the comparative difficulty in detecting a fracture of the acromion. I have in many instances of so-called simple contusion of the shoulder of the living subject been able to satisfy myself of the presence of an ununited fracture of the acromion or of fracture of the outer third of the clavicle.

This is another instance of the extreme inaccuracy of the published statistics of the relative frequency of fractures of the various bones. In a paper in the *Guy's Hospital Reports*, 1886,¹ I have described in full the frequency of fractures of the acromion, first costal arch, and outer third of the clavicle, and I am merely referring to it here as bearing upon the rarity of fracture of the coracoid process. It is also obvious that the force required to produce a fracture of the coracoid process must be great as compared with fractures of the acromion or clavicle.

A NOTE ON THE RHYTHM AND CHARACTER OF CERTAIN TREMORS.

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THE voluntary contraction of a muscle in man is maintained by a series of nervous impulses, which reach the muscle at a certain definite and fairly constant rate. Under ordinary circumstances in health, the fine vibration thus produced is imperceptible to the casual observer; but if even a steady hand be attentively watched, it may be seen to be constantly vibrating. By the use of suitable apparatus a graphic representation of this vibration may be obtained; the general character of such a tracing is fairly represented by Fig. 1, which was obtained by one of us from his own forefinger.

The rhythm of muscular contraction for the muscles of the forearm was set down by Beaunis (*Physiologie Humaine*, 1876, p. 273) at 10.5 per second, and he added the remark that these vibrations were much more "pronounced in senile tremor and alcoholic trembling, which are only exaggerations of the physiological state."

Horsley and Schäfer (*Journal of Physiology*, vol. v) have recently found from experiment that the rhythm of muscular response to electrical excitation of the nerve centres is the same, whether the excitation be applied to the grey matter of the cerebral cortex of the motor region, the corona radiata, or the spinal cord (but not to the peripheral motor nerves); and that with all the rates of excitation higher than ten, the rhythm of muscular response is maintained at a fairly uniform rate of about ten per second. The rhythm in the case of voluntary and reflex contractions is essentially the same as that got by excitation of the nervous centres. In the case of epilepsy they obtained sometimes a slower rate, due to summation in the cells of the spinal cord. This summation on the part of the spinal cord cells explains why in some cases a rhythm was obtained the same as the electrical excitation, or, if not quite equal to that, yet considerably exceeding the normal rhythm. This was due to failure or imperfect performance of the summation process. They think that the spinal cord cells are never capable of originating a rhythm of greater frequency than ten per second, but that cortical cells may originate a rhythm of twelve, thirteen, or even more.

Schäfer (*Journal of Physiology*, vol. v) also has recently shown that a prolonged voluntary action in man is an incomplete tetanus produced by from eight to thirteen successive nervous impulses per second. He concludes that in this case the average rhythm is also ten per second.

That this rate of rhythm is maintained fairly constantly in the various movements constituting the tremor of disease is made

evident by our observations. Mr. Victor Horsley has already figured in the *JOURNAL* (vol. i, 1885, p. 112) a tracing of ankle clonus in a man suffering from caries of the spine, which showed a wave-rate of eight to ten per second, and also a tracing from a well marked case of paralysis agitans made by Dr. Beevor, showing a wave-rate of four or five in a second. Mr. Horsley added that he had found frequent indications of each wave being a compound of two.

The investigation which we now report was directed to the study of the characters, but especially of the rate, of various forms of tremor observed in disease, with the view of ascertaining whether the relation on which they stood to the normal oscillations of health was of a constant character. The analysis of complex movements such as those of athetosis, or even of chorea did not come within the scope of our inquiry.

The apparatus which we employed is represented in Fig. 2. The tracing was taken on an ordinary revolving cylinder (A) driven by

Fig 2

clockwork; the writing lever of the time marker (B) marked half seconds on the same cylinder; a Marey's tambour bag (D) carrying a writing lever (C) was connected with an india-rubber bag (F)—of the kind used by Dr. Warner in his experiments—by a long piece of glass tubing (E); this rigid tube was introduced in order to prevent as much as possible accidental jarring or shaking of the apparatus, which, especially when the patient has a severe form of tremor, is very prone to occur if the whole connection is by india-rubber. The patient placed the tips of the fingers or the palm of the hand upon the india-rubber bag; each movement was thus transmitted to the tambour (D) and inscribed upon the blackened paper of the recording cylinder by the writing lever (C). This arrangement of the apparatus has the great advantage of permitting observations to be made without difficulty in an ordinary ward; it can be quickly put together and carried from ward to ward by a single assistant.

