

## REVIEWS.

ART. XII.—*Causes générales des maladies chroniques, spécialement de la Phthisie Pulmonaire, et moyens de prévenir le développement de ces affections, &c.* Par A. FOURCAULT, de l'Académie Royale de Médecine. Paris, 1844.

*On the general causes of chronic diseases, particularly consumption, and the means of preventing the development of these affections, &c.* By A. FOURCAULT. Paris, 1844, pp. 480.

IN 1840 the Montyon prize of the French Institute was conferred upon M. Fourcault's experimental essay on the functions of the skin; the present work is mainly the application of the principles then established by the same author, to explain the causes of and to discover a rational mode of treating many chronic affections. He, in common with the most reflecting among scientific physicians saw that medicine had come to a pause, that in pathological anatomy the field of discovery was well nigh exhausted; that symptomatology, so far at least as chronic diseases were concerned, had nearly reached perfection, while the same class of disorders continued to be almost if not quite as rebellious to the power of art, as in the most uncultured age. The medical profession, too honest for its own immediate profit, confessed its impotence, and saw, nay, at this moment sees, thousands of patients flocking to homœopathy, hydropathy, and other deceptive systems, whose peculiar province it is to *promise* the cure of chronic disorders of every kind, including consumption. What matters it that so much time and labour have been consumed in tracing the history of tuberculous depositions from their first appearance to their final and fatal stage, if, after all, the disease must be confessed incurable? Indirect and secondary service the knowledge of this history does indeed render, for it puts it in our power to discriminate between incurable cases of phthisis, and curable cases of other diseases which only resemble it. Such knowledge is indeed precious, and it has not perhaps been too dearly purchased, but it is not that which was proposed as the object of the researches that have been made, nor that most to be coveted. If the study of the natural history of a disease does not lead to its prevention or cure, it deserves no higher title than that long since applied to the expectant method in therapeutics,—“a meditation upon death.” Fortunately for the progress of science, happily for the encouragement of all who are inclined to despond when they reflect on the feebleness of art, no truth can be discovered without profit. No matter how insignificant in appearance, no matter how isolated, no matter how anomalous, every truth conceals the germ of some other truth, and though, like the seed of plants it may long lie buried and forgotten, it will one day show that it contains a principle of life, and that it forms a fitting portion of the great harmony of nature. Let this console us when we see men starting from falsehood to run into error, building up theories which seem fair and strong, but which rest upon the basis of imperfect or counterfeit facts; let us feel sure that there is some solidity in the foundation though the corner-stone may be unsound, and that a permanent structure may yet be reared in the place of that which the

next tide of opinion must sweep away. It would be easy to show that the minute study even of incurable maladies is highly profitable, not only because it leads to experiments which may result in a palliative treatment, but because it fixes the attention on the generation of the disease, leads to a discovery of its causes, and ultimately to the means of its prevention. The mode in which disease is generated, the connection between its active external causes and the primary physical change, the produce in the economy, is evidently the first point to be ascertained, if possible, in settling its prophylaxis. The organic lesion of the solids, that of the fluids, and their atomic or chemical alterations, together with the mode in which external causes produce these alterations, such are the elements needful to be known before it is possible to *explain* the influence of any preventive system in medicine. The method must be established by observation and experiment, that is, empirically; the *rationale* of the method is merely the demonstration that it belongs to some class of facts already known, or falls under some principle previously settled. But the method is neither better nor worse because its rationale is understood. The distinction which is here insisted upon should never be lost sight of in philosophical investigations, and especially in all discussions relative to the connection of cause and effect; for although there may be a constant and uniform relation between an antecedent and its consequent, the bond which unites them may be quite invisible, nay, altogether inscrutable. There is an evident connection between depletion and the cure of inflammation; but who has explained in what it consists? Mercury favours the removal of plastic deposits, but who has definitively settled the *modus operandi* of mercury? Yet we no more doubt the real influence of these two remedies, than if we were in the secret of those mysterious processes through which their useful results are accomplished. When, therefore, an author professes to teach us the mode in which a particular disease or class of diseases is generated, and by observation clearly establishes a connection between certain external causes and the disease or diseases, and then adduces analogical proof in order to show the manner in which the causes and their effects are bound together, it is evident that the two portions of his argument are of unequal value; we are obliged to assent to that which is based upon correct observation, but we are at liberty to reject that which has only the force of analogy. The one part is proved, the other is, at best, only probable.

In the work before us these two sorts of argument are adopted. The author endeavours, and we think successfully, to show that the most common causes of chronic diseases are inaction and moisture combined. So far his theory is a pretty accurate generalization of facts. Further, he demonstrates experimentally, that several chronic disorders are produced in animals by arresting the secretory function of the skin. Finally, he concludes that consumption, albuminuria, &c., result from a deficient action of the skin, depending upon inactivity, moisture and their various combinations with other secondary agents. Now the value of this conclusion is entirely dependent on the closeness of the analogy between the condition of the animals in his experiments, and that of human beings subjected to the causes of disease indicated by him. But whether this be greater or less, and whether therefore the conclusion be more or less accurate, the truth of the first proposition, of the etiology that is, attributed to chronic maladies, is not in the least weakened, nor are the therapeutic, or rather prophylactic methods which it suggests, at all less worthy of being examined, and tested in practice. In the notice we are about to give of M. Fourcault's

work, we shall, for the reasons now assigned, dwell principally upon his description of the causes of chronic disorders as established by observation, adding, however, the explanation to which his experiments on animals conduct him, but without admitting either its correctness or its necessity.

In examining what has been written on the etiology of phthisis one cannot help being struck with the almost entire absence of satisfactory information upon this point. Amongst the reasons of this defect, one is very evident, that nearly all the statistics relative to the disease have been furnished by hospitals, prisons, and other public institutions whose inmates are taken almost exclusively from the lowest classes of society in large cities. Thus are left out of consideration people of the middle and upper ranks, and nearly the whole rustic population, and yet nothing can be clearer than that a comparative statement of the frequency of consumption in different classes, occupations, localities, &c., can alone lead to a knowledge of the general causes which influence its production. This, M. Fourcault professes to have accomplished. His observations were made in France, Italy, Belgium, Holland, and England, in hospitals, asylums, public workshops, houses of refuge, various manufactories, and agricultural settlements, and yet he was able, as we shall presently see, to detect the same class of causes operating uniformly under all these different circumstances, wherever consumption and certain other chronic disorders prevailed.

