ventilation there must be an inlet and an outlet for the air. In bed-rooms there is often neither, and if there is a fire-place it is generally closed up. Again, it is a mistake to suppose that foul air goes to the top of a room. Certainly the heated air goes to the top, but the chief impurity, the carbonic acid, falls to the bottom. There is nothing so efficacious in removing the lower strata of air as the ordinary open fire-place, especially if there is a fire burning. The usual defect in ventilation is the want of a proper inlet for the air. If the window be open the cold air being heavier pours down into the room, causing draughts; if the door be open, or ajar, the same thing occurs. The perfection of ventilation may be obtained in any room with a fire-place by simply providing proper inlets for the air, and nothing answers so well for the purpose as the upright tubes invented by Mr. Tobin. By this means the heavier external atmosphere ascends verdically through the tubes like the jet of a fountain, displacing the warmer and lighter atmosphere of the room, which finds its exit up the chimney. The tubes should communicate with the outer air on a level with the floor, and should be carried verdically upward in the room about four or five feet. A constant supply of fresh air is thus ensured without the slightest liability to draught, as the current goes directly upward until it strikes the ceiling. It is then diffused downwards, mixing with the heated air of the ceiling. The same principle can be carried out in any room with a sash window, by cutting out two or three holes an inch wide and three inches long in the woodwork of the upper sash where it joins the lower one. The columns of air ascend directly upwards, just inside of the window, and mix with the heated air in the upper part of the room. If this system were universally carried out, we should hear less of rheumatism and chills caught by sitting in the draughts.

9. Persons should cultivate the faculty of detecting sewer gas in houses. Typhoid fever is often caused by the escape of this gas into the house through defect of the traps and drains. However bad the drains may be outside the house, there is little to fear, provided the gas can escape externally. The following two very simple precautions would naturally diminish the cases of typhoid fever: first, every main drain should have a ventilating pipe carried from it, directly outside the house to the top of the highest chimney; secondly, the soil pipe inside the house should be carried up through the roof, and be open at the top.

THE CAUSE OF GOITRE.—Dr. Lombard, of Geneva, believes that the cause of goitre is a plethora of carbon, produced by the rarity of the oxygen in elevated regions. A sojourn on the shores of the sea corrects the affection by the greater abundance of oxygen, and by the iodine, which absorbs the carbon.

THE FORMATION OF FAT IN THE ANIMAL BODY.

There have been few more interesting chapters on the history of physiology than that which deals with the development of force within the human frame. Since Mayer first enunciated the proposition *Ex nihilo nihil fit* as applicable to the animal as well as the purely physical world, much has been done. But nothing has been more clearly made out than this: that, on the whole, albuminous substances are applied to the repair of waste; whilst hydrocarbons are either directly burnt up and appear as force, or are laid up as a reserve in a new and modified form. The form in which they are thus laid up in plants is starch; in animals, fat. Here, however, as far as animals are concerned, we enter on the borders of a most difficult question—that is, the relations of the substance called glycogen produced in the liver; but this, in the meanwhile, we must put on one side. No men have done more in their own peculiar way than Messrs. Lawes and Gilbert to elucidate practically the applications of abstract physiology to everyday life, or perhaps we might put it *vice versa*. These two gentlemen have for many years devoted their attention to applied physiology, especially as regards farming operations, and in the last number of the *Journal of Anatomy and Physiology* they supply a kind of *resume* of their results with respect to the formation of fat in the animal body.

It was first advanced by Liebig that a great part of the fat of the animal body was derived from hydrocarbons other than fat. This view was strenuously combated by none more than by the two distinguished Munich Professors—Pettenkofer and Voit. As every physiologist knows, Pettenkofer had a large air-tight chamber constructed, in which a man might live, and by means of which the various gases excreted by the human body might be collected for analysis. As regards the formation of fat, the experiments made by these gentlemen were on a dog—rather, we should think, an unfortunate selection. In the result they found, as they thought, that the fat deposited in the animal resulted—first, from fatty substances contained in the food; secondly, from the decomposition of albumen; that starch or sugar only saved the albuminous materials of the body from being partially converted into fat.

The experiments long ago undertaken by Messrs. Lawes and Gilbert led to a totally different belief. They were partly made with regard to the feeding of ruminants, and partly with regard to the feeding of pigs. In 1866 they announced their results in a short paper published in the *Philosophical Magazine*, which we noticed at the time; but these results have been called in question, as above indicated. The authors have since reviewed their investigations, and the result is to be found in the article just referred to. They find that, as far as ruminants go, the results are not decisive, these animals having no special predisposition to the formation of fat; but in pigs it is otherwise. In dealing with pigs, the proportion of nitrogenous to non-nitrogenous substance in the food used was considerably higher than is recognized by experience as the most suitable in the fattening food of the animals. More nitrogenous substance was available for fat-formation than was necessary to supply the estimated amount of produced fat. In the cases in which the nitrogenous substance was not so excessive, but still more than is the most appropriate, there was a considerable proportion of the total produced fat which could not possibly have been derived from the nitrogenous substance of the food. Lastly, when the proportion of the nitrogenous to the non-nitrogenous substance in the food was the most appropriate for fattening, there was a much larger proportion (about 40 per cent.) of the total produced fat which could not possibly have had its source in the nitrogenous substance consumed. Striking as are these results, it is obvious that a still larger proportion of the produced fat would appear to be formed from the carbo-hydrates, if it were assumed, with Henneberg and Voit, and as is doubtless nearer the truth, that 100 parts of albumen will not yield more than 51·4 parts of fat, instead of about 61 parts.

