gical treatment of disease; for Mr. Hill asserts that he had not only extirpated eighty-eight genuine cancers, all of which except four had ulcerated, with only two deaths; but that of seventy-seven such cases, sixty-six continued free of cancer as long as they lived, so that "the different patients lived as long after extirpation of the cancer as, according to the bills of mortality, they would have done had they never had any cancer, or undergone any operation." Sir Charles in this way disposes, to his own satisfaction, of his friend the "late justly esteemed" Dr. A. Munro. I have no desire to follow his example, and attempt to strengthen my opinion regarding carcinomas of the breast which should be operated on by referring to figures, for "everyone knows how easy it is to twist statistics to suit any moral which the manipulator is anxious to enforce."

Excluding cases of cancer which have advanced beyond hope of relief and those whose health is seriously compromised by some other disease, Sir B. Brodie avoided operating on rapidly-growing carcinomas, as well as on those very slowly-growing tumours above referred to. He was also disposed to hesitate in operating when the skin and axillary glands as well as the breast were affected with cancer in younger persons. There seems good reason why he should have formed this opinion, because fifty years ago the death-rate directly following an operation for excision of the breast was hardly less than 16 per cent., and if the glands were removed it rose to 25 per cent. With a risk of this kind from the operation, and the certainty that by far the larger proportion of those who survived excision of the glands would die of cancer within two years, Sir B. Brodie was right in declining to operate unless in exceptional cases of this kind. Thanks, however, to drainage, anæsthetics, and antiseptics, we may now take a more favourable view of the risks incident to excision of the breast; the death-rate from this proceeding has diminished of late years, and the pain from the subsequent dressings has been greatly alleviated, so that we are not only justified, but it is our duty to remove a large proportion of carcinomas of the breast, although the skin and axillary glands are diseased; we may thus hope to prolong life, and we have good reason to believe that we shall also save our patient much suffering. It is true there are a certain few cases of rapidly-growing carcinomas of the breast, and some very slowly-growing tumours we had better leave to run their course, but these do not form more than 12 or 15 per cent. of all the cases of scirrhus we meet with, and their existence cannot justify practitioners abstaining from excising the affected gland in the large majority of cases, especially in the early stages of the disease, a subject to which I shall return in my next lecture.

MODE OF FIXATION OF THE SCAPULA, SUGGESTED BY A STUDY OF THE MOVEMENTS OF THAT BONE IN EXTREME FLEXION OF THE SHOULDER- JOINT: ITS BEARING UPON FRACTURE OF THE CORACOID PROCESS.

By W. ARBUTHNOT LANE, M.S., F.R.C.S.,

Assistant-Surgeon to Guy's Hospital, and to the Hospital for Sick Children,
Great Ormond Street.

In the *Guy's Hospital Reports*, 1886, page 332, I showed that during the movement of flexion of the shoulder-joint, the scapula rotates around a transverse axis, or, more accurately, around an axis whose direction is, on the whole, obliquely inwards and forwards. While the scapula is performing this movement, that portion of it which is most fixed as regards the clavicle is the acromion at its articulation with that bone, and next to that the coracoid process of the scapula. The lower extremity of the scapula glides outwards, forwards, and then upwards, over the convex outer surface of the thorax, while its upper margin is carried backwards and somewhat upwards from its relative position to the clavicle in the pendulous attitude of the arm.

The coraco-clavicular ligaments oppose and limit this separation of the two bones, and the coracoid process is prevented from moving upwards and backwards by its coming in contact with the under surface of the clavicle.

I also pointed out that in those labourers who have to carry loads upon the head or trunk, in order to keep their heavy burdens in place by their arms, the shoulder-joints are retained in a position of extreme flexion, the scapula being fixed upon the clavicle by the opposing surfaces of clavicle and coracoid process;

that in such labourers an arthrodial joint is developed in this situation, and that the perfection at which the joint arrives depends entirely upon the strain exerted upon the arm, and therefore upon the opposing surfaces of coracoid process and clavicle while the shoulder-joint is in a position of complete flexion (this condition is even more marked when the load exerts a direct as well as an indirect pressure upon the clavicle).

In some cases I have found this joint remarkably well developed, the articulating surfaces on the coracoid process and clavicle being eburnated, and the capsule surrounding them strong and well defined. In that paper in the *Reports* I suggested that this apposition of the coracoid process of the scapula and clavicle was the developmental factor which determined the separation of a portion of the tendon of the pectoralis minor to form the coraco-humeral ligament, that tendon originally passing superior to the coracoid process, as a large portion of it does in occasional instances. In the same manner it has possibly destroyed a portion of the subclavius, which may have formerly extended outwards as far as the acromion. In porters I have seen the subclavius arising by fleshy fibres from the capsule of this joint, rendering it obvious that during one lifetime the extent of the origin of that muscle can be considerably altered. As it does not bear directly upon the point I wish to illustrate here, I will only mention the similar joint formation and other pressure changes, identical in character with the above, and associated with them, which develop between the clavicle, rhomboid ligaments, and the underlying first rib and cartilage.

Fig. 1 represents the upper two costal arches, the clavicle, the extremity of the coracoid process, and the half of the manubrium of the left side of the body of a labourer. On the upper surface of the coracoid process C the articular facet, by which this bone articulates with the under surface of the clavicle, is represented as a slightly elevated plane. The dotted line indicates the position of the capsule of the acquired coraco-clavicular joint. A points to the arthrodial joint which has developed in the outer portion of the ossified first costal cartilage. O indicates the position of facets on the first costal cartilage and on the anterior extremity of the first rib, which articulate with a corresponding articular surface on the under surface of the clavicle, and form with it what I call the chondro-clavicular articulation.

