patient endeavours to delay its fall. By this means the deltoid may be exercised while still too weak to raise the arm from the side.

Paresis of the short muscles of the hand and of the flexors of the fingers provide suitable cases for this form of treatment. As before, the muscles are first put into their shortest position and then elongated, while the patient resists the extension.

Mode of Application.

The question as to how often the movements should be performed is of importance. They should be performed from five to ten times at each sitting, and the sittings may be given once or twice daily. A common mistake is to exercise paretic muscles too frequently. If this is done, the muscles become exhausted and recovery is retarded, not hastened. The manoeuvres must