As the outcome of all these experiments, the authors say :—

" It is, then, perfectly clear that neither the amount of food consumed in relation to a given live-weight within a given time (which of course covered the requirements for increase as well as sustenance), nor the amount taken to yield a given amount of increase in live-weight (which in its turn covered the requirements for sustenance also), was at all in proportion to the amount of the nitrogenous constituents it supplied. It is quite obvious that the consumption, both for sustenance and for increase, was much more nearly in proportion to the amount of digestible non-nitrogenous constituents supplied; but it was more nearly still guided by the amount of the total digestible organic substance—nitrogenous and non-nitrogenous together—which the foods contained.

" That the great variation in the amount of nitrogenous substance consumed was not due to a deficiency of it in most of the foods employed, is shown by the fact that it was in the experiment in which the food contained the lowest proportion of it that the smallest amount of nitrogenous matter was not only consumed in relation to a given live-weight within a given time, but was required to produce a given amount of increase. It is obvious that where two or three times as much nitrogenous substance was consumed it was much in excess of the normal requirement. In fact, the animals consumed, almost regardless of the amount of nitrogenoussubstance supplied, until they had obtained a sufficiency of non-nitrogenous, or of total organic substance. It is further obvious that the range of variation in the amounts of non-nitrogenous constituents consumed would have been very much less but for the very variable amount of nitrogenous substance necessarily taken with it, the variable amounts of fat in the foods, and the greater amount of indigestible matter in some of them than in others. The indication is, indeed, that the excess of nitrogenous substance consumed substituted a certain amount of non-nitrogenous constituents; that, in fact, within certain limits the two classes of constituents may, for the purposes of respiration and fat-formation, mutually replace each other.

"Lastly on this point, not only did neither the amount of food consumed, nor the amount of increase in live-weight yielded, bear any relation to the amount of nitrogenous substance supplied, but the more excessive the supply of it the greater was the tendency to grow, and the less the tendency to fatten. There is, of course, a point below which the proportion of nitrogenous substance in the food should not be reduced, but if this be much exceeded, the proportion of the increase, and especially of the fat increase, to the nitrogenous substance consumed, rapidly decreases; and it may be stated generally, that, taking our current fattening food-stuffs as they are, it is their supply of digestible non-nitrogenous, rather than of nitrogenous constituents, which guides the amount, both of the food consumed, and of the increase produced, by the fattening animal."

Finally, they conclude that, as far as pigs are concerned, more fat was produced by various feeding than could possibly be derived from the albumen of their food, and that both experiment and experience in feeding point to the fact that carbo-hydrates must be of essential service in the production of animal fat.

Of course these results are not new—they are only advanced by the authors as confirmatory; but it is none the less useful to recall them to the minds of our readers. They have here in a concrete and practical form the knowledge acquired in very different ways. We are sure we need not point out its practical application.—*Med. Times and Gaz.*

SCHOOL HYGIENE.

Repeatedly in this JOURNAL have attempts been made to draw special attention to the importance of applied hygiene in all that relates to youth during the important and susceptible period of school life.

On this subject we give the following extracts from an article in the *Sanitarian* by Dr. McSherry, Prof. of Practice of Medicine, University of Maryland. It need hardly be said, we fully agree, as, we believe, will almost every intelligent physician, with every word he writes, especially with the 'early days, yea, years, wasted and mismanaged in the school course.'

'Perhaps the reader may, the writer certainly does, recall early days, yea, years; wasted and mismanaged in the school course. It is true no boy or girl of average capacity can pass childhood and youth in the schools without acquiring a considerable amount of elementary knowledge; and yet there may be, and furthermore there usually is, a fearful waste of time in this acquisition. And time is precious: *ars longa, vita brevis.* But, besides time, much money is lost. And, besides loss of time and money, health is often irretrievably impaired. Upon this last matter it becomes the physicians of the land to unite their voices in opposing a great evil. In many individual families it is observed that one or two of the children are suffering from the school course; they become obviously dyspeptic and languid, physically and mentally. They may struggle through, or they may fall by the way. What is known in the experience of one family is known by the attending physician as occurring in many families, and what one physician sees in his circle of practice is seen by every other physician in his circle, so that the sum total is a perennial epidemic among school children. . . . .

After referring to the foul air in the over-crowded and ill-ventilated school-room, to the children sitting hour after hour almost without change of position, and to the great mental labor sometimes demanded, especially in understanding and answering some questions during examination, Dr. McSherry continues:

'The worst of it is, that when many of these matters have been taken in by memory at great expenditure of brain force and attendant violation of hygienic laws, they are practically worthless. They will not make the possessors in any sense happier, better, wiser. Many of the questions would stagger the most intelligent ladies in any or every society; they would be too hard for members of Congress, ministers of the Gospel, judges of the Supreme Court, or even members of the American Medical Association. For such learning, *Cui bono?* The answer would be difficult. *Cui malo?* The answer would be easy. The young mind, like the young body, may be exhausted by overwork. Athletes become stale young, and the overtaxed mind of the child is often followed by mental inertia. Thus both mental and physical forces are frequently impaired. Taxing the memory to surprise and delight examiners with ready answers to difficult questions is not so good for the learner in reality as in appearance. 'I have seen all the works done under the sun, and behold all is vanity,' says a great authority; and the text is often illustrated in the examinations.

'It has been truly said that the mind, like the body, becomes dyspeptic from cramming. And, furthermore, impairment of the nervous system in one generation becomes a matter of entail. If entails be against American statute law, they are nevertheless in accordance with natural law. The prize-girl's children are perhaps very bright and precocious, but when sick they are fearfully liable to delirium and convulsions, and multiform nervous maladies. This is not a theoretic idea, but something that the writer has seen in practice.

'The mind and the body, being in close sympathy, ought to be educated together. If we go back to ancient Athens in the days of her glory, we find that intellectual and æsthetic culture and gymnastic training were carried along *pari passu*, and in the common interests of mind and body, and for the development of physical as of mental strength, and of physical beauty.

