POPULAR LECTURE

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(FELLOW.)

THE MAN VERSUS THE MICROBE.

I TRUST it is superfluous for me to assure you at the outset that I highly esteem the compliment paid me by the Sanitary Institute in inviting me to follow in the train of the distinguished apostles of Hygiene who have, in the past five-and-twenty years, occupied this rostrum of the Congress and proclaimed to the public that without health there is no true wealth, and that, to secure to the people health—mental and moral as well as physical—should be our highest aim and the object of our highest law.

I have watched from its commencement the work of the Sanitary Institute: I have observed the width and breadth of view embraced in the object for which it was founded, namely, “for *collecting* and *imparting* information on all matters connected with the subject of the public health.” I have also noted with satisfaction that in realising this joint ambition of *imparting* knowledge as well as *collecting* it, the Sanitary Institute (unlike some other scientific societies) does not rest content with the mere *production* of knowledge, wherewith to indulge an esoteric circle and gratify a selfish or merely curious appetite, but it is fired with a missionary zeal for the *distribution* of the knowledge it has garnered, and is urged, as it were, by a divine discontent to seek no rest until the earth shall be full of sanitary knowledge as the waters cover the sea. Whether we look with Bentham to the greatest happiness of the greatest number as the goal of our ambition or not, we must, nevertheless, admit that from its very nature, unless the science of health is comprehended and practised by what Cobden called “the toiling base of the social pyramid,” the preaching of the sanitary reformer must remain sterile and unprofitable.

My old friend and late colleague, Sir B. W. Richardson, in his autobiography says he visited Manchester a few years ago “in order to show the working people that the business of sanitation belongs not exclusively

but rigorously to them, so that if they would only take it up and lead the way all the country would be converted to sanitary principles."

It has, I say, been to the infinite advantage of sanitary science, and it was from the first the sagacious policy of the Sanitary Institute, that those engaged in *various* professions, those occupied in legislation and administration, and indeed the public generally—not omitting the largest part of that public, viz., the working classes—should all be welcome as co-workers in the cause of sanitation. In this way there has been secured not merely a cross-fertilisation of the sciences, whereby those following different, but convergent, callings have gained by interchanging a knowledge of methods and means of research; but also a liberality of sentiment has been thus engendered, and the intelligent layman has learned to co-operate with the specialist and the expert, to the infinite advantage of one another and of all.

Had sanitary science been regarded as the exclusive preserve of the pathologist or the medicine man, it is safe to assert that it would not be now enjoying the reputation and recognition which are universally and spontaneously conceded to it. Neither Edwin Chadwick nor Louis Pasteur were medical men: yet their influence on sanitation in the nineteenth century has been profound.

I know there are some who view with jealousy the intrusion of those whom they are pleased to regard as outsiders within the sacred precincts of the temple of medical science. They would surround the goddess Hygeia, as did that empiric, Dr. Graham, in his temple of health at the Adelphi, with an atmosphere of mystic sacerdotalism; and in their sacrosanct exclusiveness would regard the people who know not the laws of health as, pathologically speaking, accursed. There are yet others who view with disapprobation the appearance of a medical man upon a public platform. I fear I am too hardened a sinner to feel that taunt, but by way of extenuation I would urge that since our public administration and our legislation have come to concern themselves as much with the "Health of Nations" as with the "Wealth of Nations," it is not only lawful and right, but it is the prerogative and duty of the medical man to take his place in the councils of the nation, which have for long been the too-exclusive preserve, as well as the happy hunting ground, of his fellow professional, the lawyer.

But I go further, and assert that the medical man by his very training should be well qualified to take his part in public life. What is diagnosis in its ultimate nature but the prompt apprehension of minute differences, —what is prognosis in final analysis but accurate forecast of the future

based upon faithful observation of the past?—and what, indeed, is the secret of successful treatment but resourcefulness in the case of emergency? Are these qualities, I would ask my critic, of no account in public service? And the question is answered in the asking. I speak of what I know when I say that the training I received at the University of London and at St. Bartholomew's Hospital was of infinite service to me when my colleagues of the London County Council placed me in the chair of that body, as it is still in the chair of its Housing of the Working Classes Committee, which I at the present time have the honour to occupy.

I therefore rejoice, ladies and gentlemen, that this congress of the Sanitary Institute annually affords an opportunity for exchange of views and friendly intercourse between municipal workers, sanitary officers, engineers, chemists, architects, doctors, and social workers of all kinds who, in their several ways, are co-operating to one end, are engaged in building one temple, wherein the work of all is essential to the success of each, and the welfare of the whole is dependent on the convergent effort of every one.

In this coronation year of King Edward VII. our minds have, not unnaturally, been full alike of retrospect and prospect, of counting up our national gains and losses, and wondering on what lines of progress this ever expanding empire is destined to proceed during the reign of his present majesty.

Historians of the Victorian era are constantly reminding us that two of the most important, if not *the* two most important reforms which that era witnessed were connected with the development of municipal institutions and national education. It would not be difficult to adduce reasons for regarding the late Queen's reign as especially the epoch of sanitary reform. The year of Queen Victoria's coronation has, indeed, been fixed upon by those who have written the history of sanitary institutions as a landmark in our vital statistics and as memorable for the first step then taken in the utilisation of medicine by the State. I refer to the initiation of the work of the Registrar-General and to the reports of Dr. Kay and Dr. Southwood Smith on the prevalence of fever in the east end of London. It is generally allowed that the credit for promoting both these reforms rests with the late Sir Edwin Chadwick.

