demonstrable cause. The ulnar paralysis may be caused by certain occupations, as Duchenne has already observed repeatedly in workingmen who are obliged to press the elbow

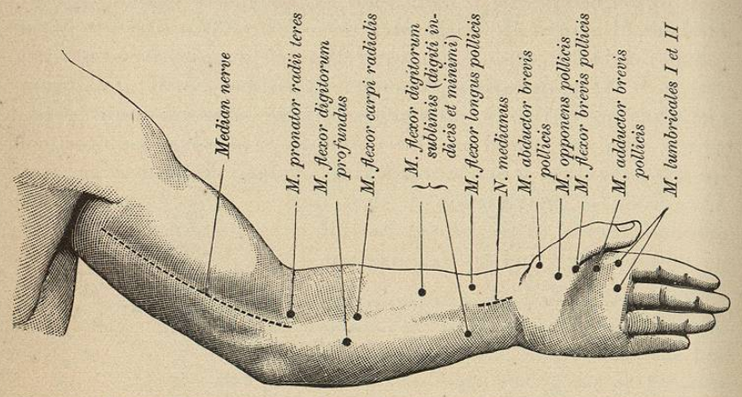

Fig. 102.—Motor Points of the Median Nerve and the Muscles supplied by it.

firmly upon a hard surface. It is not a rare occurrence in those who have to use the ulnar side of the hand—hypothenar eminence—a great deal to strike certain instruments (cabinet-makers, dyers, cobblers, etc.).

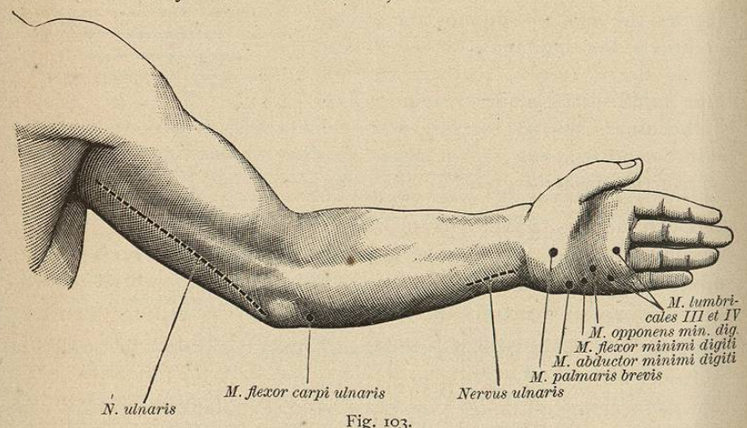

Fig. 103.

A pure median paralysis is chiefly characterized by the inability to pronate the forearm and to flex the hand, as we can easily understand from the anatomy of the parts. A very slight flexion of the hand toward the ulnar side is, however,

rendered possible by the action of the intact flexor carpi ulnaris. The terminal phalanges can not be bent, but in the first phalanges, which are under the control of the interossei, this motion is not impaired. The part of the flexor profundus digitorum which is supplied by the ulnar makes it possible for the patient to seize some objects with the third, fourth, and fifth fingers. The extended and adducted thumb, which lies in close apposition to the index finger, is almost useless.

On the other hand, we find in ulnar paralysis that the thumb can not be pressed against the index finger on account of the paralysis of the adductor pollicis, that the terminal phalanges of the fingers can not be straightened, the first ones not flexed (paralysis of the interossei), and that the little finger

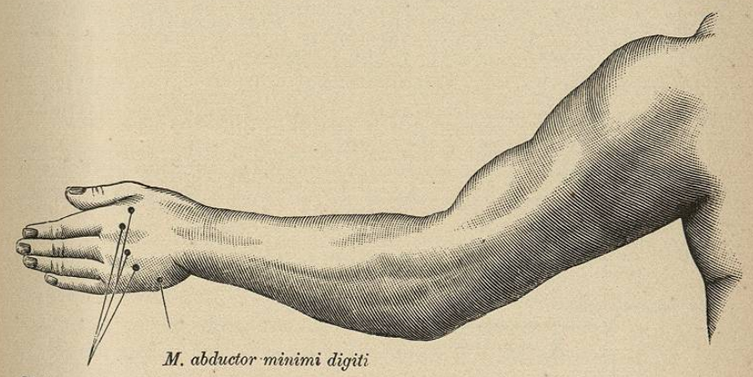

Fig. 104.—Motor Points of the Ulnar Nerve.

is almost wholly useless. With the median paralysis the ulnar form has this in common, that flexion at the wrist joint is greatly impaired. In the latter especially lateral movement toward the ulnar side is interfered with owing to the paralysis of the flexor ulnaris. Lastly, the difficulty which is experienced by the patient in spreading his fingers apart and bringing them together again, movements which are indeed almost impossible, greatly facilitate the diagnosis of ulnar paralysis, which, however, for that matter, is always simple.