The first of these causes he describes as the influence of sedentary pursuits and of *réclusion*, which word includes want of exercise, light, and air. Although most writers upon etiology and hygiene have pointed out the evil effects of unremitting labour in close, dark, and badly ventilated rooms, they have not exhausted the subject, nor shown the reason of the singular uniformity with which the same diseases are produced under similar circumstances. They have dwelt chiefly upon secondary causes, or those affecting particular organs, such as position and foul air with their relations to hæmatisis, rest and bad food with their influence on nutrition, &c. Our author without denying to these agents a share in generating disease, finds that his facts contain the expression of a more general and primary cause, to wit, the derangement of the excretory functions of the skin.

In France, towns with a population of about two thousand souls, composed chiefly of farmers, mechanics, and persons of small fortune, owe from one 40th to one 60th of their mortality to consumption, when they are situated on mountain slopes, on high table land, in dry and open valleys, or in fertile plains. And even then the disease is extremely rare amongst those who till the earth or are employed in very active labour of any kind, while its victims are taken almost exclusively from amongst the sedentary, those who exercise only their fingers or hands, who are rarely in the open air and never exposed to bad weather. Such are sempstresses, dressmakers, ironers, embroiderers, spinners, weavers, tailors, and turners, and females who lead an indolent and luxurious life. On the other hand butchers, blacksmiths, wheelwrights, carpenters, cabinet makers, drovers, road-makers, carters, and day labourers, with women who work in the country exposed to every kind of weather, for the most part enjoy an exemption from the ravages of phthisis, except where the climate or the locality is habitually damp. It is not sufficient that the individual's trade should expose him to moisture; so long as his labour maintains the free action of the skin he is in no danger. Hence tanners, wool-washers, washerwomen, soap-makers, are remarkably free from consumption. Even coalminers, if they do not remain very long under ground, are not often attacked

with consumption, because, in spite of the darkness, dust, and moisture, in which they work, the perspiration is kept up by the severity of their toil. No doubt that insufficient and unwholesome food increases the energy of the causes now mentioned, or rather diminishes the power of man to resist them, especially in damp climates. But in villages occupying salubrious sites our author declares that although he has seen much extreme poverty, he has observed very little consumption. There the cottages were often open to the four winds of heaven, the children barefooted tramping through the mud, and their parents with scarcely a rag to their backs, during the cold blast of winter, that they might beg upon the highway. And yet colds and croup are rare amongst such people. It is well remarked that wild animals, the horses of our prairies for instance, have the most beautifully smooth and glossy coats, and are full of life and vigour, while our domestic animals are only preserved from the glanders, cutaneous eruptions, &c., by the removal with the curry-comb of the crust which rapidly forms upon their skin when confined to the stable. The frequency of tuberculous disease in cows and dogs, and in animals exhibited in menageries, affords another illustration of the importance of air and exercise to health, while it is confirmatory of the opinion that an intimate connection exists between the health of the skin, and that of internal organs. A curious fact to the same purpose is recorded by Parent-Duchatelet. He mentions that a large number of prostitutes who have abandoned their infamous trade and entered the houses of reform where they are employed chiefly in needle-work, die of consumption and other chronic disorders, whereas they are fresh, fat, and healthful so long as they are free to pursue their business in the open air and in all weathers. In religious boarding-schools and convents where the exercise is infrequent, or restrained within very narrow bounds, all the signs of a lymphatic constitution are developed, and scrofula and consumption decimate the ranks of the pupils. When want of exercise, light, and air, begins to act at birth, we find its subjects presenting, during infancy, many cases of rickets, somewhat later of scrofula, and, after the age of puberty, those who have survived are extremely apt to perish by phthisis. Or the predisposition may be cured by a change of life. Thus at Scheveningue, in Holland, a fishing town of about 5000 inhabitants, phthisis is a rare disease; and yet the children who crowd the narrow houses of the poorer inhabitants are very subject to scrofula. But no sooner do they reach an age at which they can be useful at sea, than their scrofulous disease, and even their tendency to it, is cured, not by saline emanations, as some would have it, but by fresh air, the light of heaven, and active exercise. In comparing the mortality of the almshouses in large cities with those in the country where the paupers are obliged to work in the open air, the difference is found to be enormous. To cite a single example of the comparison; the mortality in the former was 1 in 16, and in the other only 1 in 75. Again on comparing the mortality of the poor-houses of Holland and Belgium with that of the population in general, it appears that the former is about five times greater than the latter. "How many," exclaims our author, "how many of those whom the law ought to protect, are literally condemned to death for having asked charity!" We commend this fact to those who have the making of our poor laws and the management of our paupers. It is bad enough that the public should be made to pay first for erecting an absurd palace, and then for the support in it of some hundreds of lazy vagabonds, but it is far worse that the people should also pay for rendering these persons a still heavier burden upon society. Why

are they not made to work, not at picking oakum nor even at weaving, which sooner or later enervates and injures them, but at such occupations as shall stir up what little manliness is left in them, to make them feel the dignity of honest labour, and blush at eating another man's bread? It is a very questionable benevolence that degrades the object of its charity.

In prisons and penitentiaries there appears to be the same tendency to the production of scrofulous and tuberculous disease; in many of them the deaths from phthisis exceed one-half of the total mortality. A remarkable exception is furnished by the military prison of St. Germain-en-Laye, an exception, however, which confirms the rule: for that prison is in a lofty situation; the prisoners are obliged to exercise a great deal, and they work in large and well-ventilated rooms.

In our Eastern Penitentiary the deaths from phthisis and serofula alone amount to nearly seventy per cent. of the whole mortality, if we may take the reports of four years as affording sufficient data. Doubtless many of the prisoners have their health greatly impaired at the commencement of their incarceration, but we cannot suppose that this fact would explain the enormous mortality amongst them from a single form of disease.