'The last point should be by no means ignored, especially in the female sex, which usually suffers more in the school career. Beauty requires intelligence of expression, sustained by vigor of health.

Education must be so balanced as to favor the one as well as the other. A young woman should look to be capable of the fulfillment of all the duties likely to devolve upon her in life. She ought to be, as the Scripture has it, a 'valiant woman,' and a capable helpmeet. Her frame ought to be well expanded, and she ought to have the development necessary to beauty of contour before marriage, and to other purpose after matrimony. Dr. Allen tells us that the American woman, where most schooled, is steadily losing in those important requisites of feminine grace and function. Fifteen years of drudgery in the schools are very apt to impair the girl's rights and her interests in these matters, as well as the rights and interests of her future companion. Every observant physician is aware of the wrong thus inflicted upon our young women, and through them upon society at large. . . . . .

'Meantime, how many hours should be employed by children in brain-work every day? Say sixteen hours—as by a German professor? Why, no; but rather sixteen hours a week. The writer has already suggested in these pages that children should never be required to sit in a school-room over *one* hour at a time; when they should be sent out in the air for a recess, and the room vacated should be at the same time thoroughly aired. This would be a great advantage to the physical organization—would it be any detriment to the mental? Far from it. Our people like categorical facts, as it were, tabulated. Then let them look at facts. Mr. Chadwick, a most scientific observer, found that yonng children could not keep up voluntary attention to study beyond two hours in the morning and one in the afternoon. 'By force, even, they cannot get more than one additional half hour of real attention, and that half hour proves in the end *a mental mischief, as well as a bodily injury*.' He found that *half-time* children learned as much habitually in the schools as *full-time* children; that is, that those who gave three hours to study learned fully as much as those who gave six hours—we will not say to study, but to school. The half-time children came from the factories. '*As they gain in bodily condition by the reduction of their physical labor, so do they in mental condition by the reduction of the time devoted to mental labor*.'—*The Sanitarian*, Ap., 77.

'Now if children can learn as much in three hours of daily study as in six, and if confinement in the average school-room is injurious to their physical condition, upon what reasonable ground can this forcing process be sustained, which does not improve the mental faculties, but certainly injures the physical powers? Would it not be better that boys and girls should be radiant with health at fourteen or fifteen years of age, though only well instructed in the elements of English education, than that they should have the semblance of varied learning with constitutions already impaired? When the brain is unduly taxed with difficult lessons, nerve force is more or less diverted from all other uses, and consequently all other parts of the animal organism must suffer. And this is what we see all around us—the body sacrificed to the mind, and the mind not better for the sacrifice. Yet, by better and more judicious arrangements, both mind and body could be fortified in, and during the course of youthful study, by courses properly adapted to, the needs and capacities of the rising generation. Let there be more of the Athenian method in training the young, and let æsthetic, intellectual and physical culture be fairly and equitably distributed; and then the sovereign people of a third of a century hereafter will have reason to thank the wisdom, rather than to blame the folly of their parents.'

THE FUTURE OF SANITARY SCIENCE.

Dr. Richardson delivered, on the 5th inst., an able address to the members of the "Sanitary Institute of Great Britain" (*Med. Times and Gaz*). The 'whole natural scope' of the Institute is, Dr. Richardson says 'to sow the seed of sanitation; to think out plans of projects for working methods; to lend its many minds, as if they made up the mind of one man, for devising from the past the best for the present; and respectfully to declare their conclusions.' This is surely work enough; and the best help, perhaps, that could have been given to its members on the present occasion was to point out "the lines on which they would have to move—viz., the politica', the medical, and the social." Dr. Richardson declared that our legislators have, by a long precedence, taken the lead in sanitary affairs over those of other nations; and that by comparison with all other nations in the world we have obtained legislative measures which are splendidly comprehensive. He considers that no other country in the world can present an approach to the Public Health Act of 1875. "Its constitution of sanitary authorities throughout the kingdom; the power it vests in those authorities to appoint learned medical officers of health; the provisions it makes for securing to each locality better sewerage, freedom from nuisances, improved water-supply, regulation of cellar dwellings, governance over offensive trades, and removal of unsound foods; the provisions for prevention of spread of infection, and for the erection of hospitals and mortuaries; and the provisions for the regulation of the streets and highways, lighting of streets, establishment of pleasure-grounds, and regulation of slaughter-houses; these, as well as the general provisions for the carrying out of the Act, are most commendable as practical plans, by the working of which the nation may be tempered into sanitary mould of thought and character." He urged the necessity for a State Department of Health, presided over by a Health Minister. To this we must undoubtedly come sooner or later, and the Health Department must be freed entirely from the administration of the Poor-law, and many other matters which, as well as that of sanitation, are at present administered by the Local Government Board.

To insist upon, and work for the establishment of, a State department exclusively devoted to the health of the people, should be one of the first, if not the first, of the objects of the new Institute. Another great and crying need of the day, Dr. Richardson pointed out, is a digest of all our practical sanitary laws, so prepared that every person of intelligence can read and understand what may be legally enforced for the maintenance of health. And even of greater importance than this is the "systematic enumeration, week by week, of the diseases of the kingdom through the length and breadth of the kingdom." We have no need to enlarge to our readers on the value of this. If the Sanitary Institute will constantly persist in demanding from the Government the systematic registration of disease, and devote itself to the consideration of "the best means of collecting the facts on which the weekly reports of disease will have to be based," it may, in that direction alone even, do a work that will more than justify its existence. Then Dr. Richardson dwelt forcibly on the need that the politician should come forward, more determinedly than he has yet done, in order to secure for those he governs three great requisites—pure water, pure food, pure air. He, in common with large and increasingly great numbers, holds that it is hopeless to trust to companies in a matter of such vital moment as the supply of water, and equally hopeless to trust to the undirected action of local authorities. Government must do one of two things in this political part of sanitation—'It must either produce a process or processes for pure water supply, and insist on every local authority carrying out the proper method; or it must—and this would be far better—take the whole matter in its own hands, so that under its supreme direction every living centre should, without fail, receive the first necessity of healthy life in the condition fitted for the necessities of all who live.' Dr. Richardson insisted, at some length, on the want of legislation for supplying pure air, and on the vital necessity of this; and he insisted also on the need of political aid in 'quenching the drunkenness of our land.'

