The advisability of the operation in order to prevent occurrence of cancer of the cervix uteri, has been strenuously urged in America, and the question is certainly a very important one. For, if it be the fact that a torn cervix uteri is more likely to become the seat of cancer than a sound one, that would constitute an important argument in favour of carefully repairing these injuries, even in cases where the laceration is only slight in degree. What is known as to the relative frequency of uterine cancer where sexual intercourse has occurred, and in those where it has not, favours the conclusion that the latter class is markedly less liable to the disease. At present, we are hardly in a position to say whether this comparative frequency of cancer in the former class of cases is due to the mechanical injury of the structures at the os uteri (including cervical lacerations), or to the increased functional activity of the uterus associated in such cases. That eversion of the mucous lining of the cervix, followed by mechanical bruising of the structures, probably constitutes a condition in a certain degree favourable to occurrence of cancer, may be strongly suspected. In a recent paper, Zinke (*Jour. Amer. Med. Association*, July 25th, 1885), who has collected opinions on the subject of the indications for the operation from various authorities, concludes that, when there is present hereditary tendency to cancer, marked lacerations should be always dealt with by operation, even in cases where no present inconvenience exists, and solely with the idea of warding off the occurrence of cancer. This appears to me to be a proper view to take of the subject. Further, it may be suggested that, if the laceration be not so severe as to necessitate the operation, the desirability of cauterising the torn surfaces, even in cases when there is no special hereditary tendency manifest, presents itself. For it must be recollected that, in many cases of uterine cancer, no history of hereditary tendency is discoverable.

Summary.—There will, no doubt, be differences of opinion as to the indications for the performance of trachelorrhaphy; but the following may be submitted as embodying conclusions at which I have personally arrived:—

The operation is indicated by the presence of a chronic extensive eversion of the cervical lining; by the presence of considerable hypertrophy of the os, the result of laceration, and the more so if hypertrophy and eversion be conjoined; by the presence of chronic severe local pain, evidently traceable to the irritation of a raw surface less extensive in amount, or traceable to cicatricial hardening at the bottom of the fissure; by the association of marked laceration with a troublesome displacement of the body of the uterus; by the presence of repeated miscarriages in a chronic case; by the presence of a severe recent laceration, even in cases where no severe symptoms have had time to develop themselves, with the view of preventing (1) cellulitis; (2) the occurrence of cancer; (3) the supervention of symptoms generally; lastly, by the presence of general severe prostration, inability for locomotion, etc., obviously traceable to laceration.

The operation itself is not, in most cases, a difficult one, but, in some cases, it is so. In assisting to hold the cervix down, I have found the large tenaculum hooked forceps, depicted in the last edition of my work on *Diseases of Women*, made by Mayer and Meltzer, of very great utility. Sometimes the nodular hypertrophy renders coaptation of the edges, after paring them, not easy, owing to one side of the rent being very short, the other very long. Another difficulty is, in some cases, the excessive hardness of the tissues to be perforated by the needle, which is sometimes so great that much force is required to penetrate the tissues. The needles need to be very strong for such cases. I have found No. 6 silver-wire most suitable for sutures, and have generally removed them in not less than ten days. Probably it would be better to leave them a week or two longer, in cases where the patient is very weak and nutritive action feeble. The importance of a preparatory treatment before proceeding to the operation has already been pointed out.

DEVONSHIRE HOSPITAL, AND BUXTON BATH CHARITY.—A donation of £100 has been received by this institution during the past week from Mr. William Coare, Brocklehurst, M.P. for the Macclesfield division of the county of Chester. The donation was sent through the hands of Mr. R. R. Duke, one of the trustees of the hospital. A small legacy has also been received by the institution from the executors of the late Joseph Barlow, of Haslingden, the amount being £17 18s. 4d.

CHOLERA AT SEA.—An epidemic, supposed to be cholera, has broken out on board the Queensland Line steamer *Dorunda*, which arrived at Townsville on Dec. 11th. The *Dorunda* has arrived at Brisbane. Since the beginning of the outbreak there have been altogether thirty-one cases and fifteen deaths.