M. Fourcault derives additional confirmation of his views by observing the influence of manufactures, asylums, &c., on the children who are brought up in them. Everywhere he finds the greatest number of victims to disease of the bones, to serofula, and consumption, among those who are most closely confined to their tasks. In the general hospital of Lille, which is also a workhouse, there is a large number of children of both sexes, foundlings and orphans, who have been kept in the country until able to work, and then brought into the city. The girls occupy large and well-aired halls where they are employed in needle-work; the boys are hired to tradesmen in the town. The latter retain their good health; the former, on the contrary, wither in the midst of a precocious growth: they become chlorotic, their catamenia are irregular, and the greater number of them die of marasmus, rickets, serofula, or caries of the vertebræ; very few, indeed, are cut off by acute disorders. At Vienna, the girls in a charitable institution were peculiarly subject to chronic disorders. Their physician observing that the windows of the room where they worked were very much obstructed by the foliage of some mulberry trees, caused these branches to be pruned, so as to admit more light and air into the building. The result was very gratifying, for the scrofulous affections of the eyes, skin, &c., of the inmates were considerably diminished both in frequency and severity. At Marseilles, in an orphan school, which has every advantage of situation and interior arrangement, there were 45 deaths by phthisis, out of a total of 68, during 21 years. In the town itself, this malady prevails to a frightful extent amongst the shoemakers, while it passes by the labourers, fishermen, sailors, and others who work on the wharves, and are exposed to the dampness of the open air. These facts show that exercise is not less essential in warding off tubercular disease in warm than in cold climates.

Not many years ago, it was the fashion to accuse the manufacturers of England with being wholesale murderers. We were told that the children employed by them did not long survive in an atmosphere loaded with dust, and that they perished by consumption. It now appears, however, that manufactories are prejudicial to the health only when the operatives are crowded together in small rooms, and obliged to work for too many hours at a time. Then, indeed, all the diseases of a lymphatic constitution

prevail amongst them, not because they inhale particles of cotton, or other material, but because they breathe an impure atmosphere, maintain the same position, often from sunrise to sunset, are half-starved, half-clothed, and utterly hopeless. The tables of mortality prepared by the British Registrar-General, the testimony of witnesses before parliamentary committees, the publications of physicians in the manufacturing districts, all combine to show that scrofula and consumption are not only not caused by factory labour, but rather prevented by it; and that whatever superior mortality may exist in manufacturing communities over rural districts, must be attributed not to the factories but to the dampness, ill ventilation, and vice of the large towns. The conclusions of English observers are fully confirmed by the researches of M. Fourcault, and by those of M. Villermé in France. All these authorities concur in the statement, that upon analyzing the cases of phthisis, scrofula, &c., actually occurring amongst those employed in factory labour, by far the greater number of them are furnished by the workmen whose occupation requires them to remain very steadily in the same position. Thus, at Lyons, an immense proportion of the silk weavers die of consumption. Many of these toil from sixteen to seventeen hours out of the twenty-four, and during the whole of that time the left leg of the workman remains almost motionless, and becomes cold, swollen, and varicose. Of course all the evils inherent in a trade like that of the handloom weaver are aggravated by incidental causes, such as the want of work and the reduction of wages caused by embarrassments in the commercial world. In other towns in the south of France where silk is manufactured, a similar frequency of phthisis is to be observed, and in the hospitals of these towns the mortality from tubercular disease is nearly one-third of the whole. In other manufacturing towns, those for instance, where cloth is made, the proportion is considerably less; but there the labour is conducted in spacious halls, and demands a good deal of activity and strength. On comparing the statistics of the large hospitals of Amsterdam, Lyons, Bordeaux, Arles, Rouen, and Paris, it appears that the average mortality from phthisis is very nearly the same in all of them, although the climates of the several places are very unlike each other. But, as remarked by M. Fourcault, it is not to be forgotten that the social and hygienic conditions of the inmates of all these hospitals are almost identical. They are equally ill-lodged, ill-fed, and accustomed to live in dark, damp places; in other words, they are exposed to causes of phthisis hardly less active under a southern than under a northern sky. The influence of climate, however, is shown by the mortality amongst persons less exposed to the other causes of consumption, soldiers for example. It appears that those of Holland are very subject to this disease, those of Belgium less so, of France still less, and of the French army in Algiers, least of all. In the first-named place, the mortality may be computed at about one-third, but in Algiers it does not exceed one-hundredth of the whole. Consumption is said to be much more prevalent amongst the infantry than amongst the cavalry. On the other hand the superior efficacy of other causes than climate is shown by the comparative statistics of consumption in Rome and Naples. The former city is subject to very sudden and extreme changes of weather, yet its principal hospital does not furnish more than one-half as many cases of phthisis as does the corresponding charity of Naples, whose climate is more steady and mild. In the Neapolitan hospital, M. Fourcault states that nearly all the cases of tubercular disease observed by him, were in persons of sedentary pursuits, or who occupied damp, and close rooms. Not one

of them was from among the sailors, fishermen, hackney coachmen, or *lazzaroni*, all very numerous at Naples, but all living habitually in the open air.

In view of all these facts M. Fourcault appeals to parents and all who have any controul over the physical education of youth, to governments and all who can improve the sanitary condition of the poor, to aid in arresting the waste of life which can be attributed to want of air, exercise, and light, and the consequent suppression of the cutaneous transpiration. The means proposed by him we shall notice hereafter.

