

growth of the meningococcus is soluble in distilled water, less so in alcohol, and almost insoluble in ether.

Experiment VII. (Fig. 12).—To determine the action of nasal secretion extract on the growth of *B. typhosus*. In Fig. 12 the upper half of the plate has been planted out in the usual way with dilutions of an emulsion of *B. typhosus* in Ringer's solution; in the lower half, with dilutions of the same emulsion in aqueous extract of dilute nasal secretion. Fig. 12 shows that a much more abundant growth took place on that half of the plate which received the nasal secretion.

The conclusion drawn from this experiment was that the growth of *B. typhosus* is accelerated in a similar manner to that of the meningococcus by an aqueous extract of dilute nasal secretion.

Similar results were obtained in experiments with the following germs:—*Streptococcus zymogenes*, *Micrococcus pharyngeus flavus*, pneumococcus, and *B. coli communis*.

Conclusion.

The outstanding results of the foregoing experiments show that in nasal secretion there is present some body which greatly accelerates the growth of the meningococcus on an artificial culture medium. Alone it is incapable of acting as a food or stimulant to the growth of this germ. It is soluble in water, less so in alcohol, and very insoluble in ether. It has great heat-resisting power, being able to resist prolonged boiling for many hours. It is not destroyed by boiling in the presence of strong hydrochloric acid for twelve hours. In addition to the meningococcus it also stimulates the growth of many other pathogenic germs.

A NOTE ON THE CAUSE AND PREVENTION OF TRENCH FOOT.

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No one who has had an opportunity of observing many cases of trench foot, particularly in the later stages of the disease, can have failed to be struck with certain characteristics presented by it. The lesions are indolent, slow to heal, and prone to break down again on the slightest provocation. The scar tissue formed is weak and ulcerates easily. Indeed, the whole picture of the disease reminds one irresistibly of the trophic sores appertaining to diseases of the central nervous system. I wish to set forth in this paper my reasons for thinking that trench foot is an affection of a trophic nature.

Some three years ago a book on electro-pathology was published by Mr. A. E. Baines, a distinguished electrical engineer. Space does not permit me to give an account of the far-reaching vista of promise which this little-known work has opened up to medicine. An abler pen than mine has recently put the whole matter before the profession. Let it suffice to say that Mr. Baines believes that the brain, and possibly the cord, is the seat of electrical generation, and that the current so generated is carried to the tissues by means of the nerves, which to the electrician's view are nothing but insulated cables. Here we have the trophic influence of physiology and medicine, that vague generalisation which from our student days we have been content to accept without questioning. Mr. Baines has shown us how to measure and modify this trophic influence, and I venture to predict that in the future his name and fame will equal that of those illustrious ones, Simpson, Lister, and Koch, as benefactors of the human race. This is no mere discovery of an isolated fact in medicine. Many a patient worker has given his brick, his hard-wrought stone of research to the building of the sacred fane of Æsculapius. As is perhaps fitting and proper for an engineer, Mr. Baines has come and shed a flood of light in our temple. For he has given us a fundamental principle.

The dominating factor in the conditions under which trench foot occurs is wet. When a man is standing for days on end in water and liquid mud, his boots, socks, and the skin of his feet and legs become soaked. As is well known, the electrical resistance of the skin is enormously diminished when the skin is wet. Under these conditions a gradual leakage of electricity to earth takes place from the feet. Other things being equal, electricity will always leak

from a point in preference to a plane surface, which accounts for the fact that the toes are most affected. This leakage deprives the cells of the foot tissues of their trophic influence and they die. Hence the lesions of trench foot.

Local leaks of electricity may be detected by a suitable galvanometer. One pole of the galvanometer should be connected to a silver plate about the size of a florin, which is fixed in the centre of the patient's forehead; there is no special reason for fixing it on the forehead except that it is the most convenient spot in the middle line of the body. The other pole is connected to a contact plate mounted in an insulated handle so that the contact or electrode can be placed on any portion of the body it is desired to test. Before testing it is necessary to "earth" the patient in order to dissipate any induced charge of electricity of which he may be the host. If this is not done the patient's own intrinsic current may be swamped by charges he has picked up from trams, electric trains, or other sources. With both poles in contact with the body the galvanometer will give a deflection. When leakage is taking place from any particular area a high and rapid deflection is noted. I have been examining and treating various cases on Baines's principles for a matter of about two years, and have found such a leakage taking place from the feet and legs of soldiers suffering from trench foot whom I had under my care last spring. Moreover, the results I obtained by treating these cases by dielectric oil were better than the results obtained by any other method I tried. I also made a few experiments bearing on this subject.

