A LECTURE ON THE RELATIONS OF MICRO-ORGANISMS TO THE TREATMENT OF DISEASE.

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GENTLEMEN,—The first lecture of this session will be devoted to a fair and impartial inquiry as to the present position of micro-organisms in relation to the treatment of disease. As doubtless you are aware, there has been much affirmation, and much denial with regard to the special significance of these bodies. Some have belittled their importance, except in so far as their existence bears upon various doubtful and unsettled points in pathology, others have stated that the investigations in bacteriology have revolutionised previously accepted data as to the etiology of disease, and by inference also its treatment.

If we grant, as we must grant, that all rational treatment must be mainly founded upon a correct interpretation of etiology, symptoms, and *post-mortem* appearances, and if we accept the opinions of some authorities, then indeed it would be necessary now to commence, *de novo*, and to formulate other conclusions as to the action of remedies than those which in former years have been delivered to students at this University. But we may state now, and attempt to prove afterwards, that bacteriology has not revolutionised the etiology of disease nor its treatment, and that, in point of fact, micro-organisms have only been proved to influence two diseases which you are likely to see, namely, pulmonary phthisis and splenic fever; and another fever, fortunately rare, namely, relapsing. In these their significance cannot be gainsaid by any impartial or unprejudiced observer, and it would be manifestly unjust to minimise the deductions which necessarily accrue.

After these introductory remarks, we shall now proceed to ask what are bacteria? Well, they are vegetable cells, the lowest members of the vegetable kingdom. They possess constancy of form, that is to say, although they may vary more or less in outward appearance, in varying circumstances, yet each species has always a certain definite form marking its complete development. Many elongated bacteria, for example, reproduce themselves by the formation of spherical spores, but these spores seen by themselves are not to be regarded as varieties, for in truth they are merely miniature undeveloped bacteria. So also pathogenic bacteria, that is bacteria which when introduced into a healthy organism cause it to become diseased, can each arouse or bring about one and only one kind of disease. They cannot in the course of generations be so varied as to cause at one time putrefaction, at another a specific fever, at another cholera. We can, in some cases, deprive them of their noxious influence, by changing their environment, but we cannot further change them, so that they will give rise to a different kind of disease.

Further, bacteria have a cell-wall and cell-contents, and they multiply by division or by the formation of spores. The spores are surrounded by a thicker and stronger cell-wall than are the bacteria from which they develop. They are consequently harder products than the original bacteria. They can withstand to a much greater extent extremes of heat or cold, or the vicissitudes of atmospheric influences.

In a favourable environment, carefully nurtured and specially looked after, they grow and multiply with great rapidity. The vital processes so resulting give rise to chemical products, usually of the nature of an alkaloid, which are alike antagonistic to the life of the micro-organisms themselves, and of any vital tissues with which they may come into contact. Thus it is presumed they excite putrefaction and fermentation, and, when developing in the living organism, occasion the pathological changes characteristic of infectious diseases. These micro-organisms are round, (1) globular (micrococci); (2) short rods (bacteria); (3) long rods (bacilli); (4) spiral twisted (spirilla) spirochæte.

We shall now allude to some of the diseases into which these different forms of micro-organisms enter.

Micrococci.—These micro-organisms have been found more frequently in disease than any other forms of micro-organism. They are always observed in the pus of acute abscesses. They cause the secondary deposit of pyæmia; going from the wounds into connective tissue, interspaces, and vessels. In erysipelas they are especially seen at the edge of the bluish, and they occupy the lymphatic vessels, and spread along them. With regard to this affection there arises a crucial question, namely: Does it owe its origin in every case to micrococci? Pathological experience answers in the affirmative, for cultivated cocci drawn from erysipelas sources will, when inoculated in a rabbit, produce erysipelas after the incubation of fifteen to sixty hours. Clinical experience tells a different tale, for erysipelas does originate, does appear in cases when the most minute and searching inquiry is unable to detect even an abrasion of the skin on which the micrococcus could lodge. Its origin, then, must be, according to our present knowledge, undetermined. Old writers, before the micro-organism era, perhaps not wrongly attributed this to an impure or impoverished state of the blood, or to atmospheric conditions acting in ways we are as yet ignorant of.