A LECTURE

ON

THE EXCITING CAUSES OF DISEASE.

Delivered before the Edinburgh Health Society.

By BYROM BRAMWELL, M.D., F.R.C.P. Edin.,

Assistant-Physician to the Edinburgh Royal Infirmary; Lecturer on the Principles and Practice of Medicine, and on Practical Medicine and Medical Diagnosis in the Extra-academical School of Medicine, Edinburgh.

MY LORD PROVOST, LADIES, AND GENTLEMEN,—In the lecture which I had the pleasure of delivering to the members of this Society a year ago, I directed attention more particularly to the derangements of nutrition and to those disorders which result from infringement of, what may be termed, the elementary laws of health. And before proceeding to the subjects which I wish to bring under your notice this evening, allow me very briefly to recapitulate one or two of the more important points.

We saw that, for the nutrition of the body as a whole, and indeed of each one of its individual organs and parts, certain requirements are necessary. These are: 1, a sufficient supply of nutritive material—blood-plasma; 2, a sufficient supply of oxygen; 3, satisfactory removal of waste-products; 4, a healthy condition of the nervous system; 5, a sufficient amount of rest and sleep.

Now it is the object of this Society to supply to the inhabitants of Edinburgh in the first instance, and then (by means of our published lectures) to the community at large, a knowledge of health-matters. I regret that we are unable to supply to those who need it the power of self-control. We must look to the parents (more especially to the mothers) of our children, and to the teachers in our schools, for the training and development of the will and the power of self-control. There are undoubtedly great natural differences in the force of will and the power of self-control in different individuals, just as there are great natural differences in the power of acquiring information, of reasoning, and of all the faculties of the mind; but what I want particularly to insist upon is this, that the power of self-control is to a large extent a matter of training and of habit, and that the education of this power of self-control, the power of inhibition, as we technically term it—the power which the highest nervous centres have of restraining, controlling, or inhibiting the action of other and lower centres—the highest faculty of the nervous system, should begin in early infancy, and should be steadily cultivated and perfected all through life. What, I would ask, is the use of teaching a child the theoretical distinction between right and wrong, if you do not at the same time endeavour to strengthen its will and its power of self-control; if you do not encourage it, by example as well as by precept, in the habit of doing what is right, and in the habit of not doing, or in other words, in the habit of inhibiting or restraining the desire to do what is wrong? I would like to repeat more emphatically and more fully than I did in my last lecture, that the main object of education—I am, of course, speaking of so-called secular education (I may, perhaps, be allowed to remark in passing that I do not like the word secular as applied to education, for I cannot conceive of any system of education which does not include as its first fundamental the inculcating of the higher moral and religious truths)—I say that the main object of education is not, as some people seem to suppose, to cram the child with the greatest amount of fact-knowledge, but to teach it how to work; to cultivate its power of application and of mental concentration; to teach it habits of cleanliness, order, regularity, and diligence; to call forth, stimulate, and strengthen its powers of observation and reasoning; to give it opportunities of experiencing the feeling of mental satisfaction and enjoyment, with the resulting invigorating effect, both on body and mind, which attends the successful accomplishment of any piece of work, however small, which is well done; to set before it a high ideal of life and conduct; above all, to strengthen its will, to give it force of character, and to teach it the power and habit of self-control.

Now, these which are, in my opinion, by far the most important objects of any system of education, are difficult or impossible to measure by any system of payment by results. There is a possibility, therefore, of their being to some extent undervalued or lost sight of, both by the managers of schools in the selection and appointment of teachers, and by the teachers themselves.

The Exciting Causes of Disease.—This evening I wish to direct at-

tention to some other causes of disease, and to give you some practical information as to their prevention. I must premise my remarks by saying that the causes of disease may be divided into two great groups or divisions, namely: 1, the direct or exciting causes; 2, the indirect or predisposing causes; and that, for the production of many diseases, both a predisposing and an exciting cause are required.