It is, indeed, a problem worthy of some careful consideration to investigate and ascertain what were the influences and conceptions which, about the fourth decade of last century, evoked and gave so powerful an impulse to what Chadwick called "the sanitary idea." His sympathetic biographer, Sir B. W. Richardson, asks concerning him: "Was he a

legislator?" and answers "No, nor yet a lawyer, schoolmaster, or clergyman, though he made laws, introduced systems of education, and preached right living. Was he then a doctor? No. On the contrary, he had not much faith in doctors, looked on them as necessary evils and as not likely to last." Sir John Simon, in his eloquent account of English sanitary institutions, dates the modern demand for sanitary reform from about the year 1838, and in the swift succession of parliamentary committees, royal commissions, and successful as well as abortive legislation which throng the following years, he unhesitatingly asserts that "even on the surface, and still more in the deeper strata when they are known, the story of the ten years (1838 to 1848) is above all an account of the zealous labours of one eminent public servant—Sir Edwin Chadwick." What, then, was Chadwick's "sanitary idea"? It was, according to Richardson, "that man could by getting at first principles, and by aiming at causes which affect health, mould life altogether into its natural cast, and beat what had hitherto been accepted as fate, by getting behind fate itself and suppressing the forces which led up to it at their prime source." However that may be, it is interesting to remember that Chadwick and his scarcely less famous coadjutor, Dr. Southwood Smith, had been intimates of the great utilitarian and jurist, Jeremy Bentham, they were deeply imbued with his philosophic conceptions; and here again, as was the case with Sydenham and John Locke, medical reform was inspired and fostered by a congenial association with philosophy.

Bentham's long life (1748–1832) covered the most momentous years in the history of the nations of Europe and America, alike in international polity and in the beginnings of social reform: in early life the radical philosopher enjoyed the friendship of Adam Smith, the Wesleys, Pitt, and Mirabeau; in later years he found ardent disciples in Mill and Romilly; while the old man's latter days were solaced by the companionship of Chadwick and Southwood Smith, whose writings bear abundant testimony to the inspiring influence of the author of the Utilitarian Philosophy and the Constitutional Code.

While, then, I think we may trace the potent influence of Jeremy Bentham in the reforming zeal of Chadwick the Sanitarian, we must also allow something to the spirit of the time. The "new philanthropy," as it has been happily termed, still possessed the better minds of the nation; the spirit that had set John Howard to reform our prisons, Romilly to revise our barbarous criminal code, Wilberforce to enfranchise the slave, Tuke and Connolly to unchain the mentally afflicted, was still at work, and with that humanitarian zeal Chadwick was instinct. His life, pro-

longed far beyond the allotted span, witnessed not only a full fruition of sanitary reforms, but also those modern developments of pathology which have been especially associated with the germ theory of disease. I desire, to-night, to invite your attention especially to the interaction and counter-action of modern bacteriology and the earlier teachings of sanitary science.

Before the close of the seventeenth century the microscope had begun to draw attention to the realm of the minute, that hitherto neglected quantity. The crude surmises of Father Kircher, the graphic descriptions of mobile animalcules by Leuwenhoek of Delft, and the experiments of Spallanzani paved the way for the more elaborate researches of Henle and Pasteur, of Lister and Koch, whose doctrine of a living contagium has been the absorbing theme of modern medicine. Lister, addressing the British Medical Association at Cambridge, in 1880, remarked that twenty years before that time bacteria were little more than scientific curiosities, "and the notion that they had special relation to disease would have been regarded as the wildest of speculations," he spoke with enthusiasm of the rapid development of bacteriology, especially in the direction of protective inoculation, as was then being practised in the case of anthrax, and he indulged the thought "that if the British Medical Association should meet at Cambridge again ten years hence (1890), someone may be able to record the discovery of the appropriate vaccine for measles, scarlet fever, and other acute specific diseases in the human subject."

It would be not far from the actual truth to say that from that time to the present we have been living under the dominion of the *Bacillus*. That blessed word has met us at every turn, and shadowed us in every department of public and private life. The germ has, perhaps, been too much with us, and we have, perchance, sometimes lost sight of the man amid the luxuriant and magnificent flora of the bacteriological laboratory. We cannot see the man for the germs. Let me not be misunderstood; I do not wish to speak with disrespect of the deadly bacillus, or even of the lowlier micrococcus. I have been at pains to cultivate them in my laboratory, have patiently studied their developments in innumerable test-tubes, on a variety of delicacies suited to their fastidious tastes, and have examples by the gross of their infinite varieties, duly stained and preserved, and labelled with a nomenclature well calculated to overawe the vulgar, or serve the purposes of a commination service.

For a while the germ theory and all that hung to it appeared to hold the field and seemed to have solved the mysteries of medicine, and settled the questions of spontaneous generation, and infection, and immunity; while in surgery it was credited with the antiseptic treatment and all the

wonderful reforms in surgical practice associated with the venerable name of Lister. It seemed to some that sanitation in the sense of the earlier reformers was being pushed off the stage by the advent and advance of the microbic hosts.

There is always a sigh of relief when one can put aside the strife-worn insignia of some heroic struggle with the consolatory reflection that what-else may remain in the arena of discussion this or that doctrine at least may be laid aside in lavender, agreed by common consent, or by the stamping out of pestilent heresy.

But I would ask, is there not some danger in regarding the last as the final, in thinking that in the new we are destined to find an explanation of all that has been mysterious in the old?

At the beginning of what might justly be called the bacterial epoch there were not wanting warning voices. I well remember hearing my eloquent old master, Sir William Savory, at Cork in 1879, when he, in a memorable address, declared that in surgery means directed against the germ were not all in all, that "the best results are achieved by the simplest means," and that "the antiseptic system had been both charged and credited with results that do not belong to it." I remember how he ridiculed Tyndall for attributing an abscess of his foot, following a cut sustained while bathing in an alpine stream, solely to air-borne germs such as he had captured in his infusion tubes. I remember how he satirised a certain German professor who had related the extraordinary precautions he adopted, how "that on an operation morning he got up early and washed himself all over," and how Savory caustically added, "Let us hope in interests besides those of surgery, the expectation *at least* of an operation may become of daily occurrence."

