On April 29th Professor Dopfer asked us to apply our method and we gave the first injection. On the next day the patient felt decidedly better. Further injections were given on May 1st, 6th, 8th, 12th, and 14th. A considerable diminution of the painful symptoms, in the heel especially, was noted. The injections were repeated on the 16th, 21st, and 24th. Though not entirely cured the patient was considerably better, and on June 2nd the pain was no longer perceptible except in two toes of the right foot. The lameness is better and walking is becoming more and more easy, so that a complete recovery can be expected after a few more injections.

Finally, we have had quite recently the opportunity of treating four patients who had suffered for four, five, nine, and ten years respectively from pains in the joints which seemed to be refractory to all the medicines, such as salicylate and aspirin, usually employed against rheumatism. As these patients had formerly suffered from gonorrhoea, we thought it advisable to try the method of sensitised virus vaccination, and after two, three, and four injections we had the satisfaction of noticing either a considerable change for the better or an entire disappearance of the articular pains.

Experiences of this kind have led us to think that a large number of arthritic diseases, attributed to rheumatism, belong to the domain of gonococcic infection, and that in all cases of rheumatism where the usual treatment does not give any results, and especially when a gonococcic origin can be surmised or traced, it is well to have recourse to sensitised antigonococcic virus vaccination.

The action of Besredka's sensitised virus vaccination has been more especially observed by us in the course of complications resulting from gonorrhoeal infection, but it is nevertheless true that we have obtained very good results in the treatment of *acute* and even *chronic urethritis*.

In cases of acute urethritis where our help was sought we always obtained most encouraging results. The pains and local inflammation disappeared in most cases after the second injection, and at the same time the discharge grew less abundant, and also very rapidly lost its yellowish-green colour and its thickness, and took the aspect and fluidity of soapy water. The time of its disappearance was different in various cases, but after an interval of four weeks its disappearance was usually complete. None of the cases we treated showed any complication whatever.

Chronic urethritis appeared to us to be as beneficially influenced by our method of sensitised virus vaccination as the acute form of this disease. From the very first injection we always noticed a rapid decrease of secretion as well as a notable change in its appearance, for it soon became transparent like glycerine. All other disorders imputable to former prostatic infections, such as a feeling of heaviness near the anus, perineal pains, as well as pain in the region of the sacrum, usually disappeared after the first injection.

Remarks.—We have not yet come to any final conclusions concerning the various modifications which, in our opinion, ought to be made in Besredka's method of sensitised virus vaccination in order to adapt it to the treatment of gonorrhoea. Yet we are able to state that, as has been proved by the experiments of Metchnikoff and Besredka,³ in antityphoid vaccination, it is always preferable to inject living sensitised virus. In a certain number of cases, when we had absolutely failed whilst persisting in using dead sensitised virus, we obtained excellent results from the use of living sensitised virus. The serum which we employed in our operations was taken from a she-goat to which we had successfully applied Besredka's subintra injections of the veins in order to render it immune.⁴ We considered that it was not advisable to take from the patient himself the gonococci to be sensitised, and we took them from the cultures which we had had in stock for several months, and several samples of which were obtained by the kindness of Messrs. Maras and Forgeaud. Our injections were principally made in the subcutaneous cellular tissue and were repeated at intervals varying according to the different cases. None of the patients who had recourse to our help showed any sign of severe general reaction. In some cases there was a slight rise of temperature during the hours which followed the injection. Sometimes we also noticed at the site of the injection some erythema accompanied by a pain which never lasted longer than 48 hours.

Paris.

³ Besredka: *Annales de l'Institut Pasteur*, 1901. Metchnikoff and Besredka: *Ibid.*, 1911.

⁴ Louis Cruveilhier: *Comptes Rendus de la Société de Biologie*, July 2nd, 1910.

SOME ADDITIONAL EXPERIENCES OF NERVE SURGERY.

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A CONTRIBUTION on "Nerve Surgery" was made by me to the Sixteenth International Medical Congress, held in Budapest, and was published in *THE LANCET* of Sept. 4th, 1909, p. 706. An opportunity is now taken of tracing the further progress of the cases then referred to, and of adding new ones.