Many of the diseases to which I am going to refer are due to the nature of our surroundings, and to the somewhat artificial conditions in which we are compelled, by the circumstances of our advanced civilisation, to live; to the imperfect sanitary arrangements of our houses and towns; to the fact that the air we breathe, the water we drink, the food we eat, are all liable to be loaded with noxious impurities, and that the very persons with whom we come in contact are at times eminently hurtful and injurious to us.

It is important to remember, as Mr. McCandlish forcibly pointed out at the last annual meeting of this Society, that many of the diseases to which I am about to refer cannot be prevented by the individual efforts of the person who becomes affected by them; and that it is the duty of each member of the community not only to avoid doing anything which may interfere with the comfort, injure the health, or endanger the lives of his fellow-citizens, but also to submit cheerfully and readily to any regulations which the authorities who watch over the public health may see fit to impose, and to co-operate heartily with them, so far as he is able, in their laudable endeavours to diminish sickness and to protect health.

Let us now look at some of the more important of the direct or exciting causes of disease.

1. *Accidents and Injuries* are such common and obvious causes that they need not detain us. Nor can I pretend to advise you how they are to be guarded against and prevented any better than you can advise yourselves.

2. *Catching Cold*.—Exposure to cold, especially to damp cold, and to sudden variations in temperature, is a fertile source of disease, more particularly of rheumatic, bronchial, and pulmonary affections. The number of deaths which annually result from this cause is great.

It may not perhaps be altogether inopportune if I say a few words with regard to the proper clothing of the body. One of the most striking characteristics of good health is the power which the human body has of maintaining its temperature at a fixed point, notwithstanding the external alterations in temperature to which it may be exposed. Two things only (in addition to health) are required: firstly, it must be supplied with a sufficient quantity of suitable food or fuel; and, secondly, it must be suitably clothed.

Had time permitted, it might perhaps have been interesting to have described the exact manner in which this fixed temperature is maintained under varying conditions. Suffice it, however, to say that the heat-production is due to the chemical changes which are constantly taking place in all the tissues, more especially in the muscles, and in the great glandular organs, such as the liver; that the loss of heat is in great part due to radiation and conduction from the surface of the skin, and to the evaporation of the surface-moisture or sweat; and that the balance between the production and loss of heat is regulated by a beautiful self-adjusting or automatic nervous mechanism. When, for instance, the body is placed in a cold atmosphere (a), the vessels in the skin contract: less blood passes through the superficial or surface circulation; less heat is consequently carried to the surface, for the blood is the great means or channel through which the heat, which is produced in the deeper tissues, is distributed through the body; (b) the condition of the skin is so altered that its power of transmitting or conducting heat is diminished; (c) the secretion, and, therefore, the evaporation of sweat, is greatly lessened. For all these reasons, the loss of heat is very much diminished, and the body does not cool down and reach the temperature-level of the surrounding atmosphere, as an inanimate object or even a cold-blooded animal would do. But, further, the temporary application of cold to the surface not only lessens the loss of heat, but it so acts upon the central nervous system that the production of heat is actually increased. In this way, chiefly by the diminution of loss of heat, but partly by the increased production of heat, the cooling of the body is prevented. Now, in very cold climates, Nature requires to be assisted in her efforts at maintaining a fixed temperature. The Laplanders, for instance, eat large quantities of blubber and fat, which are eminently heat-producing foods, and clothe themselves with furs, in order to form an additional non-conducting heat-barrier between the severe external cold and their own warm bodies.