Passing on from the political to the medical aspect of his subject, Dr. Richardson gave great praise to the medical profession for the part they have taken in urging—as may be thought, against their own interest—*that prevention must take the place of cure.* Of the great future of preventive medicine he spoke at considerable length, and with much enthusiasm, and concluded this part of his subject with a few words deprecating the fear of over-population. 'It is felt by some,' he observed, "that the medical sanitarian of the future will have its best-efforts thwarted by the forcible excess of life beyond the means that can be found for the support of life, as if life were a mere secondary principle in the universal order. I see no such cause for fear. That in the progress of life on the earth the day will ever come when the earth will not supply food for its people, is, to my mind, pessimism carried to an insane vulgarity. It is clear that man can always reduce to his wants the lives of all animals except man. The question rests therefore on the abnormal increase of man alone. Nature knows that, and rules accordingly. . . . I think it my duty to deal plainly with a question which effects so closely the future of sanitation, and to express, from an experience which is confirmed, as I know, by some, of the highest ornaments of my learned profession, that nothing is wanted to correct the danger of over-population but improvement of mental process; nearer communion with the Eternal Mind in His works; purer artistic education, healthier homes, more rational amusements, and the ennobling influence of a holier life amongst those who assume to be the cynosures of the nation.' Then treating, finally, of the future of sanitary science in relation to social life generally, Dr. Richardson dwelt on the importance of teaching sanitary science 'so as to carry the sympathies of the learner and his more refined tastes along with his reason, so as to attract and charm his senses as well as his intellect.' He declared his desire strongly to enforce that 'it is the section of the nation which Dr. Farr classes as the domestic, the six million of women of the nation, on whom full sanitary light requires first to fall.' Health in the home, he said is health everywhere. Elsewhere it has no abiding-place; and the woman is the presiding genius of the home. And the address closed with an eloquent expression of the surpassing value of the help sanitarians will obtain if they can win the matchless generosity of women, and 'their overpowering love for every device tending to promote the happiness of all things of life,' to the cause of sanitary science.

CROUP CAUSED BY MIASMA.

Dr. Lewis S. Pilcher has recently made a valuable report to the Kings County (Brooklyn, N.Y.) Medical Society on the subject of croup, published in "The Proceedings" of that Society, April, 1877. Dr. Pilcher has studied that disease with much care with reference to local conditions. A map of Brooklyn accompanies the report, on which the dwellings wherein cases of the disease have been met with are suitably indicated. It needs but a glance at the map to perceive just where the malady has been most prevalent, and to enable deductions as to the probable influence of the soil, drainage, etc., on its persistence to be readily made.

Under the term 'croup,' Dr. Pilcher includes 'all forms of acute inflammatory affections of the larynx or trachea which may produce narrowing of their caliber to such an extent as to occasion serious prolonged dyspnœa.' This embraces three conditions, namely, catarrhal croup, membranous croup, and diphtheritic croup. The first two differ in the secretion, in the former case being liquid, and in the latter its giving rise to a false membrane of varying thickness. Diphtheritic croup differs only from membranous croup in being recognized as a part of a general diphtheritic infection. Exposure to cold produces catarrhal croup; but membranous croup demands for its production not only cold and moisture, but also a miasmatic poison, the character of which is allied to that which is active in diphtheria.

The conditions under which the author has found that the worst forms of croup may be generated are abundantly prevalent in some parts of Brooklyn. The disease runs riot among the large numbers of badly nourished and weakly children in the thickly populated tenement house districts; and wherever examination has been made into the physical nature of the soil, in localities where croup has been most frequent, there unfavourable conditions have been encountered. Along the water front, occupying ground rescued from the river or bay; upon the site of marshes, now more or less obscured by the filling-in process; in valleys that have been the site of water-courses, whose drainage is imperfect; these are the districts over which, as the map plainly shows, the malady has destroyed the most people.

Dr. Pilcher's conclusions are of especial value in calling attention to the fact that so prevalent a malady is preventable by the ordinary sanitary precaution of proper drainage.

How to Preserve and Restore Flowers.—Flowers may be preserved in a fresh state for a considerable time by keeping them in a moist atmosphere. Those who love to see plenty of fresh flowers in their parlors or sitting-rooms will be gratified by adopting the following plan: Pour water into a flat porcelain or glass dish. Set a vase of flowers in the dish, and over it place a bell glass, with its rim in the water. The air which surrounds the flowers being confined beneath the bell glass, is kept continually moist with the water which rises in the form of vapor. As fast as the water is condensed it runs down the sides of the bell glass back into the dish; and if means were taken to enclose the water in the outside of the bell glass, so as to prevent its evaporating into the air of the sitting-room, the atmosphere around the flowers would remain continually damp. Those who wish 'to linger on the beauty' of a rare flower or boquet will be repaid by this experiment. It can be tried on a small scale by inverting a tumbler over a rose-bud in a saucer of water. Another method, by which some flowers may be preserved for many months is, to carefully dip them as soon as gathered in perfectly limpid gum water, and after allowing them to drain two or three minutes, to set them upright, or arrange them in the usual manner in an empty vase. The gum gradually forms a transparent coating on the surface of the petals and stems, and preserves their figure and color long after they have become dry and crisp. Faded flowers may be generally more or less restored by immersing them half way up their stems in very hot water, and allowing them to remain in it until it cools, or they have recovered. The cooled portion of the stem must then be cut off, and the flowers placed in clear, cold water. In this way a great number of faded flowers may be restored; but there are some of the more fugacious kinds on which it proves useless; but flowers may also be preserved and their tints deepened by adding to the water a little of the solution of carbonate of ammonia and a few drops of the phosphate of soda. The effect of this, in giving the flower a deeper color and a strong appearance, is quite wonderful; and by cutting off every other day about one-half inch of the stems of the flowers with a sharp knife, they may be kept as long as their natural life would last.—*Sanitarian from Lancaster Farmer.*