Pneumonia.—Klein, Koch, and Friedlander have stated that micrococci exist in pneumonia. The cocci are large and oval, and, according to Friedlander, have around them a peculiar capsule, which is not, however, constant. It is affirmed that these organisms exist in great numbers in the early stage of pneumonia, not only in the exudation, but also in the lymphatics of the lung. Other observers found the coccus in the blood and blister fluid of patients with pneumonia. This they have cultivated, and state that, injected into rabbits, it produces pneumonia and fibrinous pleurisy, while cultured fluid without the micrococcus failed to do this. More recently, A. Frankel has isolated a micrococcus from the sputum of patients suffering from pneumonia. Pure cultivations of it have been made and injected into healthy animals, such as rabbits and guinea-pigs, and death followed, as a rule, in from twenty-four to forty-eight hours. On examination of the internal organs the spleen is seen to be much distended, and the blood swarms with micrococci. When the lung itself has been inoculated it is always found inflamed, and more or less condensation has taken place. As compared with Friedlander's pneumococcus, it is more specially and certainly fatal in its effects. But it has been seen also in empyema, and in the exudation of cerebro-spinal meningitis, coming as a complication of pneumonia. Further investigation is, therefore, needed before we can say which of the two, if either, is to be regarded as the real coccus of pneumonia.

Apart from these statements, we may say that the evidence of a clinical ward does not demonstrate that pneumonia passes from patient to patient, and if pneumonia does attack one member of a household, it is not found that others suffer. From a therapeutic point of view, judging from experience of such cases, we believe it would be most disastrous treatment to try to get rid of the inflammation of the lung by germicides or inhalations, which presumably might act on its supposed micrococcal origin.

Bacteria.—Diligent research has been made for a micro-organism in diphtheria. The examination is difficult, for the false membrane, characteristic of this disease, teems with a multitude of forms of bacteria, while the blood and intestinal organs are usually found untouched. One investigator has certainly isolated and cultivated outside of the body a bacterium which

causes inflammation and the formation of a false membrane when inoculated into mucous membranes of animals. But the same investigator frankly owns that he has not found the bacterium in every case of diphtheria, and that he has detected it in the mouth of a healthy child, so that the question of the specific bacterium in this disease must still be regarded as *sub judice*.

Bacilli.—We will now consider some diseases where bacilli are supposed to be the prominent factors.

Cholera.—In true cholera Koch described a bacillus, "comma-shaped," more or less "curved," which he considered characteristic of cholera and cholera alone. This opinion from the high authority of Koch was for a time undisputed, and by many is still regarded as true. Yet we must remember that the researches of Klein and of the British Investigation Committee sent to Spain, have indicated that Koch's conclusions are premature, and that the bacillus of cholera has not yet been isolated.

Typhoid Fever.—Many competent observers have testified to a bacillus of typhoid fever. They have agreed that there is a bacillus, but their opinions as to its special form do not altogether tally. The opinion is, however, nearly unanimous on this point, that the micro-organism of typhoid is swallowed, then passes through the stomach, and locates itself in the small intestine. Though this probably is the manner in which the disease originates, it is very difficult to prove it by experiments on animals. The animals experimented on, in their habits and in their food differ from human beings, and for some time it was considered impossible to give rise to a disease in them in any way resembling typhoid fever. Lately, however, a German authority has obviated, he states, this difficulty by neutralising the acidity of the gastric juice by a solution of sodic carbonate, and arresting the peristaltic action of the bowels by opium, and then by means of a catheter introducing into the stomachs of animals a pure cultivation of the typhoid bacilli. The majority of the animals so operated upon died, and in the contents of the bowels the bacilli were found in great numbers, and the intestinal mucous membrane was inflamed and altered.

Spirilla.—Whilst there may be some dubiety as to the bacillus origin of typhoid fever, there is little doubt that in relapsing fever a peculiar micro-organism exists in the blood which is spiral in form and quick and undulating in its movements. Koch has stated that this organism, termed the "spirochaeta Obermeieri," can be conveyed from man to man and from man to apes. With regard to the eruptive fevers, small-pox, scarlatina, and measles, nothing, so far as their micro-organism origin goes, has as yet been definitely settled. We have as yet only spoken of the negative or the undetermined origin of diseases dependent on micro-organism, and we now pass on to the more positive aspect, where little doubt can be entertained.

Splenic Fever.—In the disease termed splenic fever, anthrax, charbon, or woolsorters' disease we have undoubtedly a specific bacillus, which exists not only in the blood drawn from the body, but also in the organs of animals which succumb to anthrax. These bacilli, isolated and cultivated, produce, when inoculated, infection, and their spores have wonderful vitality, for, although they may remain dried and inactive for years, yet in favourable conditions of heat and moisture they are brought to further development. So the disease is caught by woolsorters, wool-pickers, horsehair cleaners, furriers, and tanners, who from their occupations have to deal with the wool and the hair of animals that have died from this disease. It is not likely that the virus can be absorbed by the unbroken skin or by the lungs, yet further it has been demonstrated that the intestine may afford ingress to the infectious matter, and that eating the flesh of animals that have died from anthrax will bring on the disease in man.