The Requirements which Clothing should Possess.—In this changeable and somewhat cold climate of ours, the first requirement which

clothing ought to possess is, that it should be sufficiently warm. There is a great deal of carelessness, more especially amongst young men, with regard to this matter. Glorifying in the enjoyment of splendid health, they are apt to think that they can go out in any weather without a great coat; that they may even get wet through and sit in damp clothes with impunity. Now, I am not going to advocate any system of coddling; it would be, I think, a bad day for our country if we gave up our football because a few boys get broken legs, if we stopped our hunting because a few men are killed every year, or if we were to keep indoors on wet days because some of us get cold; all I want to advocate is reasonable carefulness without coddle. I would like everyone to realise that a cold is not always a trivial matter. Very grave disease may, indeed, result from it afterwards. Consumption, as I shall afterwards, if time permit, more fully point out, has its starting point in a simple cold. In many cases, disease of the valves of the heart results from catching cold, and the resulting rheumatism. Most people are aware that the great risk in rheumatic fever is inflammation of the valves of the heart; but few people know that inflammation of the heart may arise when the rheumatic symptoms are slight and trivial. This is more especially the case in children and young persons, in whom a stiff neck, a painful joint, or any other indication of rheumatism, should always be most carefully attended to. Knowing the serious consequences which sometimes result in cases of this description, I would most earnestly impress you with the importance of carefulness in this matter.

The second requirement which clothing should possess, is that it should be sufficiently porous to allow the diffusion of gases and the absorption of any excess of surface-moisture. Underclothing made of flannel, or of some woollen material, such as merino, answers these requirements (warmth and porosity) the best; silk is also good, though not so good, and its first cost is so much greater that it does not come within the reach of most people.

The third requirement is, that the clothing should be light; and here I would point out that the common idea that weighty clothing is necessarily warm is often fallacious. Woollen materials, which are the warmest, may be lighter than other. It must also be remembered that a heavy dress or cloak, such, for example, as the long cloaks trimmed with heavy furs, which many ladies are wearing at the present time, have this disadvantage, that they necessarily interfere with brisk walking, which, as we all know, is one of the best ways of keeping ourselves warm in cold, frosty weather.

The fourth requirement is, that the articles of clothing should fit well and not hang heavily, nor drag nor press unduly upon any part; in short, that they should not interfere in any way with the free movements of the body. I need not say that this requirement is not always fulfilled. High heels, which throw the centre of gravity out of the proper line, and place an unnatural strain on the ligaments, bones, and joints, interfering with all free movement, and transforming the beautiful elastic step of Nature into a miserable and ugly hobble; pointed toes, tight skirts, "wasp"-waists, and other monstrosities which could be mentioned, are not altogether unknown. The practice of tight lacing is specially injurious; for, by compressing the ribs and thorax, it interferes with the free movement both of the heart and lungs, it squeezes, distorts, indents, and sometimes even dislocates the liver, and interferes, more or less, with the free play of all the abdominal viscera.

The fifth requirement is, that the clothing should be suitable to the occupation and in accordance with the means of the wearer.

The sixth is, that it should be nice looking and becoming. There will, I fancy, be considerable difference of opinion as to the relative importance of this last requirement. Although I think it the least important, and have therefore placed it last, I by no means wish to undervalue it. I not only like to see people nicely dressed, but I even go so far as to say that it is, in my opinion, the duty of every one to look her best (I put it, you will observe, in the female gender); I say I think it is the duty of every woman to look her best, and to see not only that she is clean and tidy in her person, but that her dress is neat, tasteful, and becoming. Do not, please, misunderstand me, and suppose that I am advocating expensive or fashionable dressing. Quite the contrary; I strongly deprecate the wasteful expenditure in dress which is only too common in all ranks of society at the present day. It is necessary to remember, on the one hand, that persons of modest means who dress expensively are not suitably and becomingly clothed; and, on the other, that with a little taste in the selection of materials, and with a little skill in the cutting and fitting, the most homely and least costly materials may be made both elegant and becoming.

Influence of Fashion.—You will hardly expect me to say anything with regard to fashion, that mysterious custom whose imperious

dictates a large number of our lady friends seem to think it would be almost a sacrilege to disobey. The best I can say of fashion is that it is good for trade, that it puts money into the pockets of the milliners, and that the changes which it necessitates are, as a rule, harmless from a health point of view. There are, however, exceptions to every general rule, and some of the customs which fashion favours are distinctly injurious. I will only mention one, the custom of puffing and painting, which is common further south, but happily comparatively rarely seen here.

