only the condition of the skin suggesting the persistence of the malady. Three months later, however, it became evident that the transplanted piece of thyroid had atrophied, as the myxoedema again showed itself and progressed. A second transplantation was made, and again an improvement, and this time greater, resulted, as the patient recovered for nine months, even menstruation returning after amenorrhoea had persisted for over a year. At the present time the symptoms have recurred slightly, but the beneficial effect of the operation was thus indubitably established.

Professor Kocher most kindly wrote to me (May 19th and 31st, 1890) and informed me that he attempted to obtain the same result as early as 1883 by transplanting a small portion of the gland freshly excised from a goitre, but the graft was soon absorbed. Hearing of Dr. Bircher's case, however, Professor Kocher took up the subject again early in 1889 by transplanting in two cases the half of a thyroid gland "in the abdomen," fixing it to the wall by sutures. In both the gland was "aseptically exfoliated" after some time. In three cases he put the gland loose in the abdominal cavity. The results of these cases Professor Kocher has not yet collected nor published, but he has already learnt that one patient has greatly improved since the operation.

Consideration of these results makes it, I think, abundantly clear that this operation should be always performed not simply in cachexia strumipriva—which, of course, with our later knowledge of the function of the thyroid gland, will ultimately disappear—but also in myxoedema and sporadic cretinism. Whether or not it is better to transplant thyroid tissue from a human goitre or a healthy gland from a lower animal, as I suggested in my first note, can only be decided by experience. I cannot forbear from referring to these facts, as tending to confirm clinically in man the truth of the views concerning the function of the thyroid gland which I advanced five years ago, and which, though violently attacked by Munk, have received confirmation from all later experimental observers.

PRELIMINARY NOTE ON THE PROCESSES TAKING PLACE IN THE DIPHTHERITIC MEMBRANE.

By M. ARMAND RUFFER, M.A., M.D. Oxon.,

SINCE the first investigations of Klebs, in 1883, it has been known that a specific bacillus is met with in enormous numbers in certain forms of diphtheria. Löffler¹ isolated the bacillus described by Klebs in six cases of diphtheria, and was able to reproduce typical false membranes by first excoriating the mucous membrane lining the conjunctiva, trachea, pharynx, or vagina of pigeons, fowls, rabbits or guinea-pigs, and then painting the mucous membrane with pure cultures of the specific bacillus he had isolated from cases of diphtheria.

It is a remarkable fact that the bacillus is found in the false membranes only, and not in the organs or blood of persons who die of the disease. Löffler, in his experiments, met with it nowhere except at the point of inoculation. Roux and Yersin² inoculated a number of guinea-pigs subcutaneously, killing one every two hours. After four hours these observers found a marked oedema at the point of inoculation; the number of bacilli increase in this local swelling up to the sixth or eighth hour; some bacilli were enclosed in cells, but the micro-organisms gradually decreased in number, so that when the animal die there were fewer microbes at the point of inoculation than six or eight hours after their introduction. Moreover, the blood and the pulp of the organs of guinea-pigs killed in the manner described were found to be sterile. In one case only did the liver substance of a guinea-pig killed six hours after inoculation give a positive result. The peritoneal liquid, when the injection was made under the skin of the abdomen, and the fluid present in the local oedema alone gave cultures each time. The same observers found that it was impossible to find the specific micro-organisms in the blood or organs of rabbits, in the veins of which a pure culture of the diphtheria bacillus had been introduced. "The spleen of a rabbit, killed after having received 1 cubic centimetre of a pure culture of the diphtheria bacillus intravenously, is removed aseptically, and placed whole into a sterilised tube. After several days in an incubator

at 33° C., no micro-organisms were met with in that spleen." It is easy to find the bacilli six to fourteen hours after the inoculation, and occasionally after twenty-four hours. Notice that the organs of such animals taken out of the body, even when not previously subjected to any processes of heating, etc., form most excellent cultivating media for these bacilli.

It is evident, therefore, that in man and many animals a struggle takes place between the living tissues and the specific microbes, and that, as the result of this struggle, the latter are unable to penetrate into the tissues, and are killed if forcibly introduced into the system.

I have during the last few months obtained evidence that such a struggle takes place in the diphtheritic membrane of man.

The pharynx, larynx, etc., of human patients dead of diphtheria were plunged at once into absolute alcohol until perfectly hardened. Small pieces were removed and soaked for twenty-four hours in a mixture of chloroform and ether, and, if the tissues were very tough and hard, for a like period of time in a saturated solution of paraffin in chloroform at a temperature of 40° C., and for twenty-four to forty-eight hours in paraffin at 42° C. They were afterwards cut in the usual way after embedding in paraffin. The thinnest sections were glued on the slide with a mixture of camphorated glycerine albumen, the albumen coagulated by moderate heat, and the paraffin dissolved with benzole. The slides now passed through absolute alcohol, water and were stained in the usual way with strong alum carmine. After fifteen minutes' stay in a solution of gentian violet in aniline water, the sections were placed in a very weak solution of iodine and water, washed in water and absolute alcohol, rinsed for two to five seconds at most in a solution of three parts of pure xylol to one of aniline, and allowed to remain two to five minutes in pure xylol. If proper care be taken the sections thus obtained are exceedingly pretty, the nuclei and protoplasm of the cells being very distinct, and the deep purple bacilli standing out conspicuously. It is possible in sections so stained to study the position of the bacilli with regard to the surrounding structures.