I remember also that in 1881 one of the fathers of The Sanitary Institute, Dr. Alfred Carpenter of Croydon, speaking at Brighton, said that the right course to be followed in preventing infectious diseases was to seek to remove "from our persons and our habitations those *débris* which arise from the act of living, and the removal of which would render us proof against the evils caused by contagion." And he added: "However much, therefore, I may admire the efforts of Pasteur to prevent the spread of infectious disease at the present time among our domestic animals, I believe it is *not* the direction in which we should look in the future with regard to ourselves."

It was I believe Sir Benjamin Richardson, speaking at the same time at the Brighton meeting, who said: "Science is, in the main, most useful, but is sometimes proud, wild, and erratic, and has lately proposed a

desperate device for the prevention of infection's perils. She proposes to prevent one peril by setting up another. She would inoculate new diseases into our old stock, in anticipation that the new will put out the old. I pray you, be not led away by this conceit. This manufacture of spic-and-span new diseases in our human, bovine, equine, ovine, canine, and perhaps feline species is too much to endure the thought of, especially when we know that purity of life is all sufficient to remove what exists, without invoking what is not."

In utterances like those we catch the apprehensive note of the older school of sanitarians before the advancing whirlwind of the germ theory and all it carried along with it.

The aged Chadwick detected the coming storm, and in the evening of his days shrewdly recorded his opinion in these words:—"Presuming that the advocates of what is called the germ theory of disease could sustain their case, it is still believed by many observers that a predisposition or nidus in the affected person must exist before the exciting influence can take effect."

So also the grand old man of Berlin whose loss we so recently mourned, the veteran Virchow, Progressive and Pathologist, in 1881 inquired, "in what relation does the infecting organism stand to the cells of the living body?" He affirmed that "the old doctrine of *predisposition* to disease, which might seem to be quite antiquated, would gain a new basis," and prophesied that "we should come back to the old doctrine of weakness and strength as explaining liability to disease, of which he (Professor Virchow) had always thought highly."

It was, according to Sir John Simon, something of a reproach to the old Board of Health and sanitarians of the Chadwick type that "in their perfectly proper zeal against filth, they immensely under-rated, not to say ignored, the independent importance of the morbid contagia," and that accordingly "the doctrines they promulgated on the subject of epidemic infection have long since been made obsolete by the advances of exact knowledge." Now, it is impossible to read the doctrines of the sanitarian school as enunciated by Chadwick, Southwood Smith, Richardson, and men of that stamp, and compare them with the more modern and fashionable doctrines of the school of thought associated with the names of Pasteur, Lister, and Koch, without realising that we are in the presence of two different and, to some extent, conflicting views of the nature of disease, and of the methods of disease prevention. The former is imbued with the potency of such factors as go to make up environment—pure air, pure water, refuse-removal, personal cleanliness, the fortifying of the

individual against all attack from without upon the integrity of health. The latter, intent upon the microscopic causes of contagion, relying upon analogies drawn from the process of fermentation, is bent on conferring immunity upon the individual by establishing within him a condition of insusceptibility which will enable him to successfully resist the assaults of his unseen foes, the circumambient microscopic germs. The former school, with Chadwick at their head, maintain that "Fevers occur in the greatest proportion on common conditions of foul air, from bad drainage, from sewers of deposit, excrement-sodden sites, from filthy street surfaces, from impure water, and from overcrowding in private houses and in public institutions, and that the entire removal of such conditions by complete sanitation and by improved dwellings is the effectual preventive of diseases of these species, and of ordinary as well as of extraordinary visitations: and that where such diseases continue to occur their spread is best prevented by the separation of the affected from the unaffected." The other view removes the battle-ground with disease from the environment of the individual to his tissues and blood, and by protective inoculation would endow him with an immunity which shall preserve him from the pestilence that walketh in darkness and the destruction that wasteth at noon-day. These two schools of thought are regarded by some as mutually destructive, as internecine, and indeed the late Sir Thomas Watson, following Dr. Christison, hazarded the view that such divergency of opinion on the causes of contagious diseases depended in part "upon the different structure of men's minds, and their peculiar habits of thought," and regarded it as a curious psychological fact that one of these schools of thought was mainly advanced by those who entertained "what are called liberal opinions in politics and in religion." I do not know how this may be: such reasoning may afford a field of inquiry, hitherto unworked, whereby a bacillus of heterodoxy, or a serum good against philosophic radicalism, may reward the industrious and orthodox investigator, if only he be endowed by Nature with a conservative mind.

But, jesting apart, let us now proceed to inquire what accumulating experience has shown to be true in either doctrine, and let us seek to apply in practice the combined wisdom of both parties.

This was the prudent course adopted by Dr. Farr, who was one of the earliest to recognise the just value of Pasteur's researches, and at the same time one of the most strenuous supporters of "the sanitary idea." In 1867 he wrote: "The primary object to aim at is placing a healthy stock of men in conditions of air, water, warmth, food, dwelling, and work most favourable to their development. *The vigour of their own life* is the

best security men have against the invasion of their own organisation by low corpuscular forms of life : for such the propagating matters of zymotic diseases may be held to be. Vaccinate by all means : but at the same time provide streets, spaces, dwellings, water, drainage. Do not leave the dirt in rookeries, in pits, in dunghills. What are municipal bodies, town-councillors, aldermen, mayors, provosts good for, if they cannot by administrative measures displace rookeries by healthy habitations, supply the people with water, and with the means of 'cleanliness', which stands proverbially 'next to godliness'?"

The sanitarian, like the schoolmaster, has been abroad since Farr indicted this encyclical, and the municipal conscience is now awake and ready to follow the lead of sanitary science, if only its voice be clear and unambiguous. Leaders of thought, alike in Church and State, can now with truth allege "We are all sanitarians now". It was not ever thus; there was a time when theology offered formidable obstacles to sanitary progress, and despite the admirable doctrines of the Levitical law, acted as if under the impression that to avoid pestilence was to defy the Almighty.