3. The Introduction into the Body of Noxious Materials.—The diseases due to this cause are very numerous, and many of them of great importance. The noxious material may come into contact with the surface of the body, and produce disease of the skin; or it may be inhaled with the breath, or carried into the stomach and alimentary canal with the food and drink.

Diseases due to Mechanical Irritants.—In some cases, the noxious material, or poison, as we might perhaps term it, is simply a mechanical irritant. As an illustration of this group, I may mention the bronchial and pulmonary diseases which are due to the inhalation of dust-particles. Stone-masons, knife-grinders, potters, and the workers in many other trades, for instance, very frequently suffer, and often die, from severe forms of lung-disease produced in this way. In coal-miners, the lung sometimes becomes impregnated with minute (microscopic) particles of coal-dust and smoke; though, in consequence of the better ventilation of the pits, this disease—coal-miners' phthisis, as it is technically termed—is by no means so frequent as it was a few years ago. All measures which prevent the escape of dust-particles into the atmosphere, free ventilation, and the use of respirators, are the means by which the diseases due to the inhalation of fine dust-particles are to be prevented.

Diseases due to Chemical Poisons.—In other cases, the noxious material is a chemical poison. Obscure cases of illness, for instance, every now and again result from arsenic having been used in the manufacture of wall-papers and paints. Bright emerald greens, which owed their colour to arseniate of copper (Scheele's green), were at one time largely used in house-decoration; but it is not only greens which are injurious; white ground papers sometimes contain large quantities of arsenic. So recently as six years ago, my own children suffered from very anomalous symptoms, which I could not explain until I detected arsenic in the wall-paper of the nursery—a white ground paper, with a blue pattern. Dr. Stevenson Macadam, who was kind enough to confirm the analysis, found that the quantity of arsenic in this paper was very great. For the first few months after a paper which contains arsenic is put up, there may be no injurious effects; it is only after the surface of the paper becomes rubbed and its gloss taken off, that the poisonous particles are thrown into the atmosphere, and are absorbed into the system chiefly through the air-passages. I understand that the best manufacturers are now fully alive to the danger; but it is as well, in choosing a paper, more especially a cheap paper which contains bright green colours, to have a guarantee from the paper-hanger that it is free from arsenic.

I might mention several chemical substances which prove injurious to the workers in particular trades. Makers of lucifer matches, for example, used not unfrequently to suffer from decay (necrosis) of the jaw-bone, the result of phosphorus-poisoning. Painters, plumbers, and all persons who come into contact with white lead, are liable to suffer from chronic lead-poisoning. The manufacturers of white lead not unfrequently die from lead-poisoning. Severe cases of this description are, fortunately, not met with in this neighbourhood, for there are no white lead factories near Edinburgh; but in Newcastle-on-Tyne, where I formerly practised, I used frequently to have amongst my hospital patients the most serious cases of this kind.

I have known symptoms of chronic lead-poisoning produced by the use of hair-dyes containing lead. A few years ago, a medical friend told me of a case in which death had actually resulted from lead-poisoning produced in this manner.

Diseases due to Living Organisms.—In other cases, the noxious material is a living organism. In this group, an immense number of diseases are included, many of them highly contagious and infectious.

In some, as in ringworm and scabies or itch, the disease is local, and confined to the surface of the body. In the former (ringworm), the poison is a minute vegetable organism; in the latter, an insect (the *sarcoptes scabiei*). Both diseases are readily communicated by contact from person to person. To prevent their spread, you must destroy by local means the parasite which is their cause.

In others, the disease is local and internal. The most common and fatal disease, pulmonary consumption, has been proved by the celebrated German pathologist, Professor Koch, to be due to a minute living organism (the tubercle-bacillus).

