tied. "Then with blunt instruments or with scissors and knife the glandular capsule is separated from the inner surface of the tumour until the posterior surface has been reached outside the region of the recurrent nerve. This spot must be measured accurately, since the nerve is sometimes drawn out of its normal groove between the trachea and œsophagus and is bent over the posterior surface of the tumour." [A specimen illustrating this point was shown.] "The glandular capsule is then again cut vertically. It is especially important that the section on the inner side should be made well above the level of the cricoid cartilage so as to avoid any possibility of wounding the recurrent nerve." The above description applies to the operation as performed for a more or less circumscribed tumour. In the next lecture I shall have more to say about such tumours and their treatment by enucleation. When there is no such tumour but the whole gland is more or less diseased, as in parenchymatous goitre, then no separation of the capsule is made, but the section is carried directly backwards through the gland. This is resection-exstirpation.

Comparing Kocher's with Mikulicz's operation it will be seen that both agree in leaving intact that portion of the gland that is nearest to the recurrent nerve. But the former surgeon avoids separating the gland from the surface of the trachea, and especially refrains from tying up masses of thyroid tissue—a practice which he, quite rightly I think, strongly condemns. He says that, not only does it tend to prevent that primary union which is so important, but that the application of the ligatures is apt to endanger the safety of the nerve. This may occur even when the greatest care is taken. With reference to this point Kocher says that formerly, when he had had less experience in removing goitres, he had sometimes, when attempting to remove one, been obliged, on account of bleeding or dyspnoea, to tie the pedicle in one or more masses, in order to cut short the operation. But he had noticed tolerably often that hoarseness from paralysis of the vocal cord was produced at the moment of applying the ligature.

The chief advantages of resection are: (1) That it enables the operator to remove, when necessary, both lobes of a goitre and yet leave behind sufficient gland tissue to prevent the supervention of cachexia strumipriva. (2) By leaving untouched that portion of gland which covers the recurrent nerve it lessens the risk of injuring the latter. When compared with intraglandular enucleation it has the advantages that (3) it avoids the severe hæmorrhage that often occurs in the separation of the tumour from its capsule, and that (4) the capsule of functionally useless gland tissue is not left in the wound. Thus the very deep sutures necessary to bring the sides of this capsule into contact to secure primary union may be avoided.

Details of the results of Mikulicz's operation have been published in a recent paper by Trzebicki.⁹ He records twenty-three cases. The patients were nearly all young subjects. In all cases dyspnoea was present; in many it was very severe. One case proved fatal from recurrent hæmorrhage; in one tracheotomy had to be performed, but union by second intention, nevertheless, took place without trouble; in one other case the wound healed in the same manner. In the remaining twenty cases, with the exception of two in which a little superficial suppuration took place, healing by first intention was perfect. [Further details of the cases and of the results obtained were then given.] The dyspnoea in all cases disappeared almost immediately after the operation, and, so far as is known, did not return. In no case was there any report of a return of the goitre in that part of the gland that was left behind, although many of the cases were examined personally, and in many others information upon this point was obtained from the local doctors. In no case did any impairment of general health (cachexia strumipriva or tetany) follow the operation. Of the fourteen patients on whom the operation was performed on both sides, twelve are known to have remained in good health.

The following case is one in which I performed a modification of Mikulicz's operation:

CASE II. Parenchymatous Goitre; Dyspnoea; Modified Mikulicz's Operation; Primary Union; Complete Recovery.—A. H., aged 15, kindly sent to me by Dr. Lewis Jones. For four

years she had had a parenchymatous goitre which produced considerable stridor and dyspnoea. After a prolonged but ineffectual course of medical treatment, an operation was performed similar to that of Mikulicz, but differing from it in that the isthmus was not divided, and that no portion of the gland was tied *en masse*. Practically the whole of the left lobe was removed with the exception of a small lump in the dangerous region near the larynx. The patient made a rapid recovery; the highest temperature after the operation was 99°. From the seventh day after the operation all dressings were discontinued, the wound having healed by first intention throughout. On the thirteenth day the patient went home quite well, and entirely relieved of her symptoms.

The last method of removing parenchymatous goitre is:

C. Resection of the Isthmus.—About this it is not, however, necessary to say much more, since the operation is very similar to division of the isthmus already described. Instead, however, of merely dividing the isthmus after the ligatures have been applied on either side, the intervening portion of the gland is cut away. I cannot say, however, that I have myself any great liking for the operation. In my opinion it does not usually remove enough of the goitre to relieve the dyspnoea permanently, and the operation is by no means devoid of risk. I have already pointed out some of the objections to mere division of the isthmus, and some of these hold good also for the larger operation of resection of the isthmus. In connection with this subject, I will describe the following case.

