$\frac{1}{2}$ gr. doses three times a day in a croton chloral pill combination. Indeed, it seems to me that everything tending in any way to improve the general health in such cases is of benefit to the patient. Hence not only strychnine and quinine, but likewise mineral acids—notably phosphoric and nitrohydrochloric—are of service. Antipyrin I once or twice found very useful, as well as occasionally the peroxide of hydrogen.

Should non-success follow upon the treating of diabetic cases upon the principles inculcated, I trust before they are condemned the reader will kindly reflect that he may have erred either in the differential diagnosis of the case, or in his selection of the remedy employed for its cure.

A CASE OF FOCAL EPILEPSY: TREPHINING: ELECTRICAL STIMULATION AND EXCISION OF FOCUS: PRIMARY HEALING: IMPROVEMENT.

By RUSHTON PARKER, B.S., F.R.C.S.,
Professor of Surgery in University College, Liverpool;
WITH REMARKS

By FRANCIS GOTCH, M.A., F.R.S., M.R.C.S.,
Professor of Physiology in the same College.

REPORT OF THE CASE BY PROFESSOR RUSHTON PARKER.

A boy, aged 9, from St. Helens, Lancashire, was sent to the Liverpool Royal Infirmary by Dr. Knowles on account of fits at the end of September, 1892. The family and personal history were healthy, and nothing was known of any epileptic or other fits previous to this case. As to injury, the boy had fallen on the right side of his head while at play in October, 1891, when he vomited slightly about an hour later. Nothing more was noticed wrong until about three weeks later, when there occurred a slight tremor of the left hand, which subsequently twitched several times that day. These tremors and twitches became more frequent, but were at first confined to the hand, and still of momentary duration (according to the father's opinion). After the middle of December, 1891, the fits became longer in duration, and affected the forearm. Later the head began to move in the fits, and in March, 1892, the eyes turned to the right. By this time twenty or thirty fits a day occurred, with all the movements above noted sometimes combined. Whatever he happened to be doing, whether talking, whipping a top, or what not, would merely be momentarily interrupted during a fit and be resumed immediately after. He was first noticed to fall in June, 1892, and in July of the same year, while staying in Ramsey, Isle of Man, he fell about twice a day, vomiting and weakness following. At last the falls became so frequent that he was not allowed to go alone, even about the house. The twitching fits have always been of the same character, and have never implicated other parts than the left hand and arm, the head and eyes; but though increased in frequency and length, no fit has lasted longer than about ten seconds. No dulness or stupidity, loss of power or sensation, headache or other ill consequence, has ever resulted. There has never been a cry or other sound in any way associated with a fit, nor has he ever bitten his tongue or micturated at these times. As to "aura," he used to be aware when a fit was coming on, and said he "felt funny" in the left arm from shoulder to wrist, but nothing in the hand. It has been all along difficult to decide where the movements began, whether left shoulder, forearm, wrist, fingers, or thumb; but it was finally decided that the thumb and wrist movements seemed to be the first. In the hand there was slight twitching tremor of fingers and thumb, none of which were flexed into the palm, but all kept apart. The forearm was held at right angles to the arm, in the position of pronation, the elbow being flexed and extended in short limits. The arm was held abducted slightly during these movements. The head, in two or three jerks, moved towards the right shoulder, and there remained during the fit, while the eyes moved together to the right. It was also difficult to say where the last movements occurred, but apparently twitching of the hand could be so considered.

On December 6th the eyes were examined by Mr. T. H. Bickerton, oculist to the Royal Infirmary, and found healthy in all respects.

On December 7th, 1892, chloroform being given but without previous injection of morphine, he was trephined over the right Rolandic area, with the view of finding and excising the motor centre of the left thumb and wrist. The line estimated to be over the Sylvian fissure was drawn from a point one inch and a quarter outside the external angular process of the orbit to a point three-quarters of an inch below the most prominent part of the parietal eminence. Reid's base line was marked, and from it two verticals drawn to the sagittal line, one just in front of the external auditory meatus, and the other at the hindmost part of the mastoid process. The sagittal end of the posterior vertical was now joined to the Sylvian end of the anterior, the diagonal thus drawn being one recognised method of estimating the fissure of Rolando. Another measurement was made by marking a point on the sagittal line one centimetre behind the central point between the naso-frontal junction and the external occipital protuberance, according to Professor Victor Horsley's suggestion in Cunningham's Memoir (Royal Irish Academy, 1892). This point came nearly three-quarters of an inch in front of the sagittal end of the diagonal above referred to, so a fresh line parallel to that diagonal was drawn from the new point. A line midway between the two was then adopted as that of the fissure of Rolando. The situation of the thumb centre was estimated by marking a point about midway between the sagittal end and the Sylvian end of the line adopted. This is not a very accurate statement, but it is the nearest to the fact that can be recollected.