The operation for facial paralysis by facio-hypoglossal anastomosis has proved to be a permanent and almost complete success. The patient was shown at the Royal Society of Medicine in 1909, and it was then difficult to distinguish which side of the face had been affected, except for the fact that there was, in repose, a very slight droop of the left angle of the mouth. All the movements on that side of the face were perfect, there was a total absence of associated movements of the tongue and face, and the tongue was protruded directly and without any deviation.

Of the cases of operation on the brachial plexus¹ one was for Erb's or the upper arm type of infantile paralysis, where the anterior branch of the fifth cervical nerve was grafted into the sixth, with gradual recovery of power in the biceps and partial recovery in the deltoid,² the fibres to these muscles on the outer and upper part of the fifth nerve cord being split off and inserted into the sixth nerve cord. Improvement took place in the deltoid in so far that three years after the operation the arm could be abducted 8 inches from the side, when the scapula was held. A better result would have been obtained if the significance of a paralytic subluxation of the shoulder had been recognised and the looseness of the capsule rectified as a preliminary step.

A case of severe laceration of the brachial plexus and complete paralysis of the right arm was also reported upon.³ Here there was absolute and complete paralysis of the whole of the muscular and sensory area supplied by the brachial plexus. All the nerve roots were found to have been torn apart, and were matted together by fibrous tissue; scar tissue also intervened between the proximal and distal segments of the nerves. The scar tissue was excised and the proximal and distal segments of the plexus were sutured together *en masse*. Five years afterwards—that is, in March, 1911—the recovery of motor power had extended to the biceps, brachialis anticus, and the deltoid. The patient could flex the forearm fully and abduct the upper arm to a right angle, sensation had returned over the distribution of the upper external cutaneous branch of the musculo-spiral nerve and over the internal cutaneous branch of that nerve, and recovery is still slowly progressing.

Neuroplasty on the popliteal nerves, after anterior poliomyelitis, has not been by any means so successful, and an explanation may be found in Warrington and Murray's hypothesis⁴—viz., that, "there may be sufficient nerve cells left to supply one group of muscles, but insufficient to supply two"; or, to put it in another way, there are enough cells to supply the internal popliteal nerve, but not the external as well, and *vice versa*. In one case where the distal part of the external popliteal nerve was grafted into the internal no result followed, perhaps due to the fact that there was also some degeneration in the internal trunk, or that the remaining nerve cells were insufficient.⁵

In a second case, one of paralytic equino-varus, where the distal part of the external popliteal was grafted into the internal popliteal nerve, no sign of recovery was observed during two years, and then the area of the previous operation was exposed. It was then found that the grafted portion of the external popliteal nerve was evidently undergoing regeneration, as shown by the increasing size of its distal part as compared with the free proximal part, and by its whiteness, roundness, and firmness. It was further noted that direct stimulation of the distal or grafted portion of

¹ A. H. Tubby: *Deformities*, second edition, p. 747.

² *Ibid.*, p. 676.

³ *Ibid.*, p. 760.

⁴ Nerve Anastomosis in Infantile Palsy, *THE LANCET*, April 2nd, 1910, p. 912.

⁵ A. H. Tubby: *Loc. cit.*

FIG. 1.

To illustrate a case of paralysis of the left suprascapular nerve before operation. Note the hollows above and below the spine of the scapula.

FIG. 2.

Another view of the patient's condition before operation.

FIG. 3.

Showing the condition of the patient three years after operation on the left suprascapular nerve. Note that the suprascapular fossa has entirely filled up and the infra-scapular nearly so

FIG. 4.

Another view of the same patient three years after operation.

the external popliteal nerve caused contraction of the anterior and external leg muscles. Here the outlook may be described as distinctly hopeful.

One example of talipes calcaneus, where the nerves to the soleus and gastrocnemius were separated from the internal popliteal trunk and grafted into the external, showed partial recovery during a term of three years, but the condition has been stationary for the next three years; that is, whilst the patient has recovered sufficient voluntary power to plantar-flex the foot when it is off the ground, yet when seen in July, 1913, the improvement in muscular strength had been arrested. And a similar remark may be made of another case of talipes calcaneus where the range of ankle movements became almost normal, without, however, there being sufficient strength to lift the weight of the body on the toes of the affected foot alone. Such is the record up to date of cases of nerve-anastomosis and neuroplasty reported previously.

