contraction, the difference from the normal is not nearly so great as in the cases of lengthened contraction, but it is perfectly clear.

FIG. 11.

Fig. 11 records the contraction of the tibialis posticus in a case of hysterical contracture which had persisted for over twelve months. The muscle was tensely contracted, leading to equino-varus position of the foot, and the condition had begun after injury to the thigh. Unlike true reflex contractures, this condition was cured after a short course of psycho-therapy. It will be seen that the contractions of the affected muscle are of exactly the same length as on the normal side, and it was this observation that led to the adoption of psycho-therapy as the suitable treatment.

Conclusions.

In the foregoing records I have shown that after injury to a motor nerve the muscles supplied by the injured fibres respond to stimulus with a contraction longer in duration than that of normal muscle, and that this has been observed in every one of the many hundred cases tested. It appears to me that this lengthening of the contraction is due to hyper-excitability in the muscle following a definite sequence of events, though there is an alternative conclusion which I am at present investigating.

It is a matter of common knowledge that when for some pathological reason the stimulus from the upper motor neurone weakens or ceases, the anterior horn cells of the lower neurone become hyperexcitable, and the muscle tone is increased.

In health there must always be a delicate adjustment between the irritability of the upper and lower neurones, so that the lower respond in a proper degree to the stimuli passed down from above. For this reason it is a natural sequence for the lower neurone to become hyperexcitable when for any reason the upper stimuli become less intense, and we know that in upper neurone impairment this hyper-excitability is increased to a pathological degree, as shown in the exaggerated reflexes of such cases as cerebral tumour, certain injuries of the cord, etc.

There must also be an adjustment of irritability between the lower neurone and the muscle. As an instance of lower neurone interruption the most typical case to cite is one of complete division of a nerve.

In Fig. 5 the record of the contraction of extensor carpi radialis longior after division of the musculo-spiral nerve shows a great lengthening of the period of decontraction, and that is exactly what one would expect if the excitability of a muscle were increased. That it is not a slowness of contraction is made evident by the angle of the upward line showing the contraction of the muscle. It is true that frequently this upstroke is more slanted than normal in tracings of muscles whose nerve supply has been retarded, but this difference is always very slight compared with the difference in the length of the line showing the decontraction, and I ascribe it to slight tissue changes owing to disuse. At any rate, in many cases, as in that shown in Fig. 5, there is no slowing of contraction displayed while the period of decontraction is much prolonged. I think this lengthening of the period of response of paretic muscle is not to be associated with the chronaxie (rapidity of excitability) of a muscle, because it has been abundantly proved by Lapique and others that the chronaxie of these muscles is increased to as much as thirty or forty times the normal, whereas I have shown that the response to the stimulus lasts at most three or four times as long as the normal. In fact, the chronaxie would appear to bear no further relation to the contraction of the muscle than the flash point of an explosive to the explosion.

In the examples exhibited above, it has been shown that when the nerve impulse is slightly retarded, the muscle responds with a slightly lengthened response; that when the nerve impulse is further retarded, the muscle responds with a further lengthening of the response; that when the nerve retardation reaches a certain point, the muscle reaches a limit of response beyond which it cannot go, and this response is the same in cases of severe nerve compression or of complete division of the nerve. We have

seen also that after suture of the nerve, and its subsequent regeneration, response to faradac stimulus first appears in the muscle, proving the dawn of the new nerve supply. Then after a period the muscle begins to respond first with a slight shortening of the contraction, and then, following the gradual establishment of nerve influence, with a gradual further shortening until, following the complete regeneration of the nerve, the muscle response is restored once more to its normal length.

It is not intended here to dwell upon the great value as an aid to the more exact diagnosis of delicate nerve lesions which is to be found in the phenomena above described, but rather to look upon the subject from a purely scientific standpoint.

Having stated that probably the excitability of the muscle is increased as a result of decreased stimulus from the nerve, and that this is in the nature of an attempt at adjustment on the part of the muscle, it now remains to be shown in support of the latter statement that when the excitability of a lower motor neurone is increased that of the muscle is reduced. For this purpose I have selected the three cases given above—one of upper neurone affection, with the exaggerated reflexes common to these cases, and the others of contracture of the muscle due to reflex irritation, and in each of these cases the duration of response in the affected muscles has been shown to be shortened. These instances present a picture of protective hypo-excitability in muscles supplied by hyperexcitable nerves.

Summary.