In others, again, the disease is general. That dreadful disease, pyæmia, which used to be common in our hospitals, and was frequently the cause of death after surgical operations—even after trivial operations—is due to the entrance of germs or septic particles into a wound, and to the poisoning of the system by the putrefactive products which result therefrom. Owing to the free use of antiseptic measures, decomposition in wounds, and the resulting pyæmia, are now happily rare. As you are probably all aware, we are chiefly indebted for this immense advance in the treatment of surgical cases, and for the enormous saving of life and suffering which it has effected, to the great surgeon, Professor Lister, whose name will, without doubt, be honoured by posterity as one of the greatest medical celebrities and benefactors of this or any other age.

The great group of specific infectious diseases, such as scarlet fever and small-pox, are probably all due to the introduction into the body of a particular organic poison, though in every case the poison has not as yet been demonstrated.

The Prevention of the Specific Infectious and Contagious Diseases.—The prevention of these diseases is of such immense importance, that, although several previous lecturers have spoken to you on the subject, I make no apology for again bringing the matter before your notice.

It is astonishing how much ignorance, I fear I must go further, and say, how much culpable negligence, there is in regard to the precautions which should be taken to prevent the spread of these diseases, and that even amongst the more intelligent and more highly educated classes. Take, for instance, the spread of infectious diseases in schools. Cases are again and again met with, in which a child is sent to school from a house in which there are cases of scarlet fever, or still worse, in which a child, who has just recovered from an attack of whooping cough or scarlet fever, is sent back to school while still infectious. I fancy that most of those who have conducted for any length of time our high-class day schools in Edinburgh, have met with some cases of this description. Certainly more than one has come to my own knowledge. I need not say that, if cases of this sort occur in the upper ranks of society, they are still more liable to occur amongst the labouring and working classes. I can hardly conceive that the magnitude of the consequences which may result from carelessness in this matter is fully realised. A child who is sent to school from a house in which there is a case of scarlet fever, may carry (observe, I do not say will carry) the fever poison with it; some of its fellow pupils may contract the disease, some of them may die; the schoolmaster or schoolmistress will certainly be caused grave mental anxiety; the school may have to be shut up, the house repapered and repainted; serious pecuniary loss may, in consequence, be inflicted on those who are perhaps little able to bear it, for I need not say that schoolmasters and schoolmistresses are not, as a rule, wealthy people. These consequences are serious, they are surely sufficiently serious to necessitate the most scrupulous care on the part of all concerned; but I would be giving you a very inadequate and imperfect idea of the magnitude of the evils which may, and which sometimes do actually result, if I were to stop here. I may perhaps enable you to realise more vividly what these results may be, if I make use of a comparison. During the past few years, we have from time to time been startled by the accounts of one of those dreadful dynamite explosions, which, thanks to a kind providence, have happily, I think I am right in saying, been miraculously unattended with any loss of human life. Now, suppose that a parent, either through ignorance, or carelessness, or culpable negligence, were to send a child to school with its pockets filled with dynamite; suppose that the dynamite were to explode, to wreck the building, and to kill both teachers and scholars, would not a thrill of horror reverberate from one end to the other of the civilised world? And, supposing that such a catastrophe were to occur again and again, would not the nation rise as one man, and demand that the most stringent measures be immediately taken to prevent the possibility of the recurrence? Now, I speak without any exaggeration when I say that the evil which may result from introducing scarlet fever into a school may be even more disastrous. True, the immediate effects are not so startling and sudden, and the full results may never perhaps come before the public eye; but the total loss of life and suffering may be infinitely greater. There is this essential difference between dynamite and the scarlet fever poison, that, in the case of dynamite, the maximum effect is at once reached; although the immediate result may be terrible, yet the evil is at an end with the occurrence of the explosion; and it is possible, immediately after the accident, to sum up the damage, and exactly measure the result. But the scarlet fever poison is a living material, which, so long as it meets with a suitable nidus or soil, continues to grow and multiply, and which may be propagated from person to person almost indefinitely. A single case may thus give rise to an epidemic, which may spread