We must now pass on to more recent cases.

CASE 1. Traumatic lesion of the brachial plexus; operation; nearly complete recovery.—A male was admitted to Westminster Hospital on Sept. 9th, 1909, with a history that 12 months ago he had been knocked down by a heavy wagon. He stated that his shoulder had been dislocated and the dislocation had been reduced, but he was unable to use his arm. On admission it was noted that whilst movements from the elbow downwards were good, with the exception of full power of extension of the fingers, there was a partial loss of voluntary movement at the shoulder-joint. Sensation was present below the elbow, but dull in places. Electrically, it was found that the biceps reacted, but there was no response of the supra- and infra-spinatus, deltoid, triceps, extensor carpi radialis longior and brevior, and of the extensors of the wrist. He was operated on on Jan. 24th, 1910, and the brachial plexus was exposed. There was found to be marked thinning of the fifth and sixth cervical nerve-cords just before they joined the seventh, and the fifth and sixth cords were surrounded by fibrous tissue. This was dissected away and the thinned cords were enveloped in Cargile membrane. Recovery set in rapidly and the affected muscles began to regain power, except the extensors of the wrist, where recovery has been much delayed.

CASE 2. Injury of the suprascapular branch of the brachial plexus; operation and recovery.—A male, aged 30 years, was brought to me by my friend Mr. A. Scott-Turner on May 13th, 1910. Ten months before this, in August, 1909, he was yachting, and one night the boat was rolling very heavily. In the morning he woke up with pains in his shoulder. He was aware of having hurt it in the night, and he thought it possible he might have struck his shoulder against the side of the bunk. The pain continued for three weeks, and he noticed he could not raise his arm so well as before. The loss of power increased and he consulted Mr. Scott-Turner. When the patient came to see me the arm hung by the side, and it could not be held up for long without support. External rotation was limited, and there were two deep hollows (Figs. 1 and 2) above and below the spine of the scapula, evidently due to the wasting of the supra- and infra-spinatus. The posterior fold of the axilla was less full than normal, and on testing these muscles electrically there was no reaction to galvanism or faradism with any bearable current. It was evident that the suprascapular nerve was involved, but it was impossible to say if it was torn, if it had merely been stretched, or if it was embedded in cicatricial tissue. An exploratory operation was therefore done on May 31st with the assistance of Mr. E. R. Carling and Mr. H. F. Strickland, Mr. Scott-Turner giving the anæsthetic.

A triangular flap was turned up over the subclavian triangle with the apex towards the point of the shoulder. The omo-hyoid was situated very low down, and crossed the triangle immediately above the clavicle. Search for the suprascapular nerve proved long and tedious, as it was abnormal in its origin and course. It was found that a nerve-trunk came from the outer side of the plexus. On testing with sterilised electrodes we ascertained that this cord was composed of the outer head of the median and possibly of the suprascapular. To verify this anatomically the clavicle was sawn across and the cord traced downwards. Opposite the lower border of the clavicle a branch of the cord above mentioned was discovered, which on being traced backwards to the upper border of the scapula was evidently the nerve we were in quest of. About half an inch from the spot where this nerve separated from the outer head of the median it was seen to be embedded in cicatricial tissue. Electrical stimulation above this point gave a very feeble reaction in the supra- and infra-spinatus, whereas stimulation below gave a full reaction. The cause of the paralysis was therefore evident. The scar tissue was dissected away, and a piece of subcutaneous fat was freed so as to form a flap, which was fixed around the site of compression of the nerve. It appeared to us that the abnormal course of the nerve threw light on the injury, and we thought that it must have been compressed during sleep, as the patient had rolled to and fro in his bunk. Another hypothesis was that his shoulder was wrenched and hæmorrhage took place, but the fact was that there was no bruising seen after the accident. Three weeks after the operation it was thought that the fossæ were beginning to fill, but no voluntary movement was present in the muscles. On July 14th, six weeks after the operation, there was definite reaction to galvanism in the muscles. Although the supra- and infra-spinous fossæ were still flat, yet the upper one had begun to fill up. Six months afterwards the fossæ had almost filled, and the patient could raise his arm to the full and hold it there. He could also rotate the arm well externally, and the power has gradually increased until now, when it is nearly as good as on the other side. This case was shown at the Congress, and the condition three years afterwards is shown in Figs. 3 and 4.