The first observations were made on cases of exophthalmic goitre (Graves's disease); the exceedingly fine character of the tremor which is present in the earlier stages of that disease can only be studied by obtaining a graphic record of the movements, and, while affording a good test of the applicability of the method to clinical purposes, there seemed to be some probability that a comparison of the tracings with others obtained in other forms of

disease where the tremor is coarser might throw some light on the nature of Graves's disease itself. Fig. 3 is a reproduction of a

¹ "The Pathology of Pressure-changes in the Trunk and Shoulder-girdle."

tracing taken as above described while the cylinder was revolving slowly. The patient was a young woman, A. C., suffering from well-marked symptoms of Graves's disease in an early stage. The tremor could be distinctly felt when her hand was loosely placed in the hand of the observer. The tracing was taken with her right hand resting lightly on the tambour. The movements occur at the rate of 11 per second, and their amplitude is slight, though varying within small limits. Numerous tracings were taken from this patient, and also from another young woman, E. A., who also presented well-marked symptoms of Graves's disease in the early stage. All the tracings had the same characters, and the rate was practically identical in both patients, the maximum of numerous countings being 11.5 per second in A. C., and the minimum 10.8 per second in E. A. A study of the extended series of tracings from these two cases appears to show that even this slight difference is due to imperfections in the apparatus, and that, within the limits of experimental error, the rate in these cases was almost identical. Fig. 4 is a reproduction

tion of a tracing taken with a more rapidly revolving cylinder. Though the general aspect is, for this reason, different, the rate at which the movements occur (11.3 per second) is almost the same as in Fig. 3, and the two tracings have essentially the same characters.

The next tracing (Fig. 5) is from a man, W. H. H., aged 78,

who presented well marked symptoms of paralysis agitans; he was under the care of Dr. Scanes Spicer in the Fulham Infirmary, to whose kindness we are indebted for the opportunity of making this as well as the observations recorded below. Though the tremor was well marked, the patient was still able to do a little light work. The tracing gives a rate of 5.2 per second, but inspection shows that many of the curves give indications of secondary waves. This is beautifully marked in the tracing (Fig. 6) from another case, G. E., an old man, also in the Fulham

Infirmary, with incapacitating paralysis agitans. Each wave is notched at the summit with singular regularity, and is clearly compounded of two waves. The larger waves give a rate of 5.1

per second; and, as each is double, the true rate is 10.2 per second, which is about the average rate of the oscillations in health, the difference lying in an alteration in the amplitude, and in the fusing of each alternate wave with the one immediately preceding. This point is further elucidated in another tracing (Fig. 7), taken from this case on a more rapidly revolving drum. The lever, as it descends, is caught by the secondary wave, and again thrown up, very much as in a tracing of a "dicrotic" pulse. The tremor of paralysis agitans, which ordinarily gives such a tracing as that reproduced in Fig. 5, is thus seen to be due to a fusion of the waves in pairs as above stated.

Tracings were taken from two cases of disseminated sclerosis. In one, A. D., a woman aged 77, a very uniform tracing, reproduced in Fig. 8, was obtained. The rate is 5.8 per second. A tracing

obtained from another case of the same disease in a woman, A. T., affords evidence of secondary waves, which, viewed in the light afforded by the tracings from the cases of paralysis agitans (Figs. 5, 6, 7), points clearly to a process of fusion. The same effect is extremely well shown in a tracing (Fig. 9) from a case of

lateral sclerosis with tremor of the arms in a woman aged 63. The rate, if the main oscillations only are counted, is 5.2; and, as each oscillation is distinctly double, the true rate is in this case also 10.4. The next tracing (Fig. 10) is from an old woman aged

91, who had well-marked senile tremor. The average of the oscillations is 5.5 per second. Many of the curves, however, are distinctly notched, so that, as in other instances, we here have, in all probability, an effect of regular summation in pairs.

It would be easy to multiply tracings all giving evidence of the same nature, but enough has been advanced to make it clear that the rate of the tremulous movements in these various forms of nervous disorder does not overpass the normal limits observed by Schäfer and Horsley. The general result of our observations is to show that the special characteristics which clinically distinguish the various forms of tremor are to be traced to two causes: in the first place an exaggeration of the amplitude of the normal vibration; and in the second place to the fusion of vibrations, which has the effect of producing a relatively slow tremor, generally of a rate corresponding to half that of the normal vibration.

A NOTE ON FILARIA SANGUINIS HOMINIS: WITH A DESCRIPTION OF A MALE SPECIMEN. By ALFRED GIBBS BOURNE, D.Sc., Professor of Biology in the Presidency College, Madras.

OUR knowledge of the adult form of this worm is still incomplete. It was discovered by Dr. Bancroft, in Brisbane, in 1876. It has also been found by Dr. Timothy Richards Lewis, in Calcutta; Dr. Patrick Manson, in Amoy; Dr. Silva Arango and Dr. F. dos Santos, in Brazil. Dr. Bancroft's specimens were described by Dr. Spencer Cobbold. Drs. Lewis and Manson have both given descriptions of their specimens. All these specimens were imperfect, and are