The skin was punctured at this point, and the bone entered with a bradawl, after which a semicircular flap of skin, including cranial aponeurosis, stripped with a smooth raspator, was turned downwards, and the pin of a trephine entered at the guiding bore-hole. On removing the disc, an inch and a-half in diameter, and opening the dura by a tripartite incision, the Rolandic fissure was found crossing the middle of the trephine hole, and the genu of the ascending frontal convolution exposed almost exactly in its centre. Stimulation of the cortex at one point evoked movements of the thumb, and at an adjacent point movements of the wrist. The areas thus stimulated were now scooped out with a sharp spoon after incising the pia around. Bleeding from the large vessel occupying the fissure became somewhat persistent, so two ligatures of silk were placed upon it. At the moment of tying one of them a spasmodic movement of the right hand occurred. Some present thought this a semi-conscious act, due to partly restored sensibility. No fluid except warm water was brought in contact with the brain until after the electrical excitation was over, when sublimate solution 1 in 10,000 was used. The dura was sewn with silk, and the disc, previously cut up and wrapped in lint wet with warm sublimate solution 1 in 10,000, replaced to about two-thirds of its bulk in small tessellated fragments. The skin and cranial aponeurosis were reattached by a few stitches after washing with 1 in 40 carbolic lotion, and cyanide gauze applied without drainage. At the end of five days the wound was deeply healed, and most of the edge; the remainder being completed by scabbing in fifteen days. The slight pulsation and yielding over the trephine hole gradually diminished until January 25th, 1893, when he went home, and by February 20th could no longer be perceived.

After operation, on the same day, nine fits were noticed, twenty-seven the second day, six the third, three the fourth, three the fifth, and afterwards from thirty to forty a day. He was allowed up about the sixteenth day, but, having a week later fallen almost into the fire, he was sent back to bed for a couple of weeks or more.

Before operation his case was related to Mr. Victor Horsley, who kindly offered suggestions, advising excision of the shoulder centre, and this was, in consequence, at first intended. Concurrent testimony on the spot having subsequently pointed rather to the thumb and wrist centres, it was eventually decided to select them, as indicated in Ferrier's book.

The patient was subsequently brought once a fortnight to hospital, and, on March 6th, reported about four to ten fits a day, chiefly in the afternoon. Since then further improvement has taken place. Time alone will show whether or no genuine advantage has accrued to him.

I wish to thank Mr. T. H. Agnew and Mr. J. S. Macdonald for the notes from which this report has been prepared.

Fig. 1.—The circle indicates the area of the opening in the skull made on the right side by the $\frac{1\frac{1}{2}}$ -inch trephine. The dura was reflected back over the greater part of the area. The numbers indicate the regions on the ascending frontal excited by the faradic current, the dots showing, approximately, the position of the exciting platinum electrodes. The portion of cortex removed corresponded pretty nearly with the shaded region including 3 and 4. ** Points where the vein was tied.

REMARKS BY PROFESSOR GOTCH, F.R.S.

There are some points of much physiological interest in this case. These may be conveniently treated under three heads: First, those connected with the character of the epileptiform convulsions; secondly, those connected with the excitation of the cerebral cortex by the faradic current; and, thirdly, those connected with the after-effects of the ablation of the portion of cortex.

THE CHARACTER OF THE EPILEPTIFORM CONVULSIONS.

As stated in the account of the case, the character of the convulsions was extremely definite in its limitation to the left arm and the head and eyes, but it was such as to cause considerable difficulty in obtaining a clear answer to the important question as to the segment which displayed the primary or initial movement. The convulsions of the left arm undoubtedly preceded those of the head and eyes, but their short duration and rapidity rendered observations upon the succession of movements in the segments untrustworthy. A graphic record of the contractions of shoulder and wrist would alone have furnished the necessary means for distinguishing which was the initial segmental movement. In certain instances in which the convulsion was less severe it was, however, pretty clear that the arm movements were heralded by twitchings of the thumb and, more doubtfully, by spasmodic movements of the wrist.

The frequent implication of the head and eyes was a point of interest, since the movements of these organs were invariably the last of the series, and were of such character as to turn the structures to the right—that is, towards the side of the supposed focal discharging lesion. Now it is well known that in the macaque monkey and in the higher orang, Beevor and Horsley found that the electrical stimulation of the appropriate area of the right cortex evoked movements which deviated the head and eyes away from the side excited—that is, to the left. It was therefore a doubtful point in this case whether the movement in question did not imply a localised discharge from the cerebral cortex on the left side, though the arm movements pointed to the right cortex as initiating the whole effect. As will be seen in connection with the results of excitation, there is every probability that at any rate in this boy the opposite left cortex was not implicated, since the area in question on the right cortex, when stimulated artificially, evoked the same movement as was present in the fits.