Four Cases of Injury of the Ulnar Nerve and of its Branches.

CASE 3. Divided ulnar nerve in the middle of the forearm; operation; recovery. A woman, aged 43 was admitted to Westminster Hospital on Jan. 17th, 1908. Two months previously she had cut the middle of the inner border of the forearm with a glass bottle. The flexor sublimis

digitorum was found completely divided, and the profundus was much lacerated. No lesion of the nerve was discovered at the time, and the ulnar artery appeared to have escaped injury. The wound was sewn up and the arm put up on a splint. When the wound was healed and the splint removed, complete paralysis below of the ulnar nerve was discovered. Reaction of degeneration was present in the interossei muscles and in the hypothenar eminence.

An operation was performed on Jan. 27th—i.e., ten weeks after the injury. The ulnar nerve was found severed, with half an inch of fibrous tissue between the ends, both of which were bulbous, the upper being much clubbed. Both ends were deviated from their track and turned outwards. Each end was freed, and the sections of the nerves brought together and sutured with catgut. The junction was refreshed and surrounded by Cargile membrane. On Feb. 7th—i.e., ten days after the operation—it was noticed that the ulnar side of the ring finger was sensitive to touch and pain, and when the little finger was pricked sensation was referred to the ring finger. With massage and faradism she afterwards regained complete sensation and good movement. The first dorsal and other interossei muscles were acting normally, although the hypothenar and the first dorsal prominence were not so marked as in the other hand. Gradually the affected hand became quite useful.

CASE 4. Ulnar nerve injury at the wrist; division of the superficial branch and bulbous condition of the main branch; operation; partial recovery.—A woman, aged 21, was admitted to Westminster Hospital on Nov. 29th, 1909. On August 11th of that year she cut her left wrist with a bottle; the wound was stitched up, and when it was healed she noticed a loss of power in the fourth and fifth fingers. The hand was somewhat wasted, and the interosseous spaces on the back of the hand had begun to be hollow. On admission there was loss of sensation in the cutaneous distribution of the ulnar nerve, loss of power on separating the fingers, and abduction of the little finger. A puckered scar, $1\frac{1}{2}$ in. long, ran obliquely upwards and inwards, from near the middle point of the front of the wrist to the ulnar border.

At the operation, within a few days of admission, the flexor carpi ulnaris was exposed and its ends turned aside. In a mass of scar tissue the superficial branch of the ulnar nerve was found, divided; and on the main trunk of the nerve there was a small bulb, but the continuity of the nerve was complete. The ends of the superficial branch were joined by catgut, and the thickening on the main trunk was freed from scar tissue and surrounded by Cargile membrane. On Oct. 10th, 1910, nearly a year after the operation and 15 months after the injury, sensation had returned to the fingers, except that touch was rather dull on the inner side of the little finger, which was still abducted. The muscles of the hypothenar and first dorsal interossei eminences were filling out. Electrical tests showed diminished reactions to faradism in the interossei muscles of the hand, but no polar changes to galvanism.

CASE 5. Division of deep branch of the ulnar nerve; neuroplasty; partial recovery.—A man aged 20, was admitted to Westminster Hospital on Oct. 3rd, 1912. On August 17th he had cut his wrist with broken glass. The wound was situated just above the pisiform bone, and was stitched up at once. On admission there was found to be loss of sensation both to pain and touch over the palm from the wrist to the base of the fifth finger, otherwise sensation was present. The interossei muscles, especially the first, were wasted. The patient could not separate the fingers with ease. On Dec. 7th the ulnar nerve and its branches at the wrist were dissected out, and in the scar tissue a bulbous enlargement on the deep branch of the nerve was found. The branch was twice its normal diameter at this spot. The bulb was excised, the ends sutured, and the junction protected by membrane. It was evident that the main trunk and its superficial branch had escaped. It was curious to note that the injury to the deep branch was situated 1 to $1\frac{1}{2}$ in. distant from the deep scar on the skin, and was probably caused by the penetration of a pointed piece of glass. On Jan. 17th, 1913, it was noticed that there was no response to faradism in the interossei and there was a typical sluggish reaction to galvanism, whilst the lumbricales reacted to both currents. Since then the interossei have begun to respond slightly to both currents and the fingers are regaining strength and usefulness.