It is said that for more than a century not a man, woman, or child in Europe took a bath; the "passion for clean linen" was accounted accursed; the odour of sanctity was the *odor humanus*, and effectually obviated too close contact with the world, the flesh, and perhaps the devil. Personal cleanliness was impious vanity. St. Jerome commended the godliness of a monk who only combed his hair on Easter Day; the Cistercian friars carried out the doctrine to the filthiest extreme. It is not surprising that under these circumstances the pestilence was regarded as divine judgment, any thought of averting it savoured of presumptuous impiety, and in consequence the harvest of death was plentiful indeed. We may laugh at such doctrines as superstition, but I would ask, are we entirely free from it to-day?

Since theology has failed to explain pathology by reference to the infinitely Great, have not our modern microscopical scribes found salvation in the infinitely little, and I would ask: Is not the germ hypothesis at the present time carried to an untenable extreme? I do not undervalue the laborious researches of our bacteriologists which have enlarged our bluebooks and filled our library shelves, but they seem to me to suffer from the fate that ever awaits the specialist who stands too close to his own particular subject to see it in proper perspective. They seem to have realised the ideal of the grammarian who on his death-bed lamented that, instead of dissipating his energy over the whole range of etymology, he had not restricted himself to the accusative case. Dr. Billings of New York once

said that a good specialist should be a good general practitioner and something more, but that he was very often something else. It has indeed been a little humiliating to see physicians of great clinical and pathological experience speak with bated breath, and doubt their own experience because they are unable to lisp the jargon of bacteriological slang.

Let us see if bacteriology alone affords reliable guidance for practical purposes.

A few years ago medical men believed that their experience had taught them that sewer air was causally related to zymotic disease, and every endeavour was made to exclude it from our houses.

Our modern bacteriologists tell us that the organisms found in sewer air do not constitute any source of danger, are in fact derived from the outside air by ventilation of the sewer, and are fewer in number in sewer air than in the air of our houses. What shall we say then? Shall we admit sewer air to our houses? Shall we lay it on with a view to reduce the number of germs in our houses? Shall we not rather conclude that bacteriology alone is an unsafe guide in our hygienic arrangements?

In water analysis again a too-exclusive reliance upon the mere presence or absence of germs leads to ambiguity, while presumption against use for drinking purposes of any water known to have been exposed to sewage contamination remains the safer basis for administrative action.

In surgical practice the use of the carbolic spray directed against air-borne germs and other antiseptic paraphernalia has been abandoned by its author as admittedly based upon a theory which was physically impossible, and aseptic or sanitary surgery is now the order of the day.

Tubercle and Leprosy are curious examples of diseases which under the influence of dominant theories have upon the highest professional authority been declared to be *readily communicable* and *absolutely non-contagious*, and means for their repression have accordingly varied in the most paradoxical fashion.

Let us turn to the case of consumption (tubercle), and see whether the sanitarian or the bacteriologist has been our safer guide.

In the year 1890 was published an authorised translation of a little pamphlet entitled, "The cure of Consumption . . . further communications on a remedy for Tuberculosis, by Prof. Robert Koch," in which, after detailing his experiments with tuberculin, which had startled the civilised world, he arrived at the conclusion "that phthisis in the early stages can be cured with certainty by this remedy," that "patients with not too highly developed cavities improved considerably and were almost cured," and that even patients with large cavities in most cases "were cured temporarily." Now it is highly problematical whether in the years which

have elapsed since these statements were advanced any considerable number of persons suffering from consumption have, by the agency of Koch's fluid alone, been cured of that disease. Sir Thomas Barlow, addressing the British Medical Association last month, cautiously observed: "it seems desirable that we should speak more guardedly about the *cure* of consumption and insist rather upon its *arrest*;" and he doubtless voiced the verdict of the faculty when he remarked: "with respect to the tuberculin treatment of tuberculosis, it cannot be denied that the results obtained have been on the whole unsatisfactory and tentative."

In July, 1901, Koch gave an address in London on "the fight against Tuberculosis." He remarked that many doubted the possibility of successfully combating this disease, which had existed for thousands of years and was spread all over the world. This however was not his opinion, because he recognised a parasitic cause of the disease and did not refer it to social misery. He then proceeded to review the methods which with greater or less success had been adopted in combating other parasitic diseases.

Plague he traces to transmission by rats, and he asserts that "wherever the rats were intentionally or unintentionally exterminated the plague rapidly disappeared." Regarding plague, then, as a parasitic disease, it is nevertheless *not* by attacking individuals with antitoxins or vaccines that Koch would wage war on the pest; "a certain number of human beings may" he allows "have been saved from the disease by that, but the general spread of the pestilence has not been hindered in the least."

Cholera, too, he claims has been again and again exterminated in Germany without any obstruction to traffic, for "in combating cholera water is the first thing to be considered."

In the case of *Hydrophobia*, again, Koch insists that however effective the Pasteur system may be for the individual who has received the infection, "such a measure can do nothing to prevent infection." "The only way of combating this pestilence is by compulsory muzzling." *Leprosy*, again, whose reputed germ bears such a close resemblance to that of tubercle is, according to Koch, transmissible only by "close contact, as in small dwellings and bedrooms," and is to be successfully met by segregation of the afflicted.

We, therefore, have it on the authority of Koch that in those diseases in which bacteriology claims to have identified a particular germ or virus as the true cause of the disease, in which we could, if we would, prescribe the inoculation of every individual with a vaccine or antitoxin, recourse is to be had *not* to such methods of prevention, but we are to seek to "stamp out" rather than "stamp in"; if we are to combat these

pestilences successfully we must strike at the root of the evil; and to sanitary measures directed to the environment of mankind—such as the destruction of vermin, the purification of water, the prevention of contact between the infected and the sound—our legislators and administrators must direct their attention if they would make their practice accord with the latest discoveries of science.