Muscular atrophies not uncommonly develop in both of these paralyses, but more frequently in the ulnar form. The interosseal spaces on the back of the hand become sunken in, and, if the wasting affects chiefly the interossei and the lumbri-

cales, the hand assumes a peculiar appearance. It becomes not unlike a claw, since the healthy antagonists—the extensor digitorum communis and the flexor digitorum—produce a dor-

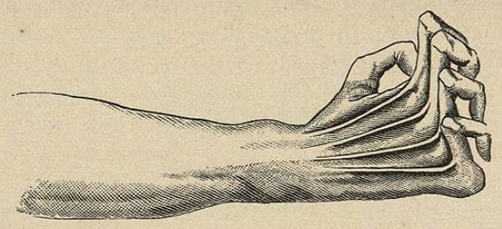

Fig. 105.—CLAW-HAND. (After DUCHENNE.)

sal flexion of the first phalanges and a complete palmar flexion of the second and third (cf. Fig. 105). This is called the "claw hand," the "*main en griffe*" of the French.

Atrophy confined to the antithenar eminence I have repeatedly observed in cabinet-makers. They themselves attribute it to the continued use of the plane.

The affections of the sensory fibres of the median and ulnar nerves may either occur alone or be found associated with those of the motor fibres. In the latter case we have to contend with disturbances of sensibility, paræsthesias, numbness,

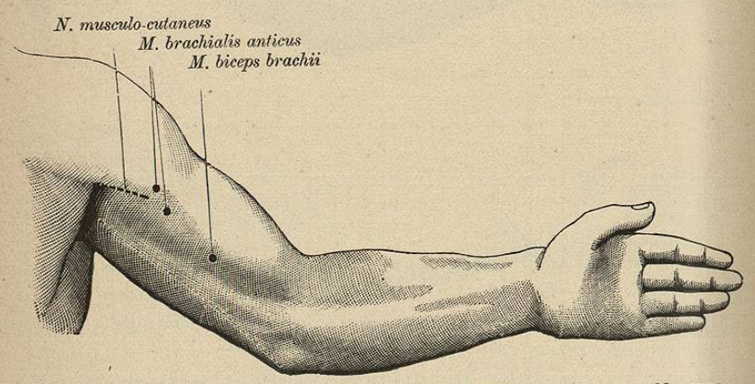

Fig. 106.—MOTOR POINTS OF THE MUSCULO-CUTANEOUS NERVE AND THE MUSCLES SUPPLIED BY IT.

anæsthesia, and pains, sometimes quite well pronounced, which are most marked in the initial stage of the paralysis. In the former there are genuine neuralgias, acute, spontaneous, lanci-,

nating pains which follow the course of the nerve and which are intensified by pressure upon it. Such pains are more frequently observed in the distribution of the median than in that of the ulnar, but they are not common in either of these regions. I have known them to occur occasionally after acute diseases, especially after typhoid fever. In their course they differ in no way from other neuralgias. The only fact remarkable is that atrophy of the interossei and the "claw hand" may develop in their course even when there are no motor disturbances present. A relapse in a case of ulnar neuralgia may occur after an interval of years, but no satisfactory explanation for this has been discovered.

Lastly, we have to consider in the upper arm the musculo-cutaneous and the circumflex nerves (Fig. 106), either of which may be affected by itself or in connection with other nerves of the plexus. The former supplies the coraco-brachialis, the brachialis anticus, and biceps; the latter, the deltoid.

Lesions of the motor fibres of the musculo-cutaneous, which are only met with independently after injury due to surgical operations, impair and completely prevent flexion of the forearm on the upper arm. In lesions of the circumflex, motion of the arm away from the trunk is difficult, and even rendered impossible, if, as often happens in the course of the disease, the deltoid atrophies. This atrophy is readily recognized by the flattening of the shoulder, and is often associated with reaction of degeneration (cf. Windscheid, Neurol. Centralblatt, 1892, 7). Occasionally the participation of the sensory fibres of the circumflex is more prominent; the patients then complain of violent neuralgic pains (Heon, cf. lit.), which are aggravated if any attempt is made to move the arm. It is important in such cases to make a careful examination of the shoulder joint, and frequently we shall find a chronic inflammation here to be the cause of the neuritis. Recently, F. Schultze has carefully studied the so-called acroparæsthesia (Deutsche Zeitschrift f. Nervenheilk., 1893, iii, p. 300).