CASE 6. Traumatic lesion of the deep branch of the ulnar nerve; nearly complete recovery.—A boy, aged 12, was sent to me on Jan. 20th, 1910, on account of a partially clawed hand, following a wound on the inner side of the front of the wrist, at the end of August, 1909. The cut was a deep one and had detached the pisiform bone with the flexor carpi ulnaris attached to it, also one of the deep flexor tendons of the little finger and a fairly large nerve were severed. When I saw the boy this scar was more than $2\frac{1}{2}$ inches long and extended to the middle of the palm inwards and upwards from the inner side of the base of the fifth finger. He had complete paralysis of the interossei. The fourth and fifth fingers were clawed, whilst the second and third were becoming so. Sensation in the fingers was defective. On the 31st a long and rather difficult dissection was made, and it was ascertained that the deep branch of the ulnar nerve was embedded in dense fibrous tissue at the base of the third metacarpal bone. The difficulties arose from the depth of the wound, from hæmorrhage from the deep palmar arch, and from the density and extent of the scar. The last was dissected out, the nerve completely freed, and its compressed portion wrapped in Cargile membrane. On Jan. 31st, 1911, it was noted that the fingers could be nearly straightened out voluntarily, the interosseous hollows were being filled up, the fingers would separate and approximate, and sensation to pain and touch were almost normal.

Deductions.

1. Brachial plexus lesions, if traumatic, are hopeful, if the loss of power has not existed for years. If due to other causes the outlook is not so good. However, we should not despair of a case recovering, even five years after the operation, provided that the improvement has set in within three months after the operation and is continuous.

2. Popliteal neuroplasty for infantile paralysis has proved disappointing for the reasons given previously.

3. Injuries about the wrist should never be sewn up until the continuity of the nerves has been ascertained, and until all the electrical reactions have been tested.

4. If the lesion of the nerve is compression by a scar the outlook after operation is most hopeful. If the nerve has

been severed primary operation is very hopeful, but secondary suture rarely permits a complete recovery.

5. No case, however, of traumatic nerve lesion should be regarded as hopeless, in view of the achievements of neuroplasty.

Finally, I should like to make a note on a painful condition connected with enlargement of the head of the first metatarsal bone, and I beg to refer to those cases where there is not only tenderness on the inner side of the joint, but also severe pain on its outer side and in the first interdigital space. This is a condition special to those cases where there is lipping of the joint surfaces and a deposit of osteophytes, and the cause appears to me to be as follows: On dissecting the part there will frequently be found a communicating branch passing from the digital trunk of the anterior tibial nerve to the corresponding nerve on the plantar surface. This communicating branch arises opposite the most prominent part of the head of the bone and passes immediately downwards over the capsule of the joint, to which in inflammatory cases it is often adherent, and it joins the digital branch of the internal plantar to the outer side of the great toe. It is easy to see how painful compression may arise, and the remedy I have adopted is simple—i.e., to dissect away the communicating branch and remove the osteophytes.

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PUBLIC MEASURES FOR THE PREVENTION OF TUBERCULOSIS.¹

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THE spread of tuberculosis in any community can only be efficiently and successfully checked by the adoption of public measures which will form a coördinated scheme for attack on the disease. Tuberculosis being to a large extent a disease of ignorance and misery, our efforts to prevent it must be directed towards the social conditions and insanitary surroundings of the poor. It is essential that a very close coöperation must be established between voluntary action and Government and municipal efforts in order that the spread of the disease can be controlled and proper means provided for the treatment and cure of those afflicted.

The general measures for the control of tuberculosis will be somewhat as follows: (1) Voluntary and compulsory notification; (2) removal of affected children from school and home; (3) treatment of children in special children's sanatoriums; (4) education of the general public with regard to the disease; (5) provision of municipal dispensaries in every community; (6) provision of sanatoriums for the cure of early cases; (7) institutions for advanced cases; (8) home training and supervision amongst the working classes; (9) rigorous supervision of the milk supply; (10) extermination of tuberculosis amongst cattle; (11) assistance to family in the absence of the breadwinner; and (12) provision of suitable employment to cured cases and those in whom the disease is arrested.