PAINT AND DISTEMPER ON WALLS—CARPETS.—As sanitary science advances and becomes more and more popular, so in proportion, we venture to predict, will the use of paper-hangings become less and less general. There are four serious objections to their use: First, that their surface collects and retains dust and impurities, and that cleansing is generally difficult and often impossible. Secondly, that layer after layer is frequently applied without stripping off the old paper, thereby often causing an offensive odour. Thirdly, that the poisonous arsenite of copper is much used in their colouring. Fourthly, that they form a convenient harbour for vermin, and we might almost add as a fifth that they too frequently conceal the miserable work that is called plastering by the speculating builder.

Many paper-hangings remain on walls for seven or ten years, some much longer, and we cannot use a milder adjective than 'disgusting' to express our views as to any part of an inhabited room not being thoroughly cleansed very many times during such a period.

We unhesitatingly express our opinion that, *cæteris paribus*, a house with painted or distempered walls is more likely to be healthy than one with papered walls.

The enamel paint might advantageously be employed on floors as a border where parquetry would be too expensive. The practice of carpeting a room all over is objectionable as it harbours dirt. We should prefer, on sanitary grounds, to see all rooms with a wide border of flooring left round the carpet, even if only plain boarding, so that it might be frequently washed, and the carpet more often taken up and beaten.—*Sanitary Record.*

USE OF TOBACCO BY STUDENTS.—In the prospectus of the Berkeley Gymnasium, a preparatory school to the University of California, we find the following section on the use of tobacco. Imagine a "young gentleman" sitting down in the smoking room, with a cigar in his mouth, elated with the dignity of his position, and proud of the concession which his instructors have made to his desires, and at the same time contemplating this permissive act, particularly that part of it relating to the "clean and the unclean."

"It is a fact not to be overlooked that a great majority of our boys in California are given more or less to the use of tobacco. We do not defend this or any other species of intemperance. We believe it is destructive to both brain and body. Yet we deem it wise to deal with the matter as an *existing thing*, which it is. We do not believe that it is wholesome for the good morals of a young man to be sneaking around the buildings in quest of any opportunity that may be presented to absent himself from school grounds to practice in secret places or vicious companionship what he would be either afraid or ashamed to acknowledge to his best friends.

"We shall therefore have a smoking room comfortably fitted up for the convenience of those students who are addicted to this habit;

but in all cases we must first have the written authority of parents or gu rdian. Under no circumstances will a student be permitted to smoke more than once a day; namely during the half hour immediately following dinner. It is our design in this to separate the clean from the unclean, and not allow the influence of tobacco smokers to be felt promiscuously upon young and susceptible pupils, as we are confident is often the case."—*Pacific Med. and Surg. Jour.*

MEDICAL EDUCATION—PUPILAGE.—Nobody would like to revive the old system of five years apprenticeship by which largely apothecaries were made. It too often took the form of wasted time, and undignified occupation and want of occupation. But there has been a very general feeling in the profession that it was too absolutely abolished, and that there is a want in the education of medical students of some teaching in the practical work of the care of patients. Sir J. Paget has lately told us that he got his first course of histology, more than forty years ago, in a small village in Norfolk of 1200 inhabitants, and that there are many such opportunities now; and that if he had to choose where to send his son with a view to entering the profession, he would apprentice him for the first year to a practitioner in the country. The General Medical Council just over recommends—"That candidates for the final professional examination be required to give evidence that they have had opportunities of practical study, with care of patients as pupil, assistant, clinical clerk, or dresser in hospital, dispensary or elsewhere." Practical study is rather to be learnt in dispensary practice and in private practice than in hospital.—*Lancet.*

THE SIZE OF LONDON.—London covers nearly 700 square miles. It numbers more than 4,000,000 inhabitants. It comprises 100,000 foreigners from every quarter of the globe. It contains more Roman Catholics than Rome itself; more Jews than the whole of Palestine; more Irish than Dublin; more Scotchmen than Edinburgh; more Welshmen than Cardiff. Has a birth in it every five minutes, and a death in it every eight minutes; has seven accidents every day in its 7000 miles of streets; has 123 persons every day, and 45,000 annually, added to its population; has 117,000 habitual criminals on its police register; has 23,000 prostitutes; and has 38,000 drunkards annually brought before its magistrates.—*Med. and Sug. Rep.*

VITAL STATISTICS OF PROFESSIONS.—Dr. B. W. Richardson, in his recent lectures upon the influences of Occupation on Health and disease, gave some interesting statistics of the rates of mortality among persons engaged in different professions and oc upations, derived from the official publications of the Register-General. He calculated that, taking 100 to represent the rate of mortality among all males in England and Wales aged fifteen years and upward, the rate, after due correction for the varying ages of persons engaged in the different occupations, was equal to 63 among barristers, 71 among the clergy, 102 among solicitors, and 106 among physicians and surgeons.—*Ibid.*