In Figs. 1, 2, 3 and 4 I have represented the chondro- and coraco-clavicular joints as they existed in a labourer who carried loads upon his left shoulder.

The movements of the scapula with regard to the clavicle during flexion of the shoulder-joint are very briefly and somewhat inaccurately described by anatomists, and I am describing them here, as a knowledge of them suggests a very important practical point in the surgical treatment of that joint.

The circumstance which I wish to call attention to is this—namely, that in complete flexion of the shoulder-joint the scapula is rendered fixed by the coracoid process impinging upon the under surface of the clavicle, and that while the shoulder-joint is

completely flexed the humerus may be rotated, completely adducted, and very extensively abducted without the scapula accompanying it in its movements.

Surgeons are all familiar with the difficulty they experience in fixing the scapula when they wish to break down adhesions which have formed between the humerus and that bone, and many means have been devised to obviate this difficulty. I will illustrate this by quoting a few lines referring to the treatment of synovitis of the shoulder-joint from Holmes's *System of Surgery*, vol. ii, page 393: "But, if adhesion remain between or about the surfaces, difficulties in restoring motion are met with in the shoulder-joint which are not present to the same extent in other joints. They are due to the mobility of the scapula, which, when we attempt to make passive motion for the stretching or the tearing of the new material, moves with the bones, and we have no *point d'appui*, as in other joints. But the difficulty can to some extent be overcome if the patient be put under the influence of an anæsthetic, by giving the scapula into the charge of an assistant, who stands at the side of the patient opposite to that of the affected joint. If now, while he grasps this bone with both hands, and fixes it against the ribs with his fingers on its borders, the humerus be slowly brought away from the side, and then rotated upon its own axis, the adhesions may be gradually loosened after one or two attempts if the assistant be able to hold the scapula firmly. Unfortunately, the patient himself will not, as a rule, carry out active motion carefully."

Fig. 2.—The dotted line indicates the limits of the chondro-clavicular joint and its relations to the subclavius muscle (S) and sterno-clavicular articulation. The outer end of the clavicle has been displaced upwards and backwards, in order to show this new joint.

The writer very wisely inserts the proviso, "if the assistant be able to hold the scapula firmly;" and in my experience the assistant was never able to do so to my satisfaction. By means of the method I suggest, not only can the surgeon and his assistant completely fix the scapula, and rotate the humerus readily when the scapula is fixed, but the patient can readily arrange that his relations or friends shall carry out the definite and simple instructions of the surgeon, and a very important part of the subsequent treatment can in this manner be secured.

It is obvious from the above description of the movements of the shoulder-joint that the coracoid process is brought into forcible contact with the under surface of the clavicle only in extreme flexion of the shoulder-joint; and that if the force exerted in bringing these bones into apposition be great, the coracoid process may sustain a strain sufficient to break it. Such an acci-

dent might then ensue by the exertion of a sudden or considerable strain upon the trunk of an individual hanging by his arms, or by a heavy fall forwards, the arms being at the time completely flexed at the shoulder-joints, and, therefore, stretched directly forwards. In either case it is very likely that fracture of the coracoid process would be accompanied by dislocation of the head of the humerus.

The coracoid process would, therefore, be broken by indirect and not by direct violence, but, according to surgical authors, the coracoid process is not broken in this manner. For instance, in Holmes's *System of Surgery*, vol. i, page 953, I find the following: "Fracture of the coracoid process is an extremely rare accident, and only produced by severe direct violence; it is usually accompanied by other injuries, as dislocation of the humerus in the cases reported by South and Holmes, or by fractures of other parts of the scapula." I would ask how it is that fracture of the coracoid process by direct violence is so frequently associated with dislocation of the humerus? It seems difficult to understand. The writer goes on to say that "Two cases of fracture of this process have come under my notice. In both the fracture was caused by a fall forward from a slight height with the arms stretched forward, etc." Again I would ask in what manner does he suppose that the coracoid process could have been influenced by direct violence when the shoulder-joint and arm were in the position he describes?

It is obvious that he refutes in a very practical manner the assertion he had just made by the two cases which he has brought forward to illustrate and verify it, since it would be almost impossible to fracture the coracoid process by direct violence under the circumstances related.

Fig. 3 represents the under surface of the left clavicle; A the facet on the clavicle which enters into the formation of the chondro-clavicular articulation; and B the facet forming the clavicular portion of the coraco-clavicular articulation.

Fig. 4 represents the upper surface of the left coracoid process. C indicating the raised flat facet on this surface of the bone, which articulates with the facet B on Fig. 3. D and E point to the trapezoid and conoid ligaments respectively.

The extreme rarity of this fracture illustrates another point in which I am interested, namely, the relative frequency of fractures of the various bones. In 325 bodies whose bones I have thoroughly examined in the dissecting-room, I found no undoubted instance of fracture of the coracoid process, though I have looked for it very carefully. In the same number of subjects I found that a considerable proportion presented fractures of the acromion, that portion of the scapula being broken more frequently than any other bone in the body. Yet in the statistics of the fractures of the upper extremity, treated at the Middlesex Hospital during ten years ending 1879, comprising a total of 1,084 fractures, there are six fractures of the coracoid process, and only ten fractures of the acromion.

The reason of the incompatibility of this last statement with the results of my experience in the dead subject is obvious from

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.

By R. NORRIS WOLFENDEN, M.D.(CANTAB.),
Physician to the Hospital for Diseases of the Throat;

AND

DAWSON WILLIAMS, M.D.(LOND.),
Fellow of University College, and Assistant-Physician to the East London
Hospital for Children, Shadwell.

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."