In other cases, again, we can not make out any organic changes in the joint, and we have to think of a joint neurosis. For information on this point the reader is referred to the chapter on Hysteria. A severe concussion, a fall upon the shoulder, which at first produces hardly any symptoms, may give rise to disease, lasting for years, in which both the joint and the nerves of the plexus take part.

In any one of these affections of the nerves of the arm we should in the treatment, besides aiming at the removal of the cause if such be found, make use as soon as possible of the galvanic current. It is a mistake to lose time with other measures, such as bathing, massage, rubbing, and the like. Where the electrodes are to be applied may be learned from the illustrations, in which the motor points are accurately given. We need hardly say that, besides the electricity, various placebos, rubbing and passive motion, may be used to quiet the patient's mind.

Not uncommonly several nerves of the brachial plexus are paralyzed at the same time. Duchenne was the first to describe such instances in children in consequence of obstetrical operations, such as version and subsequent extraction, the Prague method of extraction, etc., and designated this form as "paralysie obstétricale infantile du membre supérieur," or birth palsies. Independently of the French investigator, Erb has given us an excellent well-defined picture of such a paralysis. The lesion which affects the plexus gives rise to a simultaneous paralysis of the deltoid, the biceps, the brachialis anticus, and the supinator longus, and the patient can neither move his upper arm away from the body, nor approach the forearm to the upper arm. The whole extremity hangs down flaccid, while the fingers and hand retain their mobility. The lesion in such cases must be situated at a point where the circumflex and the musculo-cutaneous and the musculo-spiral are still close together—i. e., at about the exit of the sixth cervical nerve—between the scaleni, and it is from this so-called "Erb's" or "supraclavicular" point (cf. Fig. 107) that we are able to stimulate simultaneously all these four above-mentioned muscles. If the infraspinatus is also taken in, the arm is in a position of internal rotation, and can not be turned outward.

This paralysis, which Erb has aptly termed "combined shoulder-arm palsy," is often a very tedious and troublesome affection. The longer it lasts the more the nutrition of the muscles suffers, and the most varied degrees of atrophy, which is often especially marked in the deltoid, are seen. On electrical examination we find that the faradic and galvanic excitability of the nerves, although not completely lost, is diminished, as is also the faradic excitability of the muscles, while the galvanic excitability of the same has undergone qualitative as well as quantitative changes, a condition which Erb has designated as partial reaction of degeneration. Sometimes, also, there is present complete reaction of degeneration (cf. page 91). If the sympathetic is also implicated (Seeligmüller), the ensuing paralytic symptoms, contraction of the pupil, narrowing of the palpebral fissure, and retraction of the bulb on the affected side, are further sources of annoyance to the patient.

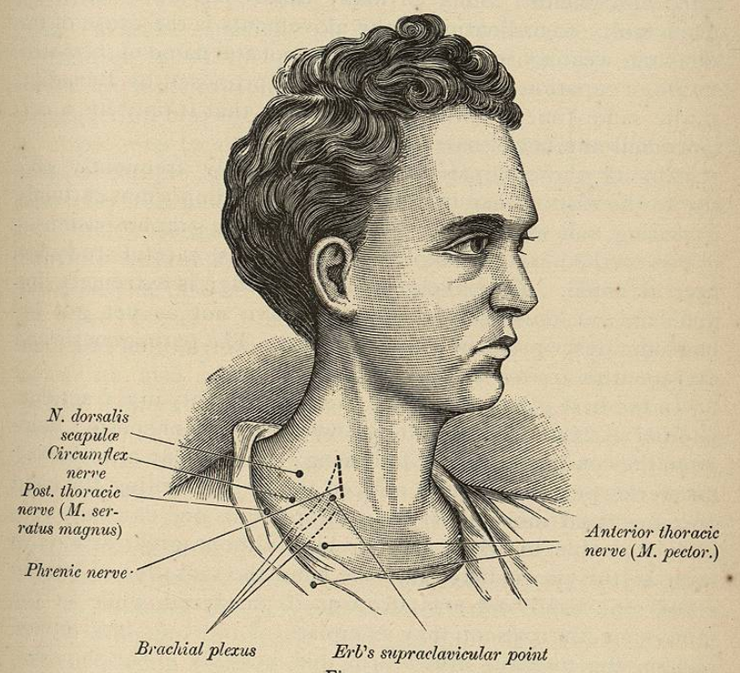

Fig. 107.