VALUE OF THE EUCALYPTUS.—We learn from the *Meteorological Magazine* that, at the Eastern *réunion* at the Sorbonne, some information was given by Dr. de Pietra, a delegate from the Climatological Society of Algiers, as to the results of an investigation made in Algeria to ascertain the importance and value of the *eucalyptus globulus* in relation to public health. It appears that reports were received from fifty localities where the aggregate number of blue gum trees is nearly one million, and from these reports the following conclusions have been drawn: (1) It is incontestably proved that the eucalyptus possesses sanitary influence; for (2) wherever it has been cultivated intermittent fever has considerably decreased both in intensity and in frequency; and (3) marshy and uncultivated lands have thus been rendered healthy and quite transformed. Similar results have been obtained in Corsica, where it is computed that at the end of the present year there will be upwards of 600,000 plants of eucalyptus in full growth.—*Scientific American.*

THE SO-CALLED TURKISH BATH is no modern invention. Hot-air baths have been familiar for ages, in almost all the countries of the world. William Penn found them among the North American Indians. But it was the Greeks and Romans who brought the art of hot-air bathing to its perfection in their luxurious baths. The Romans introduced the practice as one of the fine arts into our country during their occupation of it. But it seems to have departed from our island with the conquerors. The so-called Turkish baths are in reality Roman baths; and their introduction in the nineteenth century is only a revival of a practice which prevailed 1800 years ago among our ancestors.—*Med. Times and Gaz.*

BIOLOGY AND THE GERM THEORY.—In a recent lecture on Biology, Professor Huxley instanced the germ theory of disease as an illustration of the value of biological study. He said, 'There was little doubt now that infectious diseases were caused by living organisms, and if that should prove well founded it must needs lead to the most important practical measures in dealing with those most terrible of visitations. It might be well for the general public, as well as for the professional public, to have a sufficient knowledge of these matters to be able to take a rational interest in the discussion of such measures.—*Sanit. Rec.*

THE MOVEMENTS OF THE BRAIN, as described by Drs. Giacomin and Mosso, are as follows:—1. Pulsations produced at each contraction of the heart. 2. Oscilliations corresponding to the movements associated with respiration. 3. Undulations—larger curves of motion—caused by movements of the vessels during efforts of attention, or cerebral activity in sleep. The observations were made by the graphic method with one of Marey's instruments upon a woman who had lost a considerable portion of the frontal and parietal bones from the effects of syphilis.—*Lancet.*

THE SANITARY JOURNAL.

Communications solicited from Medical Men and others on all subjects pertaining to Public Health.

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OUR DAILY BREAD.

Amidst and notwithstanding the marked and rapid progress and improvement during the last quarter of a century or more in the art of manufacturing almost everything, the bread of to-day is, upon the whole, inferior to that made twenty years ago. It is now more difficult, more rare, to get a loaf of white, well baked, clean bread than it was then. The cause of this is frequently asked for, but never given or explained. It appears better wheat is now grown in the country than was twenty years back, from which better flour is made. But most of the better flour is sent out of the country, exported ; because it would seem the bakers or the people here will not pay the price for it that the bakers or the people of the East will. Private families frequently buy flour at least one grade better than that used by the average baker, and can hardly make any thing out of it that any one can eat. Yet the bakers contrive in some unaccountable way to manufacture a dark, mottled, doughy mass, commonly called a loaf of bread, which in the absence of anything better in this form the public for the most part are obliged to eat. Do the millers manufacture an inferior flour from the poorest wheat or middlings, which the bakers use, both classes, millers and bakers, doing this because the public are indifferent enough to buy it? There can be no doubt that something must be added to this flour, some adulterant, or the bakers could not make from it even the unpalatable, indigestible stuff which they do.

We do not profess to be able to explain *how* it is, that it is thus regarding bread, but it is a positive fact that the bread is not now even so good as it used to be. Twenty years ago there was more good bread, a white, well baked article was then more common, than now, in this city; and we believe Toronto is not at all exceptional in this respect.

But beyond this making bad bread from bad flour, there is, what has been several times referred to in this JOURNAL, the dirt. The exercise of the greatest care, by the cleanest baker, cannot possibly produce clean pure bread, as the *Medical Examiner* recently stated it, under the practice of 'flesh dough-kneading.' The perspiration, sensible and insensible, of the workers, and the epithelium or cuticle which is being constantly rubbed off the skin,—'truly not very different from the sweepings of a Turkish bath,' must mingle and become incorporated with the dough. Where bakers are not cleanly disposed and careful, the mind can hardly imagine or conceive the number and variety of 'foreign matters' and most unpalatable ingredients which find their way from the person of the worker and the vermin infested bake-room into the porous mass of dough. But the less the imagination dwells upon this state of things, the better probably the relish for the bread, and let us 'draw a veil over it.'

True, we can all, especially in Toronto, turn with a sort of 'feeling of relief' in the gastric region, to the one manufactory in Ontario of ærated bread, that of Mr. Nasmith, which certainly turns out a beautiful white, well baked article, that can be made, too, only from good flour. This being manufactured by machinery, there is no process of kneeding, and human cuticle and perspiration can hardly get into it. But it appears this is the only manufactory of the sort in Ontario; and many do not like the flavor of the ærated bread so well as that of the fermented.

The great want in this country is a system of inspection of foods; of bread, of milk, of flesh meats and vegetables, and especially of the two first. It seems most remarkable that though a great want of this sort may be universally acknowledged, yet it is so difficult a matter to get the want supplied. Sooner or later it undoubtedly will be supplied as regards the inspection of foods. How long the people will continue to suffer first, no one can say. It rests chiefly in their own hands.