CASE III. Parenchymatous Goitre; Severe Dyspnoea; Removal of Isthmus and the Lower Part of each Lateral Lobe; Complete Recovery.—P. T., aged 18. For eighteen months she had had a parenchymatous goitre which produced loud stridor and great dyspnoea, and quite prevented her from following any occupation. Medical treatment had been employed without any beneficial result. In September, 1889, I performed an operation in some respects like resection of the isthmus, but differing from it in that the lower half of each lateral lobe as well as the isthmus, were removed. No ligatures were applied to the gland *en masse*. On the tenth day the patient was allowed to get up, but convalescence was subsequently delayed for a few days by a slight amount of suppuration at one corner of the wound. She went home at the end of a month, completely relieved of all her symptoms, and has remained perfectly well and quite free from dyspnoea ever since. This is the only case in which I have had any suppuration after removal of a goitre, and in it the amount was very slight.

PURE CULTIVATION OF THE LEPROSY BACILLUS.

By A. A. KANTHACK, F.R.C.S.,

AND

SURGEON-MAJOR A. BARCLAY, M.B.,

Members of the Leprosy Commission.

IN our previous article we expressed the hope that it might be possible to find out the conditions under which our bacillus, which we ventured to consider to be the true bacillus of leprosy, would acquire a resistance against acids, such as the bacillus of tuberculosis possesses. There seems to be no doubt that the characteristic reaction of the leprosy and the tubercle bacillus depends on certain chemical changes. The experience we had with our own cultivations only confirmed this idea. For here we have a bacillus which at one time reacts typically according to the Koch-Ehrlich method of staining, but on continuing to grow it on agar-agar it soon loses its resisting power against acids almost completely. If transferred to gelatine and bouillon it is found that bacilli taken from certain regions of the nutrient medium retain the fuchsin well after being passed through hydrochloric acid. It is also noticed that the bacilli which are taken from a "mucoid" layer of the bouillon or gelatine react best.

At the time we published our first communication we expressed a certain amount of disappointment, seeing that we were unable to obtain uniform results. For in the absence of animal experiments the staining reaction can be the only criterion. But now we have also succeeded in finding out the conditions under which our bacillus will resist the de-

⁹ R. Trzebicki, *Arch. f. Klin. Chir.*, 1890, XXXVII, 408

colouring action of acids, and we may safely say that our bacillus in almost every detail corresponds to the leprosy bacillus in the body; and coupling this with the fact that in two out of three cases examined we got identical results, and that the method used was one which held out most hope for success, we do not hesitate to consider our artificially cultivated bacillus to be the true bacillus of leprosy.

We tried first of all eggs, which were prepared and inoculated in the manner laid down in Hueppe's work *Die Methoden der Bakterienforschung*—a method by which Professor Max Wolff, of Berlin, succeeded in cultivating the actinomycetes. This gave us no result, as hardly any growth took place, most probably due to the deficiency of oxygen, for we had found that our bacillus is very aerobic. Acid gelatine and agar-agar likewise were of no avail.

On returning to our gelatine cultivations the following was observed. As described in our first communication, after inoculating a gelatine peptone tube the first thing noticed is the formation of a characteristic skin floating on the surface of the liquefied gelatine. The gelatine liquefies quite uniformly and slowly. The liquid gelatine under the pellicle is "stringy" and "mucoid." When the growth is two weeks old an opaque whitish sediment will be observed at the boundary line between the liquefied and non-liquefied gelatine. On removing material from this sediment it was found so mucoid as to be removed with difficulty. Heating the cover glasses carefully, and staining them according to Ziehl's method, we found that all bacilli retained the stain most beautifully. The same result was obtained with all the tubes examined, amounting to over twenty.

There can thus be no doubt that our bacillus also reacts like the leprosy bacillus, and in fact it only differs from it in this, that it takes up methyl-blue much more readily than the leprosy bacillus from tissues does. Staining the bacilli from the above sediment according to Gram's method, we have also obtained pictures showing the beaded appearance well, so that in this again our bacillus agrees with the leprosy bacillus.

A successful animal experiment would at once decide whether our claims are justified. So far, however, they continue to be in vain, and perhaps also but little result may be expected from them; for leprosy is so exclusively a human disease that one can hardly hope to produce the disease in animals. So far Melcher and Ortmann have been the only ones who succeeded in causing a dissemination of the leprosy bacillus after implanting a small nodule of leprosy tissue into the anterior chamber of a rabbit. We must therefore, for the present, depend on morphological and tinctorial characters. Now as far as these are concerned, we have brought also the last proof that our artificially cultivated bacillus is identical with the leprosy bacillus.