How the participation of the sympathetic is to be explained, whether, as Klumpke (cf. lit.) holds, by a lesion of the communicating branch of the first dorsal, we can not decide. If the sensory fibres are also implicated, the patient complains, in addition to the motor, also of sensory disturbances, not only of great difficulty in moving the arm, but also of pains, numbness, and formication.

The treatment, of course, consists in the use of electricity, galvanic stimulation from Erb's point, and the application of

the faradic brush, which, acting reflexly, often give very good results.

Peculiar and very curious motor phenomena in the upper extremities are observed in connection with and as a direct consequence of certain callings. Such occur in cases where no particular exertion of the muscles might lead us to think of a peripheral lesion of the plexus as the result of overstrain, but in persons whose occupations bring into play complex, co-ordinated movements. Since in many cases—but by no means in all—a faulty co-ordination of the movements is the cause of the affection, we may for the present accept the name of "co-ordination occupation neurosis," which was proposed by Benedikt, at the same time insisting upon the fact that it only fits a certain small number of cases.

Among the occupations which relatively frequently give rise to the disturbance in question the most important certainly is writing, and writer's cramp—mogigraphia, graphospasmus—is one of the nervous diseases to which most careful study has been devoted. Nevertheless, our knowledge is extremely limited, and we must confess that we have not as yet got beyond the description of the symptoms. The pathogenesis and therapeutics are *terræ incognitæ*.

In the first place, we ought to state that only in a fractional number of cases have we to deal with a cramp or spasm; more often the conditions are the following: The patient, after having for weeks, perhaps months, noticed that while writing the hand becomes tired more easily than before, finds one day that he is utterly unable to write another line without great strain; as soon as the pen is taken into the hand the sensation of fatigue comes on; hand and arm drop as if paralyzed, while at the same time the patient may complain of more or less intense pain in the forearm, upper arm, and possibly in the shoulder. The writer's cramp in such cases is in reality a writer's paralysis. In other instances, as soon as the penholder is clasped the hand begins to tremble and the handwriting becomes uncertain and tremulous, which is all the more striking because on examination the patient's hand, especially the right, proves to be quite steady if it is not used in writing. Sometimes there is an actual spasm when the penholder is seized, which attacks the muscles of the hand as well as those of the forearm, so that hand and arm make involuntary movements or they become stiff and immobile (clonic and tonic spasm). The pen is either

irregularly jerked to and fro or firmly pressed against the paper; in both cases writing is absolutely impossible. On further examination nothing else is discovered, and, what is more especially interesting, the patient is able to do anything else with his hands, even the finest work. He is able to draw (with a pencil), play the piano, etc.; moreover, the electrical examination of the apparently seriously affected muscles seldom reveals anything abnormal worthy of mention. Dubois (Schweiz. Correspondenzbl., 1887, 5) found the excitability for both currents, especially in the thenar muscles, increased. Sensibility is, on the whole, normal. Pains only occur on forced attempts to write; in short, the patient can do anything demanded of him except write.

Analogous to the affections just described are the conditions of fatigue in the muscles of people, chiefly professionals, who play the piano a great deal. In them not only the right hand, but, especially in female patients, the left also is affected. Pain and weakness may become so marked in both hands that piano-playing has to be given up completely. This becomes the more necessary when the symptoms persist during rest as well, and not only when the patient is playing. Such disturbances are also noted in telegraph operators, cigar-makers, and in milkers of cows; also, but rarely, in tailors it is produced by the frequent handling of the heavy shears, etc. In all cases it is evident that the occupation is the sole cause, although we do not know how and upon what organs it acts injuriously. It is very unlikely that the disturbance is of a peripheral nature, the negative result of the examination of muscles and nerves and the uselessness of any treatment seeming to indicate this. We can not accept either the theory which attempts to explain the symptoms by a primary weakness of certain muscles and a secondary spasm of the antagonists (Zuradelli), or that which assumes the spasm to be of a reflex nature, starting from the sensory nerves of the skin (Fritz); or, finally, the explanation that we have to deal with a disturbance in conduction of the nerve muscle apparatus used in writing; but we are rather of opinion that the weakness and the motor disturbances of the upper extremity arising in consequence of the occupation are of a central nature and are to be referred to the brain cortex. The situation of the centres concerned in writing and in other movements which depend upon a co-ordinated action of the muscles of the hands is un-