'Home made' bread is so much preferred by many, that it is not easy to understand why it is not more generally made in households. The preference for this sort of bread is so general, that many bakers now manufacture an article called 'home made' bread, which, while in form and flavor, it resembles genuine 'home made,' the several samples of it which we have examined was as dark, badly baked and lumpy as the ordinary average baker's bread; and was evidently made from inferior flour. In the cooking-stove or range in almost every kitchen is an oven in which can be baked the best of bread, and with a little care, any average cook should be able to prepare and make it, without failures, if provided with *good flour*. If a cook does not understand how to make bread, the art is easily acquired; and a little thoughtful practice will make perfect. In this way both white and brown bread might be made at the same time, from the same yeast, and with the one trouble. Home made bread should never be eaten until it has been baked from 16 to 24 hours. This bread does not get hard or stale so soon as baker's bread, and if kept in a closed tin box, and in a dry place, will be found just as good at the end of a week as the day after it is baked. Besides the satisfaction and pleasure of having purer, cleaner, and more nutritious bread, families would find it great economy to have the bread made at home. We have had the assurance of several experienced and careful housewives that bread made in this way is much less expensive than baker's bread.

Ærated bread cannot be so readily made at home. Though it is not so generally relished, it is regarded by some as being more wholesome, and also more nutritious, as the fermenting process destroys a portion, though, to be sure, but a small portion, of the nutrient principle of flour.

WHEAT AS A FOOD.

Wheat, both in point of nutritive value, and in the ease with which it is digested, is the most important of the cereal grains, and perhaps the most important of our food-stuffs. With the single exception perhaps of milk, it will sustain the powers of the system for a longer period, and it approaches nearer to the standard of a perfect food, than any other substance known. It is richer in solids than any other article of diet; the proportion of water being very low, averaging only about 12 per cent., bulk for bulk. It contains from 10 to 15 per cent of gluten or vegetable fibrine, from 60 to 70 per cent. of starchy matter, a small proportion of fat, and some very important alkaline and earthy phosphates.

The quantity of gluten in wheat varies considerably; according to Sir H. Davy, hard or thin skinned wheat contains more than the soft or thick skinned, and is therefore more nutritious. This, and also the fatty matter and the phosphates are found in the greatest quantity near the surface of the grain, while the starchy matter exists chiefly in and about its centre. The coat immediately beneath the skin is particularly rich in gluten and phosphates, and is, consequently, very valuable as food. A considerable portion of it, however, is usually lost in the process of grinding, the result being a whiter but less nutritious flour. Those who use this food in the form of boiled cracked wheat, or brown bread, get the benefit of this most nutrient part. It is probable that in time some process will be invented by which the outer skin alone, without a trace of the nutrient matter, may be removed. As it is, the bran contains much of it.

Cracked wheat, well boiled, especially with milk, forms the most nutritious food that can possibly be obtained. With most individuals it is readily digested. It is certainly an easily digisted food if eaten slowly and masticated. Those with whom milk doos not agree well, can eat the boiled wheat with a little sugar or butter, or both, in moderation. The very best wheat only should be used for this purpose, and it should be boiled slowly for at least half an hour or, better, longer.

CASES OF DEATH IN REGISTRATION.

It is to be feared that in registering the causes of death, medical men sometimes do not give due consideration to the importance of giving the causes fully, plainly, and comprehensively. 'Syncope' and 'Thrush' are unsatisfactory, to say the least, when given alone as causes of death; 'Teething' and 'Worms' are yet more so; while 'Putrid fever,' and 'Syncope of heart,' can hardly be regarded as quite in accord with modern nomenclature. Yet such causes are found in the Registrar's books in this city, with the names of leading medical men as having attended. This must arise, surely, from 'want of thought.' It is very desirable, indeed, for the satisfaction and benefit of all, medical men and lay, that more careful thought should be bestowed upon this important matter, and causes of death, the immediate, and often even the more remote causes, should be carefully given by physicians, when possible; when not certain, the *supposed* cause.

Ivory Jelly.—This jelly, which is prepared from pulverised ivory, is very palatable, and, as it contains the bone phosphates in (according to Mr. Dugald Campbell's analysis) a soluble condition, it may be very fairly supposed to possess, for some invalids, a higher nutritive value than that of the ordinary jellies. It is manufactured and sold by Mr. T. K. Callard, Blenheim-terrace, St. John's Wood, and by Messrs. Callard and Callard, Queens's-terrace, St. John's Wood.

Annotations.

MICHIGAN STATE BOARD OF HEALTH.

The regular quarterly meeting of this State board of health was held on July 10th, at Lansing. The following portions of the proceedings are of general interest.

Dr. Kedzie made a short report on the chemical examination of a specimen of cheese believed to have caused sickness in several families. He examined it for all the mineral poisons but found none. He concluded that the poison must be organic in its nature, and that it might come from one of three causes. 1st, diseased milk; 2nd. chemical decomposition after it was made; and 3rd, bad rennet. This poisoning by cheese being so common, he was authorized to visit various cheese factories and investigate the subject.

Dr. Kedzie also made a report on the illuminating oils, in which he stated that the legislature had maintained the standard flash test of 140°F. and had provided a chill test for parafine which will require an improved quality of oil.

The board adopted the following:

'WHEREAS, by means of vaccination and re-vaccination the people may secure immunity from small-pox. *Resolved*, that all local boards of health be advised and requested to direct their health physicians to offer every year vaccination with bovine vaccine virus to every child not vaccinated within five years, without cost to the vaccinated, but at the general expense of the locality, as provided for townships in section 1736, compiled laws 1871.

The secretary was directed to have the document relating to treatment of the drowned reprinted, and to secure 6,000 copies for gratuitous distribution.

Dr. John S. Calkins, a regular correspondent of the board, was requested to investigate the outbreak of diphtheria at Rochester.