Experiment 1.—With the aid of Miss Flecker, at the Ladies' College Physical Laboratory, Cheltenham, I estimated the electrical resistance of a piece of oak tanned sole leather 3 inches long by 1 inch wide. We found that when dry the resistance was practically infinity. When wet the resistance is that of the fluid the leather has soaked in.

Experiment 2.—One pole of the galvanometer was connected to an electrode which could be held in the hand. The other pole was connected by an insulated cable to a copper plate imbedded in the earth. Another insulated cable was connected at one end to the metal pipe supplying water to the house, and at the other end to a brass rod of 1 inch section. After earthing myself I held the brass rod in one hand and the electrode in the other, and obtained a rapid off-scale deflection, showing, firstly, that an electric current was coming from my body; and secondly, that the earth connexions were working properly, for the current passed out by one hand through the brass tube to the water pipe, thence about 20 feet through the earth to the copper plate, and through the galvanometer to the other hand, so completing the circuit.

Experiment 3.—The brass tube was then laid on the floor which was covered by a thick carpet. I held the electrode by one hand and put both feet on the brass tube. I wore ordinary boots which were dry. No deflection was obtained because the dry leather soles of my boots insulated me from the earth. I then took my boots off and put my bare feet on the tube and obtained an off-scale deflection.

Experiment 4.—Next day was wet and I walked about half a mile so that the soles of my boots, which were free from holes and metal nails, became wet. On holding the electrode in one hand and placing my feet on the brass tube, a rapid off-scale deflection occurred, showing that current was passing through my boots to earth.

Experiment 5.—The pole of the galvanometer connected to earth by the copper plate was disconnected. It was reconnected to a hand electrode exactly like the one previously used, so that the galvanometer was now connected to the hand electrodes only. After the necessary earthing process, I held the electrodes in the hands and obtained a deflection which remained steady at 170 mm. I then placed my feet, still in wet boots, on the brass tube and awaited results. The light on the scale very slowly began to recede towards zero. I repeated this experiment several times. The light never remained at zero, but if it got as far went over to the other side of the scale, and generally registered 40 to 60 mm. I take this as evidence that electricity was gradually leaking out of my body to earth, through my wet feet. One would not expect the light to register zero as there is continuous generation of electricity in the body. In view of these experiments, the grandmotherly advice we have so often received, not to stand about in wet boots, takes on a new and important significance which ought to claim our belated respect. They also to my mind afford evidence that trench foot is probably caused by long-continued leakage of electricity from the feet.

I noted that Dr. Leonard Hill had advocated rubber boots and greasing of the feet for the prevention of the disorder, recommendations with which I cordially agree. I sent to him in the spring a note about my own experiments, and

received from him a courteous letter thanking me for my "ingenious speculations," but countering me with the query "What about fishes, fishermen, and Channel swimmers?" When truth is really truth the most knock-out objections often end in being pillars in its support. Just as the vagaries of radium appeared to undermine the whole structure of physical science, and now form an additional proof that the foundations of that science have been well and truly laid, so Dr. Hill's objections assist my argument. For fishes are provided with a dielectric coat of mucus; I never heard of fishermen who had wet feet as long as the men in the trenches: and Channel swimmers always try to emulate the fish by rubbing themselves with a dielectric coat of oil. Their idea is to keep out the cold—it is really to keep in the electricity of their bodies; improved methods of accomplishing this result will at once suggest themselves to anyone acquainted with Baines's work.

The experience of officers at the front is that trench foot can be prevented. I am certain it can, but it can only be done, firstly, by keeping out the wet, and, secondly, by keeping up the electrical resistance of the skin of the feet. The feet should be thoroughly greased, and by far the best grease to use is the dielectric ointment which is now an article of commerce. It is interesting to note that our French colleagues are suggesting the use of ambrine for trench feet; they have had very good results with it in burns, but it is used empirically without appreciation of its dielectric action. I doubt if anything could improve on the results obtained by dielectric oil in cases of burns.

Rubber boots if worn for any length of time cause the feet to perspire too freely. White Robertson in the paper referred to above has shown that the soles of the feet and palms of the hands are parts which are designed to sweat freely and through which the normal escape of electricity to earth mostly takes place. The disadvantage of rubber boots is that owing to the excessive perspiration they cause the skin of the feet is liable to become sodden and so lose its electrical resistance. Soaking the boots, socks, and puttees in oil is the alternative I suggest for rubber boots. Any thick oil would do as a preventive; kitchen fat rendered with olive oil or cotton-seed oil might be tried, but I think that the skin of the feet should be rubbed with a dielectric grease. If signs of trench foot should develop in cases where these precautions have not been efficiently carried out, the best treatment is to wrap the foot and the whole of the lower part of the limb as far as the knee-joint in gamgee tissue soaked in dielectric oil. I have seen enough of this treatment to justify the assertion that no serious case of trench foot necessitating amputation need take place.