itself over the length and breadth of the land, and may produce a huge mortality. It may, of course, be said that scarlet fever is always epidemic somewhere, and that, do what you will, you cannot stamp it out; that children must therefore run their chance. Such an argument is, I hold, altogether fallacious; if it were once admitted, it would prevent us from taking any steps whatever to check the spread of diseases of this kind. I want every individual here present to realise that much more can be done, and ought to be done, in the way of arresting and stamping out these infectious diseases, than we are doing; and that it is the duty of every right-minded man and woman to do what he or she can to help in this matter.

[To be continued.]

FURTHER RESEARCHES ON CHOLERA.

By R. KOCH, M.D.,

Professor of Hygiene in the University of Berlin.

Speech at the commencement of the Second Conference on Cholera, held at Berlin on May 4th, 5th, 6th, 7th, and 8th, 1885.

GENTLEMEN,—As an introduction to our discussions, I propose to give you a short sketch of the investigations of cholera made since our last conference, and to add thereto some facts with regard to investigations which I have carried on, in conjunction with Drs. Weisser and Frank, on the pathogenic properties of the cholera-bacteria, and some questions connected therewith.

As you will, no doubt, remember, the investigations made by the Commission sent to India to investigate cholera, showed that a micro-organism, belonging to the group of bacteria, is present in cholera, chiefly in the intestines of persons who have died of that disease, and in the dejecta of those suffering from it; and that this organism can be distinguished from all other bacteria by its peculiar characteristics, and thus must be regarded as a distinct species. As these bacteria were never found elsewhere than in cholera, we had to do with a micro-organism which was characteristic of cholera, and which stood in the closest relation to it. You remember, further, the conclusions which I have drawn, partly on account of this connection, between the cholera-bacteria and cholera, and partly on account of the correspondence between the behaviour of the cholera-bacteria and epidemiological experience—the conclusion being that the cause of cholera was to be looked for in these bacteria.

It was to be expected that my statements would not at once be accepted. I had never expected that myself; and it seemed to me very desirable that my investigations should be tested, in all directions, with the utmost possible completeness, and with thorough criticism. This has also happened to the most complete extent. A number of investigators, skilled and unskilled, have busied themselves with this question, and have arrived at results, of which I shall give you a short sketch. It would lead me too far to inform you of all which has been written with regard to the cholera-bacteria; and I will, therefore, confine myself to the most important works.

The first who published anything with regard to the relation of the cholera-bacteria to cholera were Finkler and Prior, who, as is undoubtedly known to you all, were of opinion that they had found a micro-organism in cholera nostras which could not be distinguished from the cholera-bacilli. If this statement had been correct, then naturally the importance of the cholera-bacteria would have been lost. I obtained, through the courtesy of Messrs. Finkler and Prior, the opportunity of thoroughly investigating for myself the bacteria found by them, and was able to compare them with the cholera-bacteria found by me. It was very soon evident that very important differences existed between these two forms of bacteria. Instead of long descriptions, I will show you some preparations, by which you will be able to convince yourselves of their different behaviour. I hand you two vessels. In one are pure cultivations of cholera-bacteria, in test-tubes which contain nutritive gelatine, and are closed by cotton-wool plugs. You will easily recognise the characteristic growth of the cholera-bacteria, which form in the nutritive gelatine a thin whitish thread of the length of the puncture made by the platinum wire. The liquefaction of the gelatine which is caused by the growth begins at the upper end of this thread, and spreads very slowly. At the same time, a shrinking or drying occurs at the upper end of the thread; and thus a funnel-shaped depression is formed, which, when