Secretary Baker made a report concerning work done in his office during the last quarter. It mentioned the distribution of 10,094 copies of a pamphlet on the restriction and prevention of scarlet fever. These have been distributed to a little less than 10,000 persons in various parts of the state.

The amount of work accomplished by the board, and that transacted in the secretary's office seemed to be a surprise to the new members of the board, and Rev. Mr. Jacokes urged the importance of placing some account of it before the people.

The English ivy, growing over the walls of a building, instead of promoting dampness, as many persons suppose, is said to be a remedy for it; and it is mentioned as a fact, that in a room where damp had prevailed for a length of time, the affected parts inside had become dry when ivy had grown up to cover the opposite exterior side. The close, overhanging pendant leaves prevent the rain or moisture from penetrating the wall. Beauty and utility, in this case, go hand in hand.

LIFE AND GROWTH UNDER BLUE GLASS.—Mr. J. Montgomery, of Woodstock, Ont., has sent a communication to the *Scientific American* on the germination of seed under blue glass. He procured two small tin boxes, and filled them with garden soil, and put into each box 6 peas (each pea weighing exactly 6 grains) and 6 kernels of popcorn (each kernel weighing exactly 3 grains). One box he covered with strips of blue and common window glass, the proportion of blue to common glass being about four to one. The other box he covered with common glass. He watered the contents of the two boxes once a day with the same amount of water, at the same temperature. At the end of two weeks he removed the earth from the young plants by gentle agitation in water, carefully dried them between sheets of blotting paper, and weighed them. He gives a table showing the weight of each plant under the different colored glass. It was found that, after deducting the original weight of each, the average increase of the corn under the blue glass was 14 grains, while the increase of that under common glass was 18 grains, or four grains in favour of common glass. The average increase in the peas under blue glass was 22·5 grains, while under the common glass it was 25·37 grains, or 2·87 grains in favour of the latter. There was but little difference in the time of germination. The corn under the blue glass was streaked lengthwise of the leaf or blade, with deeper and lighter veins of green.

BOOK NOTICE.

THE FORTNIGHTLY REVIEW, edited by John Morley; Toronto: Belford Bros.

The Fortnightly Review has been for years the acknowledged organ of so-called liberal thought in England, and it has been an unquestioned success as a periodical. It reflects no small degree of credit upon Canadians as readers that the above enterprising publishers have felt from their experience so far encouraged as to induce them to arrange for its publication on this side the Atlantic.

The first article in the August number, which we have received, is on the 'Secret Societies in Russia,' by that *authority*, Mr. D. Mackenzie Wallace, is a *resumé* of Russian history, and a lucid exposition of the causes which have filled Russia with secret Societies. Mr. Grant Duff, in a 'Plea for a Rational Education' enters a strong indictment against what is called a classical one. He formulates a system of education, and, amongst other things, insists on a good knowledge of at least one modern language, and a *general acquaintance with the laws of health;* and that which Englishmen often lack, a knowledge of geography.

'Sea or Mountain?' by Dr. J. Burney Yeo, is a discussion on the relative advantages of sea air and mountain air as restoratives to health. Their points of similarity and their differences are dwelt on; what patients should choose sea, and what mountain regions; at what ages they should elect one or the other air, &c. Medical men will find this a highly interesting and instructive paper.

Last year, at the meeting of the British Medical Association, Dr. Yeo gave his opinion as to the mode in which mountain air acts in the treatment of pulmonary consumption.

We have long believed, and experience has strengthened the belief, that in most cases wherein 'change of air' has proved beneficial, except in established pulmonary affections, the benefit has been derived simply from the *change*. Life is all change; and monotony tends deathward. And Dr. Yeo concludes his paper in the Review as follows: 'Whether we seek health in the mountains or by the sea, in either case we shall find change—that change which is the type of life and the condition of health; that change which is rest. And who shall estimate the moral, as well as physical, refreshment we gain by changing the sordid routine of city life, the 'greetings where no friendship is.' for the contemplation of the solemn moods of nature, whether on sea or mountain? Looking on these eternal realities, in the grandeur of their calm repose or in the majesty of their roused anger, we recover that sense of proportion which we are so prone to lose—our sense of the relative proportion of the individual to the whole. Or, if we need no such stern remindings, we may seek changeful Nature in her gentler moods in the soft woodland shade, and there amid the perfume of flowers, the songs of birds, and the murmur of the trees, we may, as well as by the sea or on the mountain, recover health of mind and body as we—

'Draw in easier breath from larger air.'

The next article, 'Caviour,' is a painting, in type, of the great Italian statesman, with the history of modern Italy as a background; 'The Indian Civil Service,' and 'Three Books of the Eighteenth Century,' by the Editor, (The three books are by Holbach, qnly one being treated of in the present paper,) follow; these, and several pages on Home and Foreign affairs, make up the volume, of over 150 large pages.

THE DOCTRINE OF CONTAGIUM VIVUM is one of the great 'questions' of the day, and the admirable character of the paper on this subject in this number of the JOURNAL must be sufficient apology for its great length, occupying so much space. It could not, in justice to its author or the reader, be abbreviated; and we have given it in full. The *Medical Times and Gazette*, though not yet assenting to the doctrine therein elucidated, says in reference to the address: All those who know Dr. William Roberts, directly, or indirectly through his writings, will have looked for an Address of more than ordinary excellence and finish; and certainly that expectation has not been disappointed. It is a lucid and forcible exposition and justification of his beliefs and theories on his chosen topics.

DAIRY CONTROL IN GERMANY.—The German Society for Public Health at Berlin has appointed a commission for the control of such dairies as are in the hands of private individuals, in order to secure a upply of pure milk for that city.