Several questions naturally arise in connection with the life-history of this bacillus. First, the changes in the staining reactions tend to decrease the value of such methods as are generally used in the diagnosis of the tubercle or leprosy bacillus. However, this is a point of only secondary importance, as other means exist which will enable the bacteriologist to differentiate a doubtful microbe.

The second question is, how are we to explain these changes in staining during the lifetime of one bacillus? As far as our bacillus is concerned, we can hardly doubt that the cause of the increased resistance against acids must be sought in the mucoid process initiated by the bacillus. On making careful preparations, it may be easily ascertained that many of the bacilli are enveloped in a capsule. This lends great support to Ehrlich's view with regard to the staining of the tubercle bacilli. The capsule would protect the bacillus from the decolorising action of the acids. In fact, we have found that, if we wish to bring out the shape of the bacilli properly, we must at this stage of their development decolorise more vigorously.

We have so far called the changes "mucoid." Examining the liquefied gelatine chemically, it has been found, as a matter of fact, to contain a considerable quantity of mucin body. This is all the more interesting, as, following the instructions of Hankin, we have succeeded in extracting a body from leper tissue, which, if not a mucin, is at least very closely allied to this class of organic compounds. On these points, however, we shall report at length at some future date. The

object of this paper was to state the reasons which led us to believe that the bacillus cultivated by us is in reality the leprosy bacillus.

AINHUM ON THE WEST COAST OF AFRICA.

By CECIL DIGBY, M.D.,

Hednesford.

THE word "ainhum" signifies "to saw," and is applied by the Africans to a peculiar disease characterised by the formation of a constriction at the root of the small toe. The name of "sukha pakla," which means "dry suppuration," is applied to it by the Hindus. The disease has been observed in India among the Mahomedans and Hindus by Drs. Crombie and Wise; in Brazil among the negroes and creoles by Drs. Silva, Lima, and Seixas; and on the Gold Coast by Dr. Eyles among the Negroes.

The fifth toe is the one usually affected, but the disease has been once noticed in the fourth toe, and Dr. Eyles mentions a case in which the second finger was affected. It is mentioned as being symmetrical, but this is not usual, as out of twelve cases I have noted only two in which both feet were affected. The left foot seems to be more frequently attacked than the right, the disease occurring nine times out of twelve on this side. The race of negroes called Krumen who inhabit the coast about Cape Palmas, and who emigrate as workmen to the different stations along the coast from the Gambia to Fernando Po, seem to be particularly liable, as out of the twelve cases mentioned ten occurred in these people.

The disease has only been known to attack coloured races, and seems to occur solely in those who go about with their feet unprotected; it is worthy of note that the Krumen above mentioned have been wearing brass or copper rings on their fifth toes for generations. The nature of the soil inhabited by those affected may bear some relation to the disease, as the sandy districts of West Africa produce most of the cases. I have only noticed the disease in middle and advanced life, and it certainly occurs more frequently in men than in women, only three of the above cases occurring in the latter. Occupation I believe exerts a considerable influence in producing the disease; those men who are labourers and who are constantly employed carrying weights being most frequently affected. In fact, a combination of the above influences would materially assist in producing the constriction, irritation, and hypertrophy which characterise the disease. Dr. Seixas mentions that the disease occurs among those wearing boots as well as those who go barefooted; but I think this can be accounted for by the fact that natives who do wear boots or shoes get rid of them on every opportunity.

The disease begins by an extension in depth of the digito-plantar furrow, which at the same time extends round the sides of the toe, and ultimately joins on the dorsum, being accompanied by hypertrophy of the toe. Both these processes advance until nothing is left but a small fibrous pedicle attaching a ball of hypertrophied tissue to the foot. On section, the parts at the distal end of the toe may present a normal character, but on passing towards the furrow, the cuticle and true skin are seen to be hypertrophied, the fibrous tissue is increased, and eventually replaces the bone, which undergoes a process of rarefying osteitis.

Dr. Eyles has carefully investigated the histology of the disease, and accounts for the formation of the furrow as follows: there is a direct ingrowth of epithelium, with a corresponding depression of the surface due to very rapid hyperplasia, which pushes down and strangles the papillæ, thus cutting off the blood supply from the epithelial cells, and causing them to undergo a horny change, while the increased pressure sets up vascular changes which influence the hypertrophy of the more distant portion of the toe.

Accompanying the constriction is often observed a small ulcer in the bottom or side of the fold; it is not a constant phenomenon, and does not occur early in the disease, but arises from direct injury subsequent to the toe becoming unmanageable, and from dirt or sand lodging in the furrow. It is the pressure on this ulcer that gives rise to the great pain sometimes complained of.