After a short chapter devoted to showing that quadrupeds are, quite as much as the human race, disposed to become tuberculous under the influence of the causes which have just been enumerated, our author passes to the consideration of the connection of humidity with the development of chronic disease. And here he has reference chiefly to moisture depending upon atmospheric causes, rather than to that existing in the cellars, lanes, and courts of populous towns. This cause had by no means escaped the notice of medical writers, amongst whom M. Fourcault refers to Hippocrates, Aretæus, and Sydenham. Even Broussais, whose hypothesis concerning the generation of tubercles was made to square with the rest of his system, bears witness to the fact that the moist climate of Holland is very productive of consumption. Moisture will act variously according to the temperature of the air, and its state of calm or motion. With a steady and high temperature it gives rise to disorders of the head and bowels; with sudden, and especially periodical changes of temperature at short intervals, it generates intermittent fevers, and congestion of the abdominal viscera; with a low temperature it causes affections of the lungs and dropsies; and in all these instances, according to our author, by its action upon the skin by the arrest of its perspiration. The influence of a moist atmosphere is visible in comparing the mortality of towns and villages in elevated positions, with those situated in close and damp valleys. In the latter, the deaths by consumption form about one-eighth or one-tenth of the mortality, but in the former not more than one-fiftieth, sometimes only one-hundredth. In the valley of the Eure is the town of Anet, and not far from it is the village of Ezy. But the town occupies an elevated and sandy part of the valley, exposed to every wind, while the village lies low, being also sheltered on two sides by hills, and on the other two by lofty trees. In the former, acute diseases prevail, and the mortality from consumption does not exceed one-fiftieth; in the latter, scrofula and other chronic disorders abound, and about one-eighth of the deaths is owing to consumption. The two portions of the village of Fontenay-Saint-Père, present a state of things almost identical with that just described. So, too, if we examine the effects of moisture in large towns, we find that the same diseases prevail wherever its influence is manifest. The higher and dryer parts of the city present a great many cases of acute disease, the lower parts, especially when the streets are narrow, and the houses crowded, damp, and high, abound in scrofulous affections of every sort. If, in the same way we compare countries which enjoy a dry climate with those whose atmosphere is constantly moist, we shall arrive at the same result, that is if we compare together the entire population of each, and not that merely of cities, for in them the local causes of chronic disease exist almost equally in all climates. Thus, we shall find that in Great Britain and Holland, where the atmosphere is saturated with moisture, scrofula in all its varieties, and pulmonary consumption are the most prevalent and fatal maladies. From one-sixth to one-fourth of the

annual mortality of England and Wales is due to phthisis; and the proportion would be, our author believes, still greater but for the traveling propensities of the inhabitants, the large number of them employed in the national and commercial navy, and their immense consumption of "rosbif" and "befecks," by all which the strumous diathesis engendered by the climate is more or less corrected.

It has long since been noticed that in situations where intermittent fevers prevail, consumption is a very rare disease: the one affliction seeming to exclude the other. Some physicians of note, but who were more ready to jump to a conclusion than to reach it by careful induction, at once determined that if these things were so, there could be no better residence for their consumptive patients than on the edge of a swamp, forgetting that it is one thing to prevent a disease, and another to cure it, that a very different process is required to prevent one's receiving a pistol-ball in his body, from that which is needed to extract it or to render its presence innocuous. The fact above alluded to is certainly very curious, nor has any satisfactory explanation of it yet been given; but it would be more curious still if we were to admit with M. Fourcault, that the causes of phthisis and intermittent fever are essentially the same. Our author is a staunch anti-miasmist, and accordingly finds it easy to account for the production of intermittent fevers by moisture, heat, and diurnal vicissitudes of temperature, conditions no doubt favourable to the generation of those diseases, but which cannot be admitted to be alone adequate to such an end. However this may be, it is very certain that if moisture causes intermittent fever, it is by a sudden and temporary impression upon the system, and that when it causes phthisis it is by a slow and gradual action, and by combining its influence, not with heat nor with a changeable temperature, but with a pretty uniform coldness of the external air or of the place inhabited by the subject of the disease.

In some remarks on the influence of physical agents on the development of the organism, M. Fourcault contrasts the high stature and symmetrical forms of the inhabitants of plains and mountain sides, with the short and awkward figures of the dwellers in deep and narrow valleys where the air stagnates and the sunlight penetrates imperfectly. To the last-named circumstances he attributes the origin, at least, of cretinism and goitre, admitting their perpetuation by inheritance. In support of this opinion he adduces the gradual degeneration of the race in places where manufactures, upon the old system, have been long established, in coal districts where mining has been long carried on, and in some of which it has been found impossible to raise conscripts of the legal stature; he refers also to the diminutive persons of the Laplanders who pass the greater part of their lives in burrows under the snow.

We have now presented the first branch of M. Fourcault's argument, the facts which go to show the very important part played by several agents, such as moisture, and a want of exercise and air upon the production of scrofula and tubercles, and we might, with propriety, proceed at once to develop the plan which these considerations clearly suggest for preventing the diseases just mentioned. But we prefer giving a statement of our author's experiments on the functions of the skin, because they are in themselves very interesting, because they add to our store of physiological and pathological facts, and because they will afford to those who must have everything explained, a very ingenious *rationale*, and one that will answer quite as well as another until the advent of the next new hypothesis.



The experiments of M. Fourcault are, as was allowed by the committee of the academy to whom his memoir was referred in 1840, entirely original. His object was to determine what would be the effect of artificially suppressing the cutaneous excretion in animals. For this purpose he coated with glue, varnish, pitch, dextrine, &c., various animals, such as horses, dogs, rabbits, and fowls which had been previously shaven or plucked. The results varied with the impermeability of the coating and the extent of surface upon which it was applied; they also varied in kind, but they most commonly consisted in some modification of an internal secretion. Thus the mucous membranes were often the seat of an unusual discharge; in a horse, for example, whose skin was well covered by an adhesive preparation, a profuse running from the nose took place which had many of the characters of the secretion in glanders. A similar flow occurred in sheep treated after the same manner, and their nasal mucous membrane examined after death presented the appearance of an intense inflammation; in rabbits and in dogs diarrhoea was established and the intestinal mucous membrane was found injected, thickened, and even softened, after death. In other cases the flux took place from certain serous membranes, as the pericardium and the pleura: in others again paraplegia was produced, or the subjects of the experiments dying of marasmus, tubercles were found in their lungs. If the coating occupied only a portion of the skin the animal died slowly, but if the cutaneous exhalation was completely suppressed death came on much more rapidly, and appeared to be the immediate result of asphyxia, for the subjects breathed rapidly and laboriously, and often perished in convulsions.