No man is more entitled to speak with authority upon the parasitic nature of Tubercle, or upon the rules for prevention of that disease based upon a recognition of a germ as its cause, than is Robert Koch, since he is the discoverer of the germ so generally recognized as the cause of consumption. The prospect of conferring immunity to tubercle by inoculation of human beings with his fluid was, ten years ago, a consummation devoutly wished for by many. Such immunity in the case of guinea-pigs had, it was alleged, already been attained. Lord Lister, on returning from witnessing the early experiments with tuberculin in Berlin, told his audience at King's College (*Lancet*, Dec. 13, 1890, p. 1258), "Immunity is that which we now long for," and concluded his eloquent address with these words: "If it should so happen that as with the other diseases to which I have referred, so with tubercle, complete immunity should be obtained by means of some inorganic chemical substance which anyone can prepare, then would be achieved the complete triumph of the treatment of tuberculosis. And, for my part, I rejoice that we are permitted to look forward to that glorious consummation."

It would have been in accord with the views of some of the best-known advocates of the germ theory if Koch had followed up his teaching in respect of the tubercle germ and its antidote by developing a scheme of curative and preventive inoculation, with a view to the extermination of what has been justly described as the white man's plague.

It was, however, not on these lines that Koch formulated his "fight against tuberculosis" when, after another decade of painstaking research, he gave his matured doctrine to the world at the British Congress on Tuberculosis. Did he then urge the universal adoption of preventive inoculations? Did he advocate the careful cultivation of a state of artificial immunity on every individual member of the population? Not at all. Like a true sanitarian he struck at the root of the evil. He urged education of the people in prevention of infection from the sputa of the diseased and in ventilation, especially of their bedrooms; he advocated notification and disinfection, and the provision of sanatoria for the treatment of consumptives. But above all other considerations he placed "the domestic conditions under which the poor everywhere, but especially in

great cities, have to live." "It is," he said, "the overcrowded dwellings of the poor that we have to regard as the real breeding-places of tuberculosis; it is out of them that the disease always crops up anew, and it is to the abolition of these conditions that we must *first* and *foremost* direct our attention if we wish to attack the evil at its root, and to wage war against it with effective weapons."

The recently-published reports of the Registrar-General have borne statistical testimony to the close relation that subsists between overcrowding in tenement dwellings and a high death-rate from phthisis as well as from all causes; while recent figures gathered from the London County Council's experience show that in its model dwellings the general death-rate last year was considerably under 10 per 1,000, as against a death-rate of from 24 to 40 per 1,000 in the slum areas which these dwellings replaced.

The mottoes selected by the successful essayists for the King's prize bear witness to the same teaching which Koch's last deliverance emphasised. "Give him air: he'll straight be well"; "If preventable, why not prevented"; "Vis medicatrix naturae"; "Facte recte, nil time"; "Open air everywhere" are their distinctive texts, and they savour rather of the sanitarian platform than of the bacteriological laboratory.

The munificent gift of Sir Ernest Cassel to the King will ensure the application of some of these principles in practice. If we may take the leader in the *Times*, which announced this princely endowment for a sanatorium for the consumptive, as the expression of educated opinion we find evidence of the same tendency. The *Times* said: "The open-air treatment of consumption, if properly regarded, is a message of emancipation and independence to the laity. It is a proclamation that, *when medical science has said its last word, the best hope for the cure of disease lies simply in the strengthening by rational modes of living the resisting power of the human organism.* That resisting power, varying no doubt in different constitutions, but always present as the condition of existence, is the puzzle of medicine, but at the same time its chief reliance." The same anonymous and unimpeachable authority goes on to protest against "the intolerant and dogmatic attitude of some members of the profession," and concludes with the wise and wholesome reflection that "in no department of life is dogmatism more unjustifiable than in medicine."

Let us turn now to the animal world and inquire in the case of their infective diseases whether the laurels are with the bacteriologist or the sanitarian.

It is now twenty years since Pasteur demonstrated before a crowd of

senators, councillors, doctors, journalists, veterinary surgeons, and farmers the dramatic results of his protective inoculations against anthrax, the deadly scourge of flocks and herds. On that June morning as Pasteur stood, as it were, between the living and the dead, M. Bouley, one of his assistants, addressing a former sceptic asked, "are you now convinced?" There remains now nothing for you to do but to bow before the master and exclaim, "I see, I know, I believe, I am undeceived." From that time to this the medical journals and the lay press have periodically proclaimed the discovery of some new protective inoculation against one or other of the pests of the lower animals, or as a prophylactic against one or other of the infectious diseases of man.

In cholera, plague, and typhoid fever, protective inoculations have of recent years been freely employed, but up to the present with indecisive results, and according to Sir Thomas Barlow these methods must be regarded as still *sub judice*. In the lower animals, in addition to the case of anthrax, protective inoculation has been tried on a large scale in pleuro-pneumonia, and to a less extent in cattle plague and sheep-pox. What have been the results? Has the experience of mankind confirmed or falsified the views originally entertained respecting anthrax inoculation in cattle and sheep; is a similar method that on which we rely to keep out pleuro-pneumonia? The answer must be in the negative. The early hopes have not been fulfilled, the pleasing prophecies have not been realised, and indeed our modern successful practice is based upon entirely different principles. Reports of our own Board of Agriculture have shown that in the case of anthrax the inoculated sheep have "either died as a result of the injection of the vaccine material, or succumbed to anthrax when inoculated with the virulent material, after being what was considered immune to the disease."