looked at by transmitted light, looks as if it were an air-bubble. The cultivations of Finkler's bacilli, which are present in the second glass, and were prepared in exactly the same way, behave very differently. They liquefy the gelatine much more quickly, and in the whole extent of the needle-track. Hence that drying up or absorption of a part of the thread does not occur, and thus you miss the apparent air-bubble in the upper part of the cultivation. I will, however, remark here that this air-bubble, which is here seen in the cultivations of the cholera-bacilli, and is absent in those of Finkler's bacteria, is not the only point of distinction. It has been said that, under certain circumstances, a similar bubble may be formed in the cultivations of Finkler's organisms. This is correct. If the organisms be grown at the lowest possible temperature—that is, very slowly—a bubble-formation is produced, similar to that of the slower growing cholera-bacilli. These cultivations which you see here, however, have grown under exactly similar conditions—namely, in gelatine of the same concentration, and at the same temperature; and hence, if these bacteria be the same, they must behave similarly in the gelatine-cultivation. But this is not the case. When you compare the cholera-cultivations with Finkler's, you observe that, when the first show scarcely perceptible evidence of liquefaction, and in the lower part are thin and thread-like, Finkler's organisms have already liquefied a great part of the gelatine, and formed a sac-like fluid part with muddy contents. This is, however, as I have said, not the only difference. The products of the decomposition of these two forms of bacteria are also different, as is evident from the fact that the cultivations of Finkler's bacteria have a stinking smell, while those of the cholera-bacilli have a peculiar aromatic odour. Further, they behave differently when they are grown on boiled potatoes. The cholera-bacteria do not develop at all on potatoes at the ordinary temperature of the room, or only so slightly as not to be evident to the naked eye. You see a potato, which was inoculated with cholera-bacteria six days ago, and there is not the slightest growth. On the other hand, on this potato, inoculated at the same time with Finkler's bacteria, there has been formed, as you see, a greyish yellow slimy mass, which consists of an enormous vegetation of Finkler's organisms.

The same results as regards the difference between these two kinds of bacteria have also been obtained by others quite independently of my investigations; for example, by Dr. Van Ermengem, who had likewise received specimens of their bacteria from Finkler and Prior.

I should like to mention only, in addition, that it seems to me questionable whether the bacteria found by Finkler are related to cholera nostras, as Finkler has supposed. They were found in the evacuations of persons who had suffered from diarrhoea, and that not in the fresh evacuations, but after these had stood in a putrefying state for fourteen days. I have seen microscopical specimens of the fresh evacuations, and these did not contain the peculiar forms of Finkler's bacteria, but other forms, which, however, according to Finkler's idea, belong to their cycle of development. In addition, I may point out here that, up till now, a number of undoubted cases of cholera nostras have been investigated by different observers for the presence of comma-shaped bacteria. At our first conference I was able to inform you of some cases in which nothing could be found which was at all like the cholera-bacteria. Since then, I have investigated several cases, in part fatal ones, with a like negative result. But other investigators, also, have examined numerous cases in like manner, for example, Van Ermengem, Watson Cheyne, Biedert, etc.; but no one has found in cholera nostras bacteria which were the same as the cholera-bacteria or Finkler's organisms.

The second noteworthy research on cholera-bacteria which I must mention is that made by Dr. Klein. As is well known, Klein was sent to India by the English Government to carry out investigations into the etiology of cholera. From the reports by Klein which have as yet been published, we must conclude that he has exclusively busied himself in upsetting my statements. At least, I have as yet found nothing in Klein's publications but what stands in direct contradiction to my results. Klein has brought back nothing positive or new from his expedition. Any other result could scarcely be expected; for already, before he went to India, his judgment of my statements was decided. He attempted, at that time, to show that I had contradicted myself; that I had, in Egypt, compared the bacteria found in the wall of the small intestine with the bacilli of glanders, but that the latter were not curved, but straight bacilli; then all at once, in India, the straight bacilli had become curved ones. This objection has later, also, been brought forward by others; but—in order at once to settle this point—he who asserts this has evidently never seen side by side sections containing cholera-bacilli and glanders-bacilli—I have taken the liberty of placing here such preparations, and you will be able to convince yourselves that it is very difficult to distinguish these