On dissection the veins, and the right side of the heart particularly, were found filled with dark, liquid, or imperfectly coagulated blood. When only half of either side of the animal was covered with an adhesive coating the cutaneous capillaries of that portion were gorged with dark and fluid blood, while those of the portion exposed to the air contained red blood, and in smaller quantity. These two regions were separated by a distinct line of demarcation. From these facts it is fair to conclude that one consequence of arresting the functions of the skin is the liquefaction of the blood. But M. Fourcault is by no means content with an inference which would still leave open the question,—what are the functions of the skin? He has satisfied himself by a series of experiments that the human skin and that of the mammalia do not eliminate carbonic acid, and, therefore, do not absorb oxygen enough to assist hæmatosis. Consequently the skin is, according to him, an excreting organ, and the effect of the impermeable coating used in his experiments, is merely to throw back into the circulation the effete liquid and gaseous elements which should have been eliminated from it. We shall presently see what he regards as these injurious agents.

In order to attach a more positive value to these results of experiment, our author very properly remarks that it is essential for him to show that man, like the lower animals, dies of asphyxia when an impervious coating is laid upon his skin, and he promises to bring forward proofs of this in a forthcoming work. Meanwhile his argument has but one leg to stand upon, or at least has an awkward limp. He cites, however, one instance in point which is certainly curious. At Florence, shortly after the coronation of Leo X, a child who was covered with gold leaf to represent the golden age which that pontiff was about to revive, fell a victim to this new philosophical experiment. M. Fourcault says that he has gilded, silvered,

and tinned the skins of several Guinea pigs, and that they all, like the Florentine child, died.

The influence of an impervious coating on the development of animal heat, is very remarkable. Breschet and M. Beequerel, in repeating M. Fourcault's experiments found that they were always accompanied by a singular loss of temperature in the subjects of them. Thus in a rabbit sheared pretty closely and well varnished, the temperature fell in the course of half an hour from  $100^{\circ}$  to  $90^{\circ}$ , and in half an hour more to about  $78^{\circ}$ . Another rabbit was very closely shaven, and the varnish applied to his skin allowed to dry for an hour and a half. At the end of that time the temperature of the animal's thighs was only a little more than  $5^{\circ}$  above that of the surrounding air, which was then  $62^{\circ}$ ; so that in the course of the experiment the rabbit had lost about  $33^{\circ}$  of heat. In another hour and a half it died. Similar results were obtained by M. Fourcault on exposing animals deprived of their fur or feathers to cold or moisture, or confining them in baths of oil or water, or covering them with a layer of tenacious clay. As the temperature of the animals fell, their strength declined, but even when their death seemed imminent they could be restored by allowing the air to have access to the skin, and by placing them in an atmosphere of about  $80^{\circ}$  or  $90^{\circ}$  of temperature. Rabbits, Guinea-pigs, cats, and birds, even ducks, were placed in baths of water or oil between  $60^{\circ}$  and  $70^{\circ}$  of temperature, but allowed to breathe and move freely in them. Yet they all died, although in a medium warmer by  $35^{\circ}$  than that in which during the winter season they preserved their natural temperature almost unimpaired. The baths of oil were less promptly fatal than those of water, but both rapidly so in proportion to the lowness of their temperature. This result our author attributes chiefly to the conducting power of the water, but partly also to the absorption of that fluid by the skin, which was proved as well by its being vomited during life, as by its being found in the body after death. On the other hand he observed that it was easier to restore animals exhausted by immersion in water than those which had been plunged in oil, for the former medium acting principally by lowering their temperature did not so effectually suppress transpiration as did the oil. In the victims of the oil-bath the same alterations of the blood and local lesions were observed as in the animals destroyed by an impervious coating upon the skin. Even frogs suspended in oil so as not to interfere with their breathing soon perish, while they live long, perhaps for an indefinite period, in water that has been deprived of its air by boiling. These experiments, our author regards as invalidating the commonly received opinions on the respiratory function of the skin of batracians. From a general review of the results of the experiments now detailed, it would appear that a complete interruption of communication between the skin and the atmosphere is attended with a liquefaction of the blood, and a depression of animal heat and vigour; and further that the contact of a cool liquid or of a moist and cool atmosphere rapidly lowers the temperature of an animal, and may increase unduly the proportion of water in the blood and other fluids. Consequently whatever grounds M. Fourcault may have derived from the first series of experiments (in which varnish, &c., were applied) to believe that death was caused by the repulsion of effete matters into the circulation, he can derive none whatever from the second series in support of the grand idea of his theory. We cannot conceive what possible application the results of the first series can have in ordinary medical practice, and least of all what light they throw on the etiology of scrofula and phthisis. There

is some analogy indeed between the admitted causes of these maladies and those to which the phenomena of the *second* series of experiments were due. Cold and moisture produce scrofula, &c., they also destroy animals under certain circumstances. Varnish upon the shaven skin of a rabbit may kill it by altering its blood; a coating of gold leaf, of mud, of paint, or any other adhesive substance may have the same effect upon a man. But, surely, it does not follow that cold and moisture directly modify the elementary composition of the blood: if any inference is permissible it is that they have no such effect. So far, then, we are obliged to conclude that M. Foucault's experiments with impervious coatings afford no explanation whatever of the etiology of consumption and scrofula; and that his experiments with water and moist air instead of showing what he desired to prove, that these agents are injurious by repressing the perspiration, do, on the contrary, prove that they act chiefly by lowering the animal temperature.