In Austro-Hungary and in Germany the experience has been the same. Professor Muller, of the Royal Veterinary School of Berlin, says "Preventive inoculation of anthrax has not many, I may even say no, friends in Germany. . . I believe that preventive inoculation is now fully abandoned in Prussia, and has not been practised during the last five or six years." According to the same professor "the general opinion of scientific authorities in Germany is that the best measures against anthrax are a careful destruction of carcasses, and in most careful disinfection, and that inoculation will have no effect in lessening the loss caused by this disease." In the case of pleuro-pneumonia, the report of a Departmental Committee, presided over by Lord Cranbrook, has a similar experience to relate; they found that cattle contracted the disease "after apparently successful inoculation," and they condemned the practice as

applied to ordinary farm stock as "at once expensive, uncertain, and even possibly dangerous." They further summoned from Holland M. Lameris, the great veterinary authority of the Hague, where compulsory protective inoculation had been demanded and in part adopted; but M. Lameris was very decided in his opinion that compulsory vaccination could not have cleared his country of disease, that stamping out was the safest and most certain way of attaining this result, and proved in the long run to be the cheapest. Indeed the experience of those who practised protective inoculation in the case of the various animal pests which infect and ravage our farm stocks has led them once again to revert to the so-called stamping out method which had been adopted in cattle plague. The success that had attended this method of dealing with the rinderpest induced Sir James Simpson to apply the same principles to the suppression of the contagious diseases of man, substituting for slaughter of the infected animal the isolation of the diseased human being. The great personality of Simpson adorned all he touched, though in truth he had himself been anticipated in most of his suggestions by Haygarth of Chester, Faust of Leipzig, Rast of Lyons, and indeed by that political physician, Dr. Richard Mead, who has immortalised himself not only by his "Methods to be taken against the Plague," but also by his refusal in 1723 to prescribe for Walpole's gout until he had liberated the learned, but Jacobite, Dr. Freind from the Tower of London.

In all the instances I have cited it seems to me that whether in the case of human maladies or animal pests "the sanitary idea" of Chadwick has led to unmistakeable success, whereas practices based upon the teachings of the bacteriologists have often, after promising fair, been surrendered at discretion. The reason being possibly that the too exclusive contemplation of the microscopic has narrowed the range of observation and has led to the neglect of wide culture and a philosophic insight on which a sound pathology must be based. What seemed a success in the laboratory has often proved a dismal failure in the practical test of the work-a-day world. The possibilities of environment are not exhausted by the confectiory of the laboratory. The origin of minute organisms is not solved by reference to a remote epoch during the cooling down process of the earth, which bears a suspicious resemblance to the fairy tale explanation of "once upon a time in a country by the sea," nor can a leaf torn from the Mosaic cosmogony suffice any longer to sustain a special creation theory for specific disease. We need breadth of view. The mere case-taking fact-hunter is always with us; the dull laborious man of research with his eye glued to a microscope and his nose stuck into a test-tube is ever on hand in our laboratories; but medical philosophers are few and

far between, and unfortunately the tendency at present is to narrow rather than to widen the basis of scientific culture in the profession.

If we are ever to harmonise the apparent conflicting teachings of the sanitarian, who stands for the man, and the bacteriologist, who looks too exclusively to the germ, I believe it will be by taking a broader view and by bringing well-established philosophic principles to bear upon the explanation of the mysteries of disease.

It was considerations of this kind which led me, in the year 1881, in a communication to the *Lancet*, to urge the importance of applying the doctrine of evolution to the elucidation of the nature and origin of specific diseases. In 1884, in an essay on Specificity and Evolution in Disease, which Mr. Herbert Spencer believed would open the way to a considerable reform in pathology, I attacked the old hard and fast doctrine of specific diseases as "but a reiteration, in the language of pathology, of the principles laid down in the first chapter of Genesis, that in the beginning were created the germs of specific diseases, 'each after his kind,' that each had propagated itself in strict genealogy from that time to this; and if we are to follow the accepted view we must also believe that there were at the same time created specific susceptibilities to each and every one of these said diseases in our earliest progenitors, and ample provision made for the perennial perpetuation of the same." I maintained on the contrary:—

"That starting from *common ancestral conditions* we arrive at *specific diversities*, and that the chief, if not the only element in determining specificity is the *nature of the soil*, in which the poison (whatever be its nature) grows, that is to say, when an animal body is the soil, on the *predisposition of the individual*. That the predisposition varies with the departure from a state of health, local or constitutional, but that just as in some cases, so great is the virulence of the poison *as the result of cultivation on suitable soil*, that it may even overstep the usually sufficient barriers of health and attack the unprepared, so on the other hand predisposing and exciting causes being as it were complementary, predisposition may be so strong that, apart from contagion, it may develop disease *de novo*; such disease being more plastic, less fixed, than the more cultured variety, and often appearing in aberrant form."

I should have regarded these views as but the teachings of common sense and the natural application of accepted doctrine in natural science, had not the "Medical Press"* accused me of "essaying with all the vigour of youth to demolish the theories of specific diseases which have sufficed to satisfy the acutest physicians of this and every age," and

* May 14th, 1884.

asserted that "such teaching runs counter to all the best work of modern times."*

I therefore, in 1889, at a conference of Medical Officers of Health in the Guildhall at Worcester, returned to the charge and again urged the importance of bringing the doctrines of Darwin to bear on the evolution of specific diseases, and of recognizing the influence of the soil (*i.e.* of the state of the *man*, alike in his external and internal conditions) as well as of the *seed* (*i.e.* the *germ*, microbe, virus or whatever else we may be pleased to regard as the noxious agency of disease).

I said: "The paramount importance of soil has been absurdly underrated as a determining factor in specificity, and indeed in disease production altogether. Witness the germ of blood-poisoning of mice, which is uniformly fatal to house mice within three days, but which is harmless to field mice. Again, goats, hedgehogs, sparrows, horses, cows, and most breeds of sheep are susceptible to inoculated anthrax, whereas dogs, cats, white rats, and Algerian sheep are not so. But what is even more remarkable is the fact that disturbing conditions may bring about a susceptibility in the habitually unpre-disposed, as is shown by the fact that fish and frogs, which are normally unaffected by anthrax, are infected if their temperature be artificially raised. Inasmuch, then, as soil may operate to the extent of nullification of the action of a bacillus which is uniformly fatal to another variety of the same species of animal, how great is the importance to be attributed to it as a factor in the propagation and modification of disease.