THE STIMULATION OF THE EXPOSED CORTX.

The physiological effects of the electrical excitation of the cortex form by far the most interesting of the points here dis-

cussed; and since the recorded cases in man are comparatively few, it seems desirable to place on record the results, and to give the details of both the effects and the mode of their production.

Attention has been drawn by Beevor, Horsley, and others to the possibility of failure in the attempt to excite the cortex, owing to the diminished excitability of the nervous tissue which is produced, not only by deep narcosis, but still more by the use of antiseptic agents. In order to avoid such possibility of error as far as possible, the narcosis was rendered comparatively shallow when the stimulus was to be applied, and boiled water was used for irrigating the surface, instead of an antiseptic agent, from the moment of opening the dura mater to that when the last excitation had been effected. The area of cortex exposed by the $\frac{1\frac{1}{2}}$ inch trephine is indicated in the above diagram. It will be seen that the genu of the fissure was placed nearly in the centre of the area exposed by the trephine. The ascending frontal convolution was stimulated in four distinct portions of its course. The stimulation was effected by the interrupted faradic current, a large (quart) Daniell cell in the primary circuit of the usual Du Bois-Reymond sliding coil being used. The electrodes connected with the secondary coil consisted of two perfectly clean platinum wires, the tips of which were 2 millimetres apart, and were bent round so that the ends could be pressed firmly on the cortex without risk of injuring the surface.

The excitation period during which the faradic currents were allowed to traverse the tissue was about five seconds in duration, and each of the regions marked 1, 2, 3, 4 was excited at least twice, a short interval elapsing between the successive applications of the electrodes. The first excitation proved ineffectual owing to the stimulus not being strong enough, and it was found necessary, in spite of the precautions as to narcosis, etc., previously referred to, to make use of very strong induction currents in order to evoke any response. The secondary coil was brought to within 5 centimetres of its zero limit, and at this distance the faradic currents were subsequently found to be quite unbearable when applied to the tip of the tongue, and to be distinctly unpleasant when applied to a far less sensitive part of this organ, namely, a point lying one-third of the distance towards the root.

The results of the different stimulations were as follows:

- (a) Excitation of the area on the right ascending frontal below the genu, marked 1, evoked a movement of the head, which turned towards the right.
- (b) Excitation of the area in front of and a little below the genu, marked 2, produced no effect even when the intensity of the stimulus was increased.
- (c) Excitation of the right ascending frontal immediately above the genu, marked 3, evoked movements of the thumb—extension, abduction, and finally flexion.

(d) Excitation of the same convolution higher up, at 4, evoked movements of the wrist and some twitching of the fingers.

It will be seen that excitation at 1 evoked a movement of the head towards the stimulated side; this movement was similar in character to that which was observed in the epileptiform convulsion, and it is therefore probable that this kind of movement was represented in this area of the cortex. In addition to this result, which, being the opposite to that ascertained by experiment on the monkey, is itself noteworthy, there are two other circumstances to which I wish to draw attention.

The first is the great inexcitability of the area marked 2. A similar inexcitable area has been previously noted by Beevor and Horsley in the orang, and has been observed also in the few recorded instances in which this particular region has been stimulated in man. Its significance, lying as it does between the lower limit of the excitable area of the upper limb and the upper limit of that of the head and face, has been remarked on by the authors just referred to. The present result confirms the previous ones.

The second circumstance is one of much importance physiologically, and is connected with the enormous intensity of the stimulus which it is necessary to employ in the case of the more excitable areas. Here, too, the orang experiments pointed to the existence of a similar necessity. It was found that a series of far more intense induction currents had to be used to evoke movements from the cortex of this animal than was necessary in the case of such smaller and lower types of monkey as the common macaque. Further, the cases in which the human cortex has been excited seem to exhibit the same remarkable feature. In comparison with the strength of stimulus which is found adequate to excite most of the excitable tissues, that now employed was astonishingly great.

Two factors seem to especially determine the relation between strength of exciting induction currents and the production of nerve impulses down motor nerve paths of sufficient power to evoke muscular contractions. There are first the physical alterations in the distribution of the currents due to the mass, moisture, temperature, etc., of the tissue which these traverse, and secondly, the physiological resistance of tissue to the arousing agent. The first factor is undoubtedly largely dependent upon the mass of the tissue, especially when this is a moist conductor, and it is possible that the increased spread of current deviations through such a large bulk as that of the human brain may, to some extent, explain the high intensity which has to be used. It is, however, far more probable that the physiological factor is the more potent. The more highly differentiated cortex seems to possess greater inertia than the less highly focalised one; there is a greater disinclination in such a cortex to pass from the static to the dynamic condition. The contrast between the ease with which epileptiform attacks are evoked by artificial stimulation of the cat's brain, and the difficulty of similarly evoking such convulsions from the orang, is an indication of this. But it must not be forgotten that there is a third possibility. In the case of the spinal cord there is abundant experimental evidence to show that a discharge of impulses from its motor side is far more easily evoked by electrical or mechanical irritation of the posterior roots or posterior columns than by similar irritation of the grey matter.