M. Foucault, however, is of quite a different opinion, and believing that he has demonstrated the dependence of many diseases upon the retention in the blood of matters that should have been excreted by the skin, at once suggests how easy it would now be to introduce into the circulation substances adapted to neutralize these poisonous agents. This is to be done not by the present clumsy apparatus for transfusion, but by another elegant and efficient one . . . which our author does not describe. Here we have the old story of Sylvius and the Chemiatrists, with an improvement. Stupid as that system was, it formed no part of it to deny the propriety or the possibility of influencing the molecular composition of the body by means of medicines introduced into the stomach. But modern chemistry teaches us to better purpose. "What good," exclaims M. Foucault, "can tonics, and stimuli, and antiphlogistics do in typhus and other diseases marked by a manifest alteration of the blood?" What good! what good have they not done? Are we to reject a remedy because we cannot discover its *modus operandi*? If so, how many should we have left in the *materia medica*? We thought the "essential platitude," as it has well been called, of professing to know how and why a remedy cures a disease had been abandoned by all who prefer practice to speculation in medicine, so that when a man like our author who has not youth and inexperience to allege as an excuse, gravely tells us that it is folly to treat a disease whose cause we know not with a medicine of whose action we are equally ignorant, we cannot help wondering whether his conscience is not troubled when he is forced to eat in order to cure that worst of diseases, hunger, without at all knowing whether his stomach contains lactic or muriatic acid, and whether or not those fluids are separated from the blood by "some modification of electricity" as Dr. Prout has it. We are far from blaming those who are labouring to discover the causes of disease and the action of remedies. If their researches are properly conducted they cannot fail of being eminently useful to science; but let them not presume to assert that the art of medicine must stand still until their investigations are completed, let them rather feel and know that when they have accomplished all which they propose to accomplish, when they have ascertained the apparent cause of every disorder, the action of every remedy, their results are still to be submitted to a final test, the *experimentum crucis*. It is still to be determined whether the avoidance of the alleged causes *will* prevent, whether the application of the alleged remedies *will* cure, disease. Except in this indirect manner the establishment of what are called "principles" in medicine had never saved a single life, nor alleviated a single pang. "Principles" of medical

science have never yet been, and cannot be, anything more or better than suggestions for a course of experiments in therapeutics.

But to return to the work before us. M. Fourncault observing that *albuminuria* very generally occurs in persons who have been exposed to the combined influences of cold, moisture, and a sedentary life, concluded that the disease must be owing to an interruption of the functions of the skin. He was in consequence led to examine the state of the urine in the animals which were the subjects of his experiments. Having prepared several dogs, as already described, he found that as soon as they gave evidence of suffering and their respiration became embarrassed, their urine, on being subjected to heat and nitric acid, was manifestly albuminous, and sometimes contained red blood globules. When a portion of the coating upon the dogs became detached, the urine ceased to be albuminous, and a deposit of salts took place in the vessel containing it. He also observed that the urine of these dogs which was acid at the commencement of the experiments, gradually lost its acidity, became neutral, and then alkaline, in proportion as the albumen in it grew more abundant. Somewhat analogous results were obtained with rabbits.

Wishing now to determine how far the skin itself is concerned in forming the elements of transpiration, and in producing animal heat, and albuminous urine, M. Fourncault flayed alive several rabbits and Guinea pigs, leaving the skin, however, *in situ*. He was much surprised to find that these martyrs to science lived two or three times as long as if they had been coated with varnish, and retained their natural temperature until about to die. In other cases he covered the raw surface of the body with a layer of dextrine and found that the animal temperature declined and albuminous urine appeared, precisely as when the impervious coating had been applied to the skin itself. Whence he concludes that this organ is not essential to the elimination of the perspiratory fluid, nor to the generation of heat and albuminuria. In other words he believes it proved that the elements of the perspiration being ready formed in the blood they are merely excreted by the skin, just as in the experiments of MM. Prevost and Dumas, in which the kidneys were extirpated and urea found in the blood, the kidneys are shown to be only excretory organs. Consequently, according to our author, albuminous urine does not depend on disease of the kidneys but on a suppression of the cutaneous exhalation. Now what must be the consequences of this suppression whether it is owing to an impervious coating, a sudden chill, the prolonged influence of cold and dampness, or an attack of fever? "It is clear," says M. Fourncault, "that the acid excretion of the skin can no longer escape, that immediately there is an excess of lactic acid in the blood which necessarily *disturbs the equilibrium of the organic affinities* of that fluid, seizes upon the albumen, and precipitates it in the urinary apparatus, where the soda holds it more or less completely in solution" . . . until it is revived by nitric acid or heat. What could be simpler or more ingenious? Here is the riddle read. Tubercle is a form of albumen; the fluid of dropsy is a form of albumen, so is the matter of elephantiasis, of phlegmasia dolens, &c. &c.; in each the albumen is coagulated by the lactic acid that cannot escape by the skin. And this terrible and pernicious acid is quite a new acquaintance, first introduced, and then unceremoniously turned adrift by Berzelius, now asserted to be a constant product of digestion, and now to be an evidence of diseased chymification; by one chemist admitted to exist in an extremely minute quantity amongst the saline constituents of the blood, themselves forming but an insignifi-

cant part of that fluid, and, finally, declared by another to have no existence at all in the blood of herbivorous animals. Yet M. Fourcault makes use of it in his hypothesis as if it were something quite as material and tangible as the red-globules or the fibrin of the blood. The old fashioned acrimony was quite as respectable an agent; it, to be sure, was created by the imagination, and lactic acid by the test-glass, but it answered the purpose quite as well. It made men fancy they understood the mysteries of nature, and, in like manner, our modern chemists bending over their retorts and reagents can see nothing in man or in the universe but atoms of matter and varieties of force. The error and the abuse are not more tolerable now than they were a hundred and fifty years ago. Even Boerhaave, celebrated, too, as the most eminent antagonist of the chemical school, furnishes us with a rationale of consumption almost identical with that of M. Fourcault. He, or rather his commentator, Van Swieten, tells us that persons having a predisposition to consumption are most subject to hæmoptysis in cold and wet weather, which is "least favourable to free perspiration," and in which the "acid particles which should be thrown off by perspiration begin to stop the pores." It were hard to tell which of the two doctrines is the most captivating, that which is purely and simply a fiction, or that which with a mighty pretension to material reality turns out to be an imposition. For our own parts we think there is vastly more relish in a thoroughly impossible fairy tale, than in the thousand "stories founded upon fact"—that is in which all the parts that strike the eye are false,—invented to soothe the conscience of this prudish and hypocritical age. If any one is willing to accept the lactic acid hypothesis, and to discern in it a satisfactory explanation of the manner in which cold, moisture, and repose induce disease, we shall not accuse him of credulity, but feel disposed rather to envy him the possession of a faith, which, if more generally diffused, would soon put an end to the harassing combats that now agitate the scientific world, and establish an infallible system of medicine, under which every man might practice with a quiet conscience, and a certainty of success.