1. A muscle undergoing a succession of stimuli of varying strength responds with a succession of contractions of varying intensity but of equal duration.
2. The duration of the contraction of a muscle is the same whether it occurs in response to a short sharp stimulus or to a long diffuse stimulus.
3. When the conductivity of a motor nerve is slightly reduced by slight compression or injury the duration of response in the muscle it supplies is slightly lengthened.
4. When the conductivity of a motor nerve is much reduced or entirely destroyed the duration of response in the muscle is much lengthened.
5. When the stimulus from a motor nerve is abnormally and persistently increased the duration of the response in the muscle supplied by it is shortened.

A CONTRIBUTION TO THE STUDY OF ACUTE RHEUMATISM.

BY

F. JOHN POYNTON, M.D., F.R.C.P.LOND.,

PHYSICIAN TO UNIVERSITY COLLEGE HOSPITAL AND THE HOSPITAL FOR SICK CHILDREN, GREAT ORMOND STREET.

THE case here briefly recorded was remarkable in its clinical course, but medical literature abounds with so many surprises that this in itself would not justify publication. It is because it adds one more link to the chain of evidence upon the cause of acute rheumatism that I believe it to be of value to the student of the disease.

R. K., a girl aged 17, machinist, was admitted to the hospital July 2nd, 1918, suffering from weakness, nervousness, palpitation, and dyspnoea on exertion. A pale, thin, delicate girl, she was obviously the victim of Graves's disease and organic heart disease. The cardinal symptoms of enlarged thyroid, exophthalmos, tachycardia, and tremor, with von Graefe's sign, were all present. The heart was considerably enlarged, and there was a double mitral murmur. The history was of some interest, for the heart disease dated from an attack of rheumatic fever two years previously, and at the same time the thyroid enlargement was noticed by her doctor. The association of Graves's disease and acute rheumatism is one that is well recognized, but it is exceptional for the two conditions to be noted simultaneously.

The course of the case was at first uneventful, treatment by x-ray applications and sedatives producing some gradual improvement. On August 19th, however, she developed a severe sore throat, the temperature rose, and multiple arthritis affecting the ankles, wrists, and shoulders followed, and it was clear that she was commencing another attack of rheumatic fever. A rheumatic erythema developed, followed by cardiac dilatation, and on September 1st pericardial and pleuro-pericardial friction.

From this date onward her condition became extremely grave, the pericardial friction became general, and there followed all the signs of an unusually copious pericardial

effusion. The area of cardiac dullness extended upward and to the right and left, with muffling of heart sounds, small and rapid pulse, and collapse of the lower lobe of the left lung. Exploration excluded pleural effusion, and after fluctuations in the severity of the symptoms and failure of local applications, Mr. Raymond Johnson tapped the pericardium on October 6th, far back on the left side, and drew off 18 oz. of sero-fibrinous fluid, which during withdrawal showed the characteristic pulsatile stream.

The fluid was centrifugalized, and both free and in still greater numbers taken up in the leucocytes, were demonstrated numerous minute diplococci.

Recovery was remarkably rapid, the temperature falling to normal four days later—after a course of irregular fever lasting five weeks, and reaching at times to 103° F. The pulse-rate, which had reached to 156 in the minute, fell to 112, and the impulse of the heart became well defined and forcible in character. A wave of severe influenza then spread through the ward and the patient was attacked—needless to add, to the general dismay. From October 14th to the 22nd there was fever, which on two occasions touched 103.8° F., but the attack was passed through without serious pulmonary complication or cardiac dilatation. From that date onward she made uninterrupted progress, leaving the hospital for Christmas, with a well compensated mitral lesion. A month later improvement was maintained, but two months later the thyroid, which had diminished greatly in size during her acute illness, together with all the other signs of Graves's disease, had commenced to enlarge again, coincident with an exacerbation of the exophthalmos—and it was apparent that there was a relapse of the hyperthyroidism—for which she is again under treatment.

There is no doubt that there is much quiet scepticism as to the reality of the diplococcus, due in part to the difficulties in demonstrating its presence, the infrequent opportunities afforded, and its minute size. It may be said to hold among bacteria the position of the famous Mrs. Harris of Sarah Gamp fame. Such being the prevalent attitude of mind, it is obvious that *post-mortem* contamination is a ready explanation for the results which have been obtained from cultures, for few can spare the time to sift the detailed evidence to the contrary which, at best, makes dull reading. This case, however, presents, I think, a clear issue. A patient, the victim of acute rheumatism, with a heart injured by a previous attack, passes through a second most severe one while under observation in hospital. A general pericarditis with copious effusion develops, and the fluid withdrawn by paracentesis shows numerous minute diplococci, some in the fluid, many more carried up in numbers by the polynuclear leucocytes.

The stage of the illness is one in which the acute phase is subsiding, but death is threatened from mechanical embarrassment. This patient does not die, the effusion does not return, the temperature falls, and eventually the recovery is so good that she leaves the hospital able to walk short distances, and with a compensated mitral lesion.