This origin of anthrax has been utilised. Prophylactic measures are absolutely necessary. The carcasses of animals dying from anthrax should be destroyed by fire. Further, in this disease Pasteur has made a notable triumph; for he has shown that, if the bacilli of anthrax are kept under cultivation for several weeks at an unchanging temperature of 106° F., they gradually lose their power of infection, although their external appearance is not changed. Inoculations made with the virus so cultivated produce little or no mischief, and animals so inoculated are not affected when exposed to infection with real anthrax. Anthrax, we may presumably infer, with proper precautions will not in the future prove fatal to animals or man.

Tuberculosis.—We pass now from anthrax to tuberculosis, which in one form or another you will meet with more commonly than any other disease in the whole range of practice. In 1882 Koch

announced the discovery of a specific bacillus as the one and only cause of tuberculosis, and that without its influence tuberculosis could not originate. This bold and comprehensive statement was received with mingled feelings; some doubted its truth, some accepted it without hesitation; but now, after the lapse of six years, no one can truly question Koch's discovery of tubercle bacillus in sputum. The bacillus tuberculosis does exist; its identity cannot be mistaken. It simulates no other micro-organism, and stamps with painful and unerring accuracy the diagnosis of phthisis and the unity of the disease termed tuberculosis. It brings into its fold the scrofulous diathesis, whose characters were formerly considered different from those of tubercle. Now we must recognise them as one and the same, through the specific character of the bacillus. How the bacillus enters the system is still a mooted point. In the belief that it and it alone was the *fons et origo mali*, it was inferred that certain inhalations would destroy the bacillus in the lungs, and that this dreaded malady would, like epidemics of the past, cease to harass the human race. So inhalations were tried and tried, but the disease, unconquered, kept its course, and the life of the consumptive was not lengthened. Shall we then abandon all hope of good in the treatment of phthisis? Shall we fold our hands and in despair exclaim *Kismet*? Nay, verily. The inadequacy of inhalations to meet this disease has done much to render clear what ought to be done in phthisis. We have to meet constitutional weakness and local mischief, and the fittest way to remedy these is to place the patient in such surroundings that not by fits and starts, but at every breath, he or she must draw in air destructive to the growth of the organism, and calculated to strengthen a weakened frame. Hence the undoubted benefit of the climatic treatment of phthisis. Other treatment, which does not keep these objects in view, is simply pottering or tinkering, as pottering and as tinkering as the attempt to oust syphilis from the constitution without the aid of mercury.

Time prevents us entering more fully into this subject. The survey given has necessarily been rapid; the facts, however, cannot be questioned. While we welcome discoveries made in this new scientific field, yet we cannot discard our old weapons as rusty and futile. From the ripe experience of the past, and from present day hospital and private practice, we must still battle with acute disease. We must also remember that laboratory work does not always agree with bedside observations, and that scientific research in medicine must ever to a great extent be judged by the practical inquiry *cui bono*? And if this standard is to be set up with regard to its utility in grave disorders, it is still more necessary to raise it in connection with the slightest and most chronic ailments, in which no micro-organism can ever be traced. In dealing with these ailments, your future work will often be associated with, and your success will be judged by, the information you possess and the means you can adopt to make little troubles pass away, and thus to render the path of life easier and smoother.

Our treatment of disease has not in late years stood still. It is not altogether pharmacopoeial, for we also call to our aid climate and diet, kind sympathy, and skilled nursing. Moreover, our better knowledge of etiological facts has led to the adoption of sanitary precautions, which diminish greatly the probability of any epidemic obtaining amongst us any permanent hold.

Our present position is this: we have emerged from expectant therapeutics to a firmer and more active faith. We are daily outgrowing any belief in the grotesque, outrageous, and degrading doctrine of *similia similibus curantur*, which has never taught us how to check a malady or to relieve an ache or pain. We can afford to be amused at the wondrous tales, related in daily papers, as to faith cures, for we know that the age of miracles is past. No crossing of hands, no action on the mind or the senses, can make the dumb speak, the blind see, the deaf hear, or enable the paralysed man to take up his bed and walk. Such legends gravely told are an affront to our reasoning and our knowledge of the laws which govern the human system in health and disease.

The rational method of treatment now adopted is plainly directed by pharmacology, that is, the action of remedies. Neither being too optimistic or pessimistic in our interpretation of these actions, but relegating all doubtful points to that great tribunal, common sense, which after all is the *ultima thule* of all true belief. Guided by this method, we may justly affirm that the progress of medicine is at present satisfactory, advancing, and sure.