Clinical Notes:

MEDICAL, SURGICAL, OBSTETRICAL, AND THERAPEUTICAL.

A CASE OF SARCOMA OF THE MEDIASTINUM INVADING THE LUNG.

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THE following case illustrates the points of resemblance between phthisis and malignant disease of the lung. On the admission of the patient to the sanatorium seven weeks before his death the clinical picture was in the main one of phthisis, but in the later stages the distinguishing features of thoracic tumour manifested themselves and suggested malignancy.

A man, aged 55 years, was admitted to the Westmorland Sanatorium on Sept. 13th, 1916, with a history of good health until the previous April when he first complained of radiating pain in the front of his chest, followed shortly afterwards by cough and expectoration, which compelled him to give up work in July. His sputum was copious and mucopurulent, of a yellowish brown colour, and well intermingled with blood. No T.B. were found. Examination showed deficient expansion, dullness, high-pitched breath sounds almost tubular in character, and increased vocal resonance over the upper lobe of

the right lung. Over the apex of the right lower lobe the signs were somewhat similar but less pronounced. The left lung seemed healthy. There were no cardiac murmurs and the urine was normal. His chief complaint was of the fitting pains across his chest, which were generally most severe at night. Cyanosis, first noticed in the lobules of his ears early in October, gradually spread to the face, while there was none of the extremities. With the deepening of the lividity there developed oedema. His lower eyelids became heavy with watery bullæ and his neck swollen, measuring on the day of his death 17 inches at the level of the thyroid cartilage, while in health he wore a collar of 15½ inches. The external jugular veins stood out prominently. The superficial veins of the chest became distended, more markedly on the left side, and running along the left costal margin corresponding to the attachment of the diaphragm was a network of dilated venules. The superficial abdominal veins were not distended. There was no swelling of the arms or legs. The glands at the root of the neck and in the axillæ were enlarged. The pupils were equal and so were the radial pulses. Towards the end he became very drowsy, even falling asleep during conversation. His breathing became stertorous and he died on Nov. 1st. A differential blood count made after the cyanosis became evident showed polynuclears 92 per cent., lymphocytes 3 per cent., and mononuclears (large) 5 per cent. The Arneth count gave a ratio of 46 to 54. The temperature was normal until the last few weeks, when there was a slight rise, but not beyond 99.4° F., with a small daily variation. At the post-mortem examination it was found that a large solid mass filled the superior and the posterior mediastinum. The pleura covering the right lung was firmly adherent. The upper lobe of the right lung was almost entirely invaded by tumour, and there was involvement of the upper portion of the lower lobe. The left lung and its pleura were healthy. Microscopically the tumour was seen to be a lympho-sarcoma. A section showed the growth destroying the wall of the superior vena cava and projecting into its lumen.

The case is of interest in showing the difficulties attendant on the making of a diagnosis of phthisis in the absence of tubercle bacilli from the sputum. The blood examination was helpful, although, unfortunately, a count was not made until the later stages of the illness. The high polynuclear count suggested an acute mixed infection if the case were really tuberculous, but the nearly normal temperature negatived such an infection. The Arneth count was practically normal, while, according to the findings of different observers, an active tuberculosis causes a definite deviation to the left.

For permission to publish this case I am indebted to Dr. C. F. Walker, medical superintendent of the Westmorland Sanatorium.

Grange-over-Sands.

A CASE OF LARGE OMENTAL CYST IN A CHILD.

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OMENTAL cysts are sufficient rarities to warrant the publication of individual examples. The following notes are those of a patient in the Hospital for Sick Children, Newcastle-on-Tyne.

The patient, a girl, aged 4 years, was admitted to hospital in June, 1915, supposed to be suffering from tuberculous peritonitis. She was the only living child of a family of three, the mother having died of phthisis. It was noted that the child's abdomen had been swollen since she was 9 months old. She had been tapped on two occasions at the ages of 18 months and 2 years, but on each occasion the fluid gradually returned. After admission she was again tapped, six pints of fluid being removed. A few weeks later she developed scarlet fever and was transferred to the fever hospital. The photograph shows the condition of the abdomen at this period.

She was readmitted to the hospital in May, 1916. The circumference of the abdomen was 29½ inches. She was tapped twice shortly after admission, two pints being removed on each occasion. The fluid was of a slightly reddish colour and contained cholesterol crystals. I was then asked to see her by Dr. J. E. Dainty, who suggested that the condition might be a cyst and that abdominal exploration would be advisable. She was transferred to my ward and an operation was carried out in June, 1916. The