Bacteriology has doubtless done much for pathology, but it has done much less than scientific persons both in and out of the profession are apt to imagine. It has not yet helped us to understand the nature of any one of the ordinary acute specific diseases of man, in the sense that it has unquestionably identified a specific microbe as the cause of any one of them."

The views I have advocated from the year 1881 onwards respecting the evolution of specific diseases, and the paramount importance of soil, predisposition and environment in determining the origin and nature of such diseases have passed through the usual three stages of wholesale condemnation: adoption without acknowledgment† (not only of the ideas but even of the language in which they were clothed); acknowledgment without recognizing the process of adoption; and, finally, in an article on the Natural History of Infectious Diseases, by Dr. Thompson in Stevenson and Murphy's great work on public health‡, reference is made to my papers

* *Medical Record*, August 15th, 1884. † *Illustrated Medical News*, January 25th, 1890.

‡ Vol. II., p. 250.

of 1884 and 1889, and it is there admitted "that evolution in connection with epidemic diseases, or more strictly their causes, is day by day forcing itself more prominently upon our consideration."

Confirmation of these views has recently been forthcoming from quarters the orthodoxy of which it would be impossible to suspect.

Dr. Howship Dickinson, on February 3rd* of this year, delivered a lecture at St. George's Hospital on "The Seed and the Soil," taking for his text the parable of the sower, in whose case readers of St. Matthew's Gospel will remember that the differentiating influence of soil was very strikingly exhibited.

Dr. Dickinson pays proper homage and deference to the microbe, and burns a candle to the bacteriologist, but he pleads: "in these days of applied science and adventurous medicine it is necessary to preach caution, lest we have too much thought for the *microbe* and too little for the *man*; let us be guided (he pleads) by experience rather than by experiment." As regards relapsing fever, in which a particular germ or spirillum has long been recognised as the cause, he reminds us of its synonym, "famine fever," and remarks that "our exemption from it rests not so much on the absence of the bacillus as on the absence of the conditions which it requires," and he quotes Addison in the Tatler: "Physicians observe that the poorest and most dispirited blood is most subject to fevers."

As regards tubercle, Dr. Dickinson thinks that "the micro-organism, though the primary cause, is of secondary importance." He quotes Prof. Sims Woodhead, who believes "that a perfectly healthy lung is seldom if ever primarily infected with the tubercle bacillus," and that "the predisposing causes may be more important than the exciting cause: in urban communities the microbe is always with us, it needs the antecedent suitability to be effective."

Likewise Dr. Stephen Mackenzie,† senior physician to the London Hospital, in his oration to the Medical Society on May 26 of this year, took up the same parable and asserted, "The tendency of the medical mind at the present time seems to be to attach too great importance to the germ or seed and too little to that of the body or soil in diseases of microbic origin." And again, "we are apt to think too much of the *seed* and too little of the *soil*." "It is true," he says, "that the hopes that were raised by Dr. Koch's first tuberculin, prematurely published and boomed by the lay press, did not realise the expectations that were excited," whereas, Dr. Mackenzie thinks, "our principal object and power, whether we recognise it or not, is to endeavour by every means in our

* *Lancet*, May 10th, 1902.

† *Lancet*, May 31st, 1902.

hands to raise the natural resistance of the body to the microbe—to devote our attention to rendering the soil an unfavourable one to the growth of the tubercle bacillus.” Transferring the same thought to the infective diseases, Dr. Mackenzie concludes with the reflection that these “existed long before the discovery of the germs, and we have accumulated a large store of knowledge of the clinical course, the treatment, and the issue of these diseases. This accumulated experience is of great value, though apt to be overlooked by the keen interest excited by fresh discoveries. It is against this tendency that I wish to enter a protest, and to point out that what is true is not necessarily new. We must never forget that the *soil* is of as great importance as is the *seed* in the proper understanding and treatment of diseases of microbic origin.”

Of recent years while we have been learning much that is interesting about microbes and animalcules we have, as Lister has truly said, to recognise that “a new and surprising light has been thrown upon the means with which the living animal defends itself against their assaults.” The terror of the microbe is to some extent assuaged by knowledge of the undoubted but hitherto imperfectly recognised potentialities of the man. Healthy blood, bacteriologists admit and assert, is a potent germicide. Either in or out of the body it has been shown to be fatal to germs. Whether this power of blood as a disinfectant be due to chemical agency or to cellular activity is as yet undetermined, but its reality is indubitable.

I think sanitarians may find comfort in these latter pronouncements, and are entitled to claim that sanitation, alike in theory and in practice, has not been pushed off the stage as the result of bacteriological development, but on the contrary it has come to stay, and occupies a stronger position than it ever did before.

In one of the most practical books ever written, by one of the noblest women and best sanitarians who ever lived, and whom I was privileged to have a long conversation with the other day, and who though now eighty-two is still in the enjoyment of full intellectual vigour—I mean Florence Nightingale—the question is propounded, “Is it not living in a continual mistake to look upon diseases, as we do now, as separate things, which must exist, like cats and dogs, instead of looking upon them as conditions, like a dirty and a clean condition, and just as much under our control; or rather as the reactions of a kindly nature against the conditions in which we have placed ourselves. I was (says the authoress of “Notes on Nursing”) brought up both by scientific men and ignorant women distinctly to believe that small-pox, for instance, was a thing of which there was once a first specimen in the world, which went on propagating itself in a perpetual chain of descent, just as much as there was a first dog (or a first pair of dogs), and that small-pox would not begin itself any

more than a new dog would begin without there being a parent dog. Since then I have seen with my eyes and smelt with my nose small-pox grow up in first specimens, either in close rooms or over-crowded wards, where it could not by any possibility have been "caught," but must have begun. Nay more, I have seen diseases begin, grow up, and pass into one another. Now dogs do not pass into cats. I have seen, for instance, with a little overcrowding, continued fever grow up and with a little more typhoid fever and with a little more typhus, and all in the same ward or hut. Would it not be far better, truer, and more practical if we looked upon disease in this light?"