These remarks will relieve us from the necessity of following M. Fourcault in his construction of a general theory of chronic diseases. The key which has now been furnished will enable any one to explain the generation of nearly all maladies as well as our author has done it himself. Given a little lactic acid and some albumen mixed in the human body, considered as a combination of furnaces, retorts, test-glasses, &c., to produce the required disease.

It must be a very easy matter, or else pathological chemistry plays us false. Nevertheless M. Fourcault, in discussing the etiology of several diseases, and while he insists very much upon their being caused by inaction, moisture, &c., and a consequent torpor of the skin, says not one word about lactic acid, but loses sight entirely of this intermediate link between evident remote causes and palpable effects. Thus he dwells very strongly on the imperfect action of the skin in many nervous diseases, particularly the melancholic forms of insanity, and on the good effects which result in these disorders from active muscular exercise, but gives no hint of any acid agency in the matter, nor even alludes to what might possibly have some symbolical meaning, the common belief that melancholy people have *sour* tempers. This omission clearly indicates that a theorist will sometimes abandon his hobby, moved by an instinctive love of simple truth, just as the counterfeit cripple, when unobserved, will fling aside his crutches and rejoice in his firm tread upon the ground.

It does not admit of a doubt that the state of the skin is unnatural in a number of chronic disorders, and M. Fourcault deserves credit for having pointed out this fact more clearly than has generally been done, as well as for having shown a probable connection between the state of the skin and the production of several secondary maladies, as, for example, that of consumption amongst the melancholic. But he assumes too frequently that the skin is the part first affected, whereas there can be no doubt at all that the starting point of the disease is often elsewhere, and most commonly in the digestive organs.

In a chapter on the fundamental principles and the epochs of medicine, M. Fourcault passes rapidly in review the different systems which have at various times prevailed. The external symptoms of disease are naturally the first to be studied by physicians; next in order the lesions of the organs attract attention; and finally the molecular alterations of the solids and fluids are investigated. When this much is accomplished it only remains to show the connection of symptoms with organic and molecular changes, and the science of medicine is complete. Opinions will probably differ in regard to how much has been actually achieved of this great work. M. Fourcault believes that nosology and pathological anatomy are scarcely susceptible of further improvement, and that the present age, by the aid of chemistry, the microscope, and comparative pathology will greatly advance if not consummate what remains to be effected. The failure of Van Helmont and Sylvius to bring about a permanent change of medical doctrines, he ascribes solely to the imperfection of their means of chemical analysis, and predicts for those who with better instruments for observation and experiment are following in their steps a certain, perhaps a speedy, triumph. It is in vain to object to our enthusiastic cultivators of chemistry, that the laws of life are not the laws of matter; this argument has been perpetually sounded in their ears, but they are deaf to it, or content themselves with replying that both laws may be modifications of some superior law, to the discovery of which their researches tend. An objection of more force is, we think, a practical one: let them tell us what disease has been rendered more curable by their investigations. To what purpose have we learned the proportions of oxygen, salts, &c., in the several solids and fluids? What matters it that chemistry shows us the necessity of avoiding certain kinds of food in renal disease, when experience has demonstrated that exactly the opposite sorts are most appropriate? In one department of the healing art, in toxicology, there is indeed some show of a claim for the usefulness of chemistry in medicine. It has discovered antidotes for several mineral poisons which are effectual only *in so far as the poisons have not acted* upon the living body. When once they have attacked a tissue, all antidotes are worthless. It would be very presumptuous to assert that analytical, destructive chemistry, may not yet contribute to improve the medical art, but until some earnest of its tendency to do this is produced, we would entreat physicians not to abandon the old paths in which disease is studied as it exists, and remedies are employed for their ultimate effects, in order to follow every ignis fatuus that emanates from the laboratory of even such a man as Berzelius or Liebig, in order to exhaust their energies in speculating on explanations, when their legitimate business is to observe and classify results.

Having settled to his own satisfaction not only the physical, but also, the chemical etiology of consumption, &c., M. Fourcault proceeds to apply his doctrine. He very properly lays no claim to being able to cure

phthisis and he blames physicians for not having long ago turned their attention to prevent the disease, seeing they were pretty unanimous in confessing their inability to remove it when once developed. Our author appears to think that he is the first who has made any approach to a rational view of the subject, whether in determining the classes of people most subject to scrofula, tubercle, &c., or in pointing out a thorough physical education, as the only prophylactic treatment deserving of confidence. Fifty years ago Dr. Beddoes published his "Essay on the causes, early signs, and prevention of pulmonary consumption," which, although written for parents and preceptors, and therefore deficient in scientific accuracy, goes over a great part of the same ground, and arrives at the same practical conclusions as M. Fourcault. In that essay he shows that certain classes enjoy an almost complete exemption from consumption, such as butchers, cat-gut makers, fish-women, sailors, watermen, stable-boys, grooms, gardeners, and small farmers, in a word all who take much exercise in the open air, and live on nutritious food. In the same essay, and in one of those of which his "Hygeia" is composed, he says, "that artisans whose occupations and habits are the opposite of those just mentioned, all, in short, who follow sedentary occupations in confined rooms, whatever be their habitual posture, are extremely liable to this fatal disease." In this class he enumerates tailors, weavers, spinners, glovers, dry grinders, flax-dressers, &c. In some of these cases, indeed, he attaches undue importance to the particles given off by steel, flax, &c., in their preparation, but is careful to admit that confinement alone is sufficient to engender consumption; to this end he refers to the great mortality amongst shoemakers from consumption, and to the frequency of this disease amongst stall-fed cows. He pointedly alludes to the influence of moisture on the health of the paper-makers of Rouen, and to that of suppressed perspiration on the mortality of the London gilders, of whom he is assured six-sevenths die of phthisis before their apprenticeship has expired. He is of opinion that consumptives consist of two classes, those whose occupation necessarily induces the disease without predisposition, and those who are predisposed to it and would have it under any circumstances that did not exert a powerful counteracting influence. There are some, however, who belong to both classes, such as the indolent and luxurious among the higher ranks of society, who have a hereditary tendency to phthisis; "upon these," says Dr. B., "the blight of consumption chiefly falls."