In thin sections passing through the entire false membrane and the surrounding structures—a section a small bronchus, for instance, when the disease has extended into the lungs—the most superficial part of the membrane, that is, the free edge of the lumen of the tube, is found to contain a most enormous number of specific bacilli, lying for the most part quite free in the coagulated exudation fluid. The micro-organisms resemble short rods of the size of tubercle bacilli, and are often aggregated together into clusters containing hundreds of microbes. So thick is this layer of micro-organisms at times, that on holding the sections to the light a thin violet line is sometimes seen running along the inner margin of the section tube, this line representing the layer of microbes. Scattered among these specific bacilli, more especially in the upper air passages, other kinds of microbes—micrococci and bacilli of various sizes and shapes—are also met with.

If the false membrane immediately below this superficial layer just described be now examined, the number of micro-organisms is found to be exceedingly small, and it will be noticed that not a single bacillus is to be seen in the deeper layers of the false membrane, in the mucous membrane, or the deeper layers of the tissue. The whole process, therefore—as far as the bacilli are concerned—takes place on the surface of the false membrane, and nowhere else.

The space at my disposal does not allow me to describe here the changes taking place in the vessels and tissues of the mucous membrane in cases of diphtheria, nor the mode of formation and structure of the characteristic false membrane. Shortly stated, the latter consists of a reticulated network of fibrin, containing within its meshes a large number of wandering cells, some of which are healthy, whilst others have undergone a distinct process of degeneration. I must draw attention to the fact, however, that the wandering cells present in the membrane are of two kinds, some smaller mono- or multi-nucleated (microphages) and others less numerous, much larger, with a single, clear, vesicular nucleus (macrophages). The latter are found chiefly in the free border of the membrane, and, having wandered into the lumen of the bronchus, may even form a layer in the lumen of the tube.

Many of the leucocytes which have penetrated between the bacilli are quite empty, and contain no micro-organisms in their interior; others, however, especially those present in the layer of the false membrane close to the thick layer of the bacilli previously described, contain in their interior one, two, or more diph-

¹ *Mittheilungen aus dem kaiserl. Gesundheitsamte*, vol. ii, 1884, p. 421.

² *Ann. de l'Inst. Pasteur*, 1889, p. 637.

³ Roux and Yersin, *loc. cit.*

theritic bacilli, as many as five or six micro-organisms being sometimes enclosed within one cell. Some of these intracellular bacilli appear to be perfectly healthy, staining and retaining aniline colouring matters well, whilst other micro-organisms, also contained in amoeboid cells, show signs of degeneration varying from a mere difference in the power of retaining gentian violet, to complete disorganisation and destruction. The description of these changes I must reserve for another occasion.

Many amoeboid cells in the membrane, more especially those present in its most superficial part, show distinct necrotic changes, many of them losing the power of retaining colouring matter. The nucleus breaks up, does not stain at all even with strong log wood or carmine, the surrounding protoplasm swelling up, becoming more yellow, and not unfrequently vacuolated. In later stages they show distinct signs of breaking up. Many of the degenerated cells contain bacilli in their interior, whereas others are quite empty.

The bacilli lying between the cells in the fibrin and coagulated exudation fluid are for the most part quite normal to all appearances. Occasionally, though very rarely, one is met with presenting signs of degeneration similar to those found in the bacilli contained in amoeboid cells. I do not think it justifiable to argue from this that the inflammatory liquids present in the membrane possess a microbe-killing power, but, judging from the number of dead leucocytes present in the membrane, it is far more probable that, in all probability, these partially-digested microbes were originally contained in a leucocyte which had died and undergone liquefaction.

I conclude from these observations that:—

1. The bacilli of diphtheria are present in the most superficial part of the membrane only, that is, in a place where they are well within reach of medicinal agents—an observation not without interest from the point of view of treatment.

2. In the diphtheritic membrane there is an active struggle taking place between the amoeboid cells in the membrane and the micro-organisms. In other words, the diphtheritic membrane is a battle-field for amoeboid cells and the pathogenic microbes of diphtheria.

3. The reason why the bacilli do not actually penetrate into the tissues is probably that as soon as they try to do so, they are arrested by the amoeboid cells present in the diphtheritic membrane.

ALLEGED DEATH FROM THE APPLICATION OF AN ARSENICAL PLASTER.

By SIR CHARLES A. CAMERON, M.D.,

Professor of Chemistry, Royal College of Surgeons, Ireland; Medical Officer of Health, Dublin.