A similar condition may rule in the sensory motor region of the cerebral cortex. Indeed, it is possible that this may be only capable of responding reflexly, that is, to the stimulation of its entering afferent nerves. The comparative thickness of the human cortex would thus necessitate the employment of a current of very considerable intensity, since only under these circumstances would a derivation of adequate strength traverse and excite a sufficient number of the deeply-situated afferent bundles of nerve fibres.

THE AFTER-EFFECTS OF ABLATION.

There is little to be said on this side of the question. The area ablated is indicated in the diagram, and the results to which attention is here directed may be briefly summarised as follows:

1. The temporary loss of voluntary power in the grasp of the left hand was associated with complete inability to com-

pletely extend the thumb, and with a very marked diminution in the number of fits.

2. A restitution of power in hand and thumb occurred in a very short time (a week to ten days), and, coincident with this restitution, was a renewal of the fits at more frequent intervals.

3. There was no impairment of sensibility, but on this point the method of testing employed soon after the operation was not a satisfactory one. There was, however, a prolonged subsidence of the sensory aura (tingling, etc.), which does not appear to have been permanently lost, since the boy has informed Mr. Parker and myself that quite recently, in some of the few fits which he still has, the aura has been present again for the first time since the ablation.

A CLINICAL STUDY OF THE CAUSATION AND TREATMENT OF CERVICAL DYSMENORRHOEA.

By M. HANDFIELD-JONES, M.D. LOND.,

Senior Obstetric Physician to St. Mary's Hospital, and Lecturer on Midwifery and Diseases of Women to St. Mary's Medical School.

MANY theories, little knowledge. This saying undoubtedly applies to the subject of dysmenorrhœa, for numerous though the theories are which have been put forward to explain and account for severe suffering in connection with menstruation, yet it cannot be said that much exact and scientific knowledge of the subject exists at present. Doubtless in such a complex process as menstruation, possessing as it does numerous local and constitutional phenomena, and depending as it does on a healthy anatomical tract, on a normal blood condition, and on perfect nervous function, there are abundant opportunities for disordered working of some of the component parts. In the search for truth it would appear that some investigators, close students of the anatomical tract, have unduly magnified certain mechanical obstructions, and made overmuch of one possible factor; while, on the other hand, some who longed for a severe simplicity of explanation, have found in spasm the "fons et origo" of all the menstrual suffering which woman has endured since our primeval mother had her first monthly sickness. In the present communication I have no wish to be dogmatic, nor do I desire to lay stress on any one theory to the exclusion of all others; but having gone over the clinical records of all the cases of dysmenorrhœa which have occurred in my private and hospital practice during the last five years, I shall endeavour to set down the deductions I have drawn from a study of these cases. To avoid possible misunderstanding, the term dysmenorrhœa is used throughout this paper to describe pelvic pain, which occurs during the menstrual bleeding or during the two or three days which immediately precede the onset of the flow.

NEURALGIC DYSMENORRHOEA.

The first group of cases comes under this heading, and a single one will serve as an example:

Miss E. B., aged 19, is a well-developed girl, healthy, but not very robust. She menstruated first at 13, and has her periods with fair regularity. The periods last as a rule six days; no clots are passed; for the first three years there was no pain at the times. During the last three years she has had pain with the periods; usually at its worst on the first day. Now the interesting feature about this pain is this: The girl is engaged in domestic service, and spends part of the year in London and part by the seaside. When she has been in London some weeks, has been up late, and is somewhat overworked, then she has menstrual pain, but she loses the latter entirely on returning to the country house, where work is light and exercise in the fresh air constant. Naturally no vaginal examination has been made in this case, nor indeed in any which occur in this group, but it is impossible to believe that pain which can thus come and go is of other than neuralgic origin.

INFLAMMATORY DYSMENORRHOEA.

The majority of the cases which come under this heading occurred in women who had passed, more or less recently, through an attack of pelvic peritonitis or cellulitis. The disease in some cases had been partial and localised to one region of the pelvis; in others it had been general, involving the whole of the pelvic peritoneum or cellular tissue. In the majority of the patients menstruation had always occurred before the inflammatory attack, with little or no suffering; in all after the disease dysmenorrhœa had been a prominent