Now this doctrine of Florence Nightingale's is, I suppose, to the specifically minded devotees of the bacillus, anathema maranatha, and the rankest of heresies, and some men claiming to be scientific would now as then denounce such doctrines as running counter to all the best work of modern times. I confess I think that is a very superficial view to take, and to take it is to ignore in pathology the work of Darwin, Alfred Russell Wallace, and Spencer. As Simon condemned the early sanitarians because "in their perfectly proper zeal against filth they immensely underrated, not to say ignored, the independent importance of the morbid contagia," so I would venture to suggest that some of our modern would-be reformers in their perfectly proper zeal against bacteria are in danger of immensely under-rating and even ignoring the potency of filth and removable conditions as factors in disease production and propagation. It is usual at Congresses like this to bestow an anathema upon that intransigent section of the community collectively spoken of as "anti's." Of that negative and implacable class I know of none more pestilent and dangerous than the anti-sanitationist, whether he appear in the form of a "pragmatical quack," the owner of slum property, or the adviser of a Government department.

Let those who will rest content with the old hard and fast specificity theory in its theological attire, its crude inconceivability, and its gratuitous malevolence. I would rather reflect that what we call a "disease" is to be regarded not so much as a specific entity as a mental conception, a figment of the imagination, if you will, based on the observation of certain groups of phenomena, and therefore assumed to be due to a distinct and definite cause. To argue on the cat and dog analogy for strict and invariable propagation "after its kind" of such an entity as this is surely bad logic. The facts observed in respect of contagion and rapid multiplication of the morbid poison in the infected body no doubt suggest that the cause of infective diseases should be organic rather than chemical, but it would be imprudent to go further at present than to allow that the influence which makes for disease is in

some cases associated with the growth of lowly forms of life within the body. That among such lowly organisms on the borderland of the animal and vegetable kingdoms, on the threshold, as it were, of the organic and inorganic, it is natural to expect that variation, origin of species, and natural selection should be especially operative, and that, as recent observers have shown, the form, characteristics, and potentialities of such organisms are profoundly influenced by the soil on which they happen to grow.* It would therefore be in no way surprising to find that there is in disease, as in all nature, a tendency of the common to become the specific, for harmless organisms to acquire deadly power by growth on favouring soil, to undergo modification and variation, and to relapse into inert parasites when confronted by adverse circumstances.

I say, then, if it be true that in the life history of the lowest of organic things lie the momentous influences which may determine plagues and pestilences, it is reasonable to believe that in organisms whose cycle may be less than an hour and whose rate of propagation is incalculable, evolution must be powerfully at work eventuating in the survival of those most fitted to their environment; and that in this as in other directions, man's influence may modify natural selection, and by acting in accordance with law learn to conquer nature by submitting to her.

To look on disease in this light is indeed the final blow to superstition and fatalism; it is withal a comfortable view, some might be disposed to regard it as a religious or providential view; it teaches that disease is not inevitably the fate and birth-right of every born child, but is in fact largely of our own making, it is not outside our knowledge and our power, but largely within our own control. That filthy conditions and the imperfect removal of effete material, without and within the body, are the factors of zymotic pestilence, which aforetime walked in darkness, but is now made plain by the revealing light of science.

No one can have attended out-patients' rooms of hospitals and consulting rooms for a quarter of a century, as I have done, without being almost overwhelmed when he reflects what an enormous amount of sickness and suffering are the direct result of avoidable folly, of thoughtless and wilful neglect of the simplest rules of health, as well as of wanton wickedness and vice. It is an additional infliction to be also assured by some who claim to speak in the name of science, that over and above this preventable misery we are the sport of malignant germs innumerable predetermined to the disservice of man, and that for his torment these are and were created. On the other hand, while the evolution theory asserts

* See Nash, *Medical Press and Journal of State Medicine*, 1901.

the *origin* of disease so does it see the possibility of its *abolition*, at any rate so far as zymotics are concerned; while it was an integral part of the old specific theory to affirm that disease was from everlasting to everlasting, and that immunity could only be purchased by the propitiating influence of a protective inoculation. As Southwood Smith observed: "The human family have now lived together in communities more than six thousand years, yet they have not learned to make their habitations clean. At last we are beginning to learn the lesson. When we shall have mastered it we shall have conquered epidemics."

If I have recalled to your memories some of the half-forgotten labours of earlier sanitarians, if with the *Times* newspaper I have condemned dogma as out of place in medicine, if I have argued for breadth of view and philosophic insight against a narrow specialism and a too rigid professionalism, it is not with a desire to disparage the magnificent and industrious researches into all departments of pathology which have become so striking a feature of modern times. It is rather that I may emphasize the *greater* necessity there is that the true student of sanitary science should, like Faraday's true philosopher, be "a man willing to listen to every suggestion, but determined to judge for himself. He should not be biassed by appearances, have no favourite hypothesis, be of no school, and in doctrine have no master. He should not be a respecter of persons; truth should be his primary object. If to these qualities be added industry he may indeed hope to walk within the veil of the temple of Nature." He may be the object of ridicule by the ignorant, or the target for scorn and criticism from those whose vested interests his duties requires him to disturb; but the true sanitarian intent on enduring work will not suffer such to distract him from his task. The temple of Hygeia needs many hands and various arts to complete it and adorn it, and in the building of that stately edifice each one of us may play a humble part.

"The Greek, the Roman, reared its ancient walls,
The silent Arab arched its mystic halls;
In that fair niche, by countless billows laved,
Trace the deep lines that Sydenham engraved;
On yon broad front that breasts the surging swell
Mark where the pond'rous sledge of Chadwick fell;
By that square buttress look where Virchow stands,
The stone yet warm from his uplifted hands;
And say, O Science! shall thy life-blood freeze
When fluttering folly flaps on walls like these?"