C. F., a woman of the peasant class, aged 53, residing in the County of Wexford, was affected with cancer of the right breast. Dr. Shee, who examined her, recommended an operation for the removal of the cancer, but the patient declined to submit to it. On March 31st, 1890, she drove on a car a distance of 30 miles to be treated by a Mrs. J. W., who enjoys a great reputation as a cancer curer. Mrs. W. placed a plaster upon the affected part, and Mrs. F. returned home. It appears that the double journey of 60 miles occupied nearly 18 hours, and the patient reached home in a highly fatigued condition. On her way home she complained of sickness in the stomach, and she vomited once or twice. She remained ill, and had severe retching, and much diarrhoea (the discharge was greenish) until her death, which occurred on April 8th, at midnight. Dr. Shee, who, with the assistance of Dr. De Benzy, made the *post-mortem*, found that the part of the breast in contact with the plaster was ulcerated superficially. Dr. Shee had noticed that previous to the application of the plaster the skin was unbroken.

The stomach, portions of the liver, kidneys, and small intestines, and the right breast of the deceased, and also the plaster which had been placed on her breast, were delivered to me for analysis. The plaster was found to contain a large amount of arsenious acid. No arsenic was detected in the viscera, but the tissues of the breast contained it in decided quantity.

As a result of the inquest held on the remains of Mrs. F., Mrs. W. was committed for trial, the coroner's jury having found the following remarkable verdict. "We find that the said C. F. died at Saltmills, Parish of Tintern, of poisoning by arsenious acid, commonly called white arsenic, on the 8th day of April, 1890; and that said poison was absorbed from a plaster placed upon the

right breast of said C. F., deceased, at Kinteady, on the 31st March, by Mrs. J. W., whom the said C. F. did feloniously kill and slay against the peace of our Lady the Queen, her crown and dignity. We desire to add that to our certain knowledge Mrs. J. W. has conferred much benefit by her plaster on many persons resident in and near the locality."

Mrs. W. was tried and acquitted at the Wexford Assizes on July 17th. It was stated that the deceased had been for a long time delicate, and that she had on two occasions been ill in her stomach. Her counsel suggested that the gastro-enteritis, which the symptoms of the case and the *post-mortem* examination had demonstrated, might have been the result of the fatigue and cold caused by her long journey. For the prosecution, the medical evidence upheld the theory that the deceased's death was the result of arsenical poisoning.

In 1883, the viscera of a man, residing in the County of Cavan, who had died with symptoms of irritant poisoning, were submitted to me for analysis by the authorities. A plaster had been applied by a quack to a tumour from which the deceased suffered. After the death of the deceased the quack was arrested and placed in prison. Arsenic was detected in the liver and kidneys of the deceased, and a portion of the plaster which had adhered to the tumour was found to contain arsenic. In this case there was no doubt of the absorption of the poison from the plaster. Shortly before the time fixed for the trial, the accused died in prison.

Quite recently, in the county of Kilkenny, an embrocation was applied to the back of a cow, which shortly afterwards died with symptoms of poisoning. The embrocation was found to be a concentrated solution of arsenic, and arsenic was detected in the stomach of the animal, and in a portion of the flesh to which the solution had been applied.

PARAGUAY TEA.

By T. CRANSTOUN CHARLES, M.D.

PARAGUAY tea, called also *maté* or *Yerba maté*, from the name of the cup in which it is infused, consists of the dried leaves of the Brazilian holly, *Ilex Paraguensis*. This plant is most extensively used by the whole population of South America. It is said to possess many of the good qualities of tea, but a long indulgence in its use has been stated to induce diseases similar to those following the abuse of alcoholic drinks. I have also been told that dyspepsia is a frequent result, which I can easily understand, seeing that the common practice is to take it immediately before meals; in fact, it is taken at every possible opportunity.

Lately I was presented with some specimens of this tea by my friend, Mr. Chapman, who had been a resident in South America for several years. By his kindness I was also provided with the *maté*, or cup, in which the infusion is made, as also the *bombilla*, or tube, through which it is sucked. The tea is first placed in the gourd, in which it is well shaken; a little warm water is then added, and the leaves stirred up; the gourd is next filled up with boiling water, and in a few minutes the liquid will be ready for drinking. It is to be stirred up from time to time, and more hot water added as necessary, on account of the slowness with which exhaustion occurs, care being taken to prevent the loss of the aroma by never letting the infusion cool down.

As to the pain or discomfort of the stomach said to be produced by its use in the case of beginners I cannot say that I have yet noticed more than a slight discomfort in one or two individuals. By Mr. Christy's kindness I have also received other specimens of the *maté* tea, and I beg here to thank him for the information he was good enough to send me. I have lately made several chemical examinations of this body, as I found that the analyses published of it varied very greatly. The alkaloid present is caffeine, identical with the caffeine found in tea and coffee; there is also a tannic acid present in large amount. I have determined the percentage of both these bodies, as also the percentage of ash in tea, coffee, and *maté* after the same methods. Although in some respects *maté* is closely allied to coffee, yet it yields up its active principles in a different way. It was not until after I had discovered this for myself that I found the same had been previously shown to be the case by Conty and Mournet at the Vulpian laboratory. Percolation by alcohol, for example, furnishes the largest quantity of soluble substances; and it is also much slower than coffee in yielding up its nutritious principles to boiling water.