Some years ago Dr. Paine and I recorded the isolation of the diplococcus from the blood stream and synovial fluid during life, and we have repeatedly emphasized the rapid destruction of the diplococcus in animal tissues by leucocyte and tissue cells. Now we have once more the proof of its presence in the fluid from the pericardium of a patient who is living, and we have gained a further step in its life-history in man, and further light upon the process of recovery in rheumatic pericarditis. Clearly the cells in the exudate are busy destroying the diplococci in great numbers, and we are not surprised that cultures may not prove invariably successful, for we have always to bear in mind that if the process of their destruction is already in progress, the sudden transfer to a culture medium which can but imperfectly represent the living human medium may give the final death blow to the harassed micrococci.

This has been the first case in which I have been fortunate enough to obtain a living pericardial exudation in man in this particular phase, and it completely supports the results of experimentation.

This result also serves to strengthen the extreme probability that in the human cases of rheumatic pericarditis in which there is little effusion but great thickening of pericardial tissues, the diplococci are shut in the necrotic areas but imperfectly destroyed; and, lurking there, flare up into virulence from time to time, and thus cause the intractable relapsing examples met with in childhood. Lastly, we can realize how difficult it must be to determine, when once a patient has been infected, whether a renewal of symptoms is evidence of a fresh attack or the recrudescence of latent disease, and we are confirmed in

the faith that rheumatism must if possible be prevented, and failing this, be most persistently guided to as complete a recovery as possible.

FOUR YEARS' WORK AT AN ANTE-NATAL CLINIC.

By ARTHUR CROOK, M.R.C.S., L.R.C.P.

In this account of the work of the ante-natal clinic at the Norwich Maternity Institution during the four years 1915-18 I shall endeavour to indicate, not results, but some lines on which future work may profitably be pursued.

The patients were drawn from those who went to the institution for attendance in their homes in the surrounding district, supplemented by patients sent by the M.O.11. and a few by private doctors and midwives. The total number was 308 (151 primiparae and 157 multiparae).

The notes of the cases were filed on a card index system, and the figures and statements here given are based on these cards, and the corresponding labour and puerperium cards kept by the attending midwife.

All the primiparae were required to attend the clinic as a matter of routine, and such multiparae as complained of symptoms which might indicate abnormality as well as those who in the judgement of the "booking" midwife at the institution showed by their previous history or symptoms that there might be some abnormality.

The examinations were made at all stages of pregnancy; the women were encouraged to book early, but if they did a further examination was made at the end of the seventh month or afterwards, to decide, if possible, the factors not previously ascertainable, namely, the relative size and position of the fetus to the pelvis.

A physical examination was made of all the primiparae; it included mouth (teeth), throat, neck (thyroid), chest, abdomen (greatest girth), pelvis and limbs (oedema and veins). An examination of the urine was made at least monthly, from specimens sent to the institution. The blood pressure was estimated in many cases (Riva-Rocci instrument). The same routine was followed in multiparae when previous history or symptoms indicated it.

Pelvic Measurements.

Two cases of contracted pelvis were found. One with 2½ in. conjugate, was admitted, and Caesarean section performed with success. The other, with a conjugate of a little less than 4 in., and giving a history of several difficult breech labours, with death of the child in all instances, was unfortunately, owing to pressure of work and depletion of staff, lost touch with; she did not come back for further examination at a later date as instructed, and was not seen again by me till well advanced in the second stage of labour, at least a month over her calculated date; a rapid delivery with forceps of an overgrown stillborn child did not save her in the profound state of collapse in which she then was; undoubtedly if the clinic had been able to keep in touch with her through a visiting nurse this bad result would not have occurred.

In a large proportion of primiparae (63) the interspinous (anterior superior) measurements were 9 in. or less to as low as 7½ in. in one case; of these only six were recorded as having any abnormal prolongation of labour, thus confirming Bourne's statement.¹ In many of these cases the estimated conjugate was not more than 4 in., indicating a small type of pelvis, but with a child not above the average size trouble need not be anticipated. "Whites," meaning by this discharge abnormal in quantity or quality, occurred in 48 women; the proportion of cases with "whites" rose steadily from 10 per cent. in 1915 and 1916 to 20 per cent. in 1917, and to 25 per cent. in 1918. In all these cases treatment was given during the pregnancy, and on the card for the attendant midwife was a prominent notice directing her, if in time, to give a douche before labour, and to instil protargol into the eyes of the infant. It is satisfactory to record that not a single case of severe ophthalmia occurred in the four years. No case of syphilis either in the first or second stage was met with.

There were seven cases of heart disease with some breakdown in compensation; all except one got through labour