Voluntary and compulsory notification.—Tuberculosis being essentially an infectious disease it is desirable that a complete notification of all cases should be made to the officials who are responsible for the public health, so that they may be informed as accurately as possible of the existence of every person infected with the disease.

In England voluntary notification has been superseded by compulsory notification, at least so far as pulmonary tuberculosis is concerned, and although it is open to question whether or not it is desirable to notify the private patients of a medical man, yet if a certain amount of discretion is exercised there can be no doubt but that compulsory notification is in the general interest of the community, although it may press hardly on individual cases. A recent order from the Local Government Board, in London, compels the notification of every inmate of a public institution suffering from any form of tuberculosis. This notification must be made on special forms by the physician attending the case,

and for which he receives a small fee of 1s. As soon as notification is received by the health officer a visit is made to the home of the patient, and a careful inquiry as to his personal condition and surroundings is made; if, in the opinion of the health officer, his home surroundings are such as to make it unsafe for him to remain power is given for the patient to be removed to some institution, but this power is very rarely exercised.

In large cities and habitations where a great amount of overcrowding exists, the treatment of the advanced case of tuberculosis is of supreme importance. If he is allowed to live in the same dwelling and share the same room as his wife and children, it will almost certainly happen that one or all of his family will become infected with the disease, and therefore it is absolutely necessary that he should be removed to some safer surroundings unless he is able to have a room to himself and to look after his own personal cleanliness. It is of no use to keep a patient in a sanatorium for six months and then discharge him as incurable, to spend the rest of his life in an overcrowded cottage where he may spread the infection to a new generation. Provision ought to be made, either by Government or by municipality, for the detention and comfortable treatment of all cases of incurable tuberculosis. I am not in favour of exercising compulsory powers of removal from a man's own home, but if it is for the protection of healthy people, then removal ought to be made compulsory; but I think it will be some time before public opinion is ripe for such measures.

The health authority will disinfect and clean the clothing and bedding of any notified case, and then will also carefully disinfect the house in which he has lived. Very often the patients complain of this attention to their homes and their clothing, but it is essential that it should be done for the protection of the future residents of the house. It is also the practice to notify to the health authorities any change of address of a tuberculous person, so that they may keep in touch with any house in which he may live.

On the whole, compulsory notification will prove useful in the fight against the disease, but it should only be used in a wise and gentle manner, as otherwise it is liable to cause personal discomfort and may have the effect of ostracising the patient from society. If it is pushed too far it may also have the effect of preventing him from earning his livelihood by reason of his fellow-workers having a fear of infection in the workshop or factory. Although many countries are still doubtful as to the wisdom of enforcing compulsory notification, yet from the point of view of suppression of an infectious disease it cannot be denied that with care and consideration the compulsory notification of tuberculosis is bound to do good.

Removal of affected children from school and home.—The medical inspection of school children is now thorough and complete in Great Britain, as in many other countries, with the result that a fair number of children of school age are recognised as suffering from pulmonary tuberculosis, although this number is not so large as one might be inclined to expect. Pulmonary tuberculosis is comparatively uncommon amongst school children, whilst the other forms of tuberculosis are more often seen. When a child is recognised as suffering from open tuberculosis it should at once be removed from school, mainly for the protection of the other children, as it is possible for one child in an overcrowded and badly ventilated schoolroom to infect several of its fellows. In the case of a family the infected child should invariably, if possible, be provided with separate accommodation, or, better still, removed from the family circle until recovery has taken place, but on no account should the child sleep with any other children or even with its parents.

Treatment of children in special children's sanatoriums.—The provision of special sanatoriums for children is, I am glad to say, in England making steady and rapid progress; many of these sanatoriums have been provided by the education authorities, with excellent results. It has been found undesirable for children to be treated in a sanatorium for adults; hence it is necessary to provide special institutions for them. The children's sanatorium has the double advantage of continuing the education of the child and at the same time providing the means of cure of the disease. In Germany, where the climate is more suitable for this treatment, a great many of such sanatoriums have been

¹ Being a report presented at the Eleventh International Anti-Tuberculosis Conference, Berlin, Oct. 22nd to 25th, 1913.