Having thus settled that an active life is the greatest safeguard against phthisis, Dr. Beddoes proceeds to describe the "phthisical temperament," and to lay down a plan for its correction. This latter consists in a system of physical training, which must "begin at the cradle," and be steadily pursued in after life. Bathing, friction of the skin, and nutritious food in children; digging, working with tools, walking, riding on horseback, athletic games, &c., for adolescents and adults, are the principal features of this system. All exercise without some other object than health Dr. B. considers as of very doubtful utility, and he therefore condemns the use of dumb-bells, walking against time, solitary gymnastics, &c., to which persons of feeble constitution are apt to resort in the delusive hope of being strengthened by them.

This sketch is sufficient to illustrate the close analogy between the works of the English and French authors. The latter, indeed, takes a more extended and minute view of his subject, and therefore furnishes a more definite history of the etiology of consumption, but his path, in so far as it

has led to a really useful conclusion, was clearly marked out by his accomplished predecessor, of whose writings he does not appear to know the existence. Nearly one-half of M. Foureault's treatise is taken up in describing somewhat in detail a plan of physical education adapted to prevent the development of phthisis by giving vigour to the constitution during childhood and adolescence, but as it differs very little from that recommended by Sir James Clark, (*Cyc. of Pract. Med.*, Art. *Tubercular Phthisis*,) and is encumbered with theoretical and irrelevant discussions, we shall not notice it further in this place.

After depicting in such a striking manner the dangers to health and life of many trades, we could not expect less from M. Foureault, than that he should propose some method of removing, or at least diminishing these dangers, and accordingly we find him in a chapter on social hygiene, setting forth two remedies for one of the greatest evils of modern times. The first is that every poor child shall be taught two trades, one a more and the other a less laborious one! The second remedy is the establishment by private or public charity of manual labour schools, and agricultural colonies in neglected districts, to prevent centralization, and the increase of manufacturers at the expense of farmers! The people of the Old World are dying of suffocation while half of America remains almost uninhabited!

Our chief object in presenting this sketch of M. Foureault's work is to direct the attention of physicians to the study of the means of preventing consumption. It is very evident that in this country, the causes which are so influential in producing it in the large towns of Europe, must be almost inoperative. We have no class of persons, even in our densest population, analogous to the lowest in the Old World; our artisans devote much less time to work than those of Europe, while they receive in general much higher wages, and are therefore much better able to provide themselves with the comforts of life. Nevertheless, phthisis stands at the head of the list of the causes of death, wherever any statistics of mortality have been published in this country. It would seem, therefore, as if the hereditary predisposition to the disease must be very strong amongst Americans, and that our best hope of staying its ravages must depend on our power of invigorating the constitution of the young. There is too much reason to fear, that this subject is neglected by the medical profession, because the greater number of its members regard their pursuit rather as a trade, or at best, an art, instead of feeling that it is not less their duty than their high prerogative, to guide public opinion in everything that relates to life, and health, without which life is a burden. It is time that physicians who have been fitted by their education, for understanding the importance of good health in its relations to all the interests of the commonwealth, should enlighten the ignorance of their less fortunate brethren, and that of the people at large. Under our institutions, the doctrine of political equality has been wrested from its legitimate applications, and interpreted to signify equality in everything, and especially equality in knowledge. Whoever would teach any truths which imply, however remotely, the ignorance of his auditors, or their feebleness of self-control, will soon find himself without listeners, even if he escape persecution. As we have no authorized teachers, none to whose doctrine any legal sanction is attached, we can only hope that some who are capable of instructing us, will volunteer their services; that some will be found to discover, or to proclaim, if already known, what are the pernicious habits to which we owe the prevalence of this deadly scourge, consumption, amongst us. To such we humbly submit the question



whether or not the radical vice of society is not the love of money, for itself merely and not for the enjoyments it is capable of procuring? Whether it is not this which ties up our children from the tenderest age in school, which chains them to the work-bench too closely, which condemns our whole population to a mere alternation between sordid money-getting labour, and ascetic and gloomy idleness; which for cheerful amusement substitutes gross debauch, which by depreciating all the higher and nobler faculties of the mind, values knowledge by its power of increasing animal comforts, and genius by the price its works will command. It cannot be that the moral nature of man should be so degraded, without injury to his physical condition. If there be any truth in these suggestions, it is possible that if they were illustrated and enforced as they should be, some good might at length accrue to the rising generation. Parents might be induced to devote more attention to the physical culture of their children, to develop and train their bodies and souls, as well as their understandings, and that not to the detriment of the latter, but to their eminent advantage. Now the faculties of the mind have a morbid prominence; they never cease their feverish action upon the one great subject, and thus by an inevitable law they exhaust the other faculties of man. But if the young were subjected to a discreet plan of physical education, and not so early emancipated from the wholesome restraints of home that they may be initiated in all the heartless tricks of the trading world, there is little doubt that we should at last see a race far superior to the present, not only in physical development and in exemption from slow disease, but also in those high moral qualities which dignify and bless mankind.

A. S.

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ART. XIII.—*Urinary Deposits, their Diagnosis, Pathology and Therapeutical Indications.* By GOLDING BIRD, A. M., M. D., Assistant Physician to and Lecturer on Materia Medica at Guy's Hospital, &c. &c.—London: John Churchill, 1844. 12mo. pp. xxvi and 323.

From the earliest periods great importance was attached to the inspection of the urine in disease. The old treatises on medicine contain copious and minute details for its application to diagnosis and prognosis. The imperfections of chemistry and the absence of the microscope,—the indispensable handmaids to its successful prosecution,—together with the ascendancy of solidism, which ridiculed any investigation of the fluids, brought this once favourite method into disrepute, and it was finally abandoned to the professed charlatan, whose sole means of diagnosis it very frequently became. Since the recent impulsion to organic chemistry and the reintroduction of the microscope, a reaction has suddenly taken place, and the examination of the urine, as a means of diagnosis, again occupies an important place, and has been attended with practical results of great value.

The English chemists and pathologists were the first to again direct public attention to this interesting and pregnant subject, and to Marcet, Prout, Brodie, &c., the student of urinology owes a deep debt of gratitude. The French soon followed in their footsteps, and Rayer and his pupils added greatly to our stock of knowledge. The rapid advances in chemistry and micrography have led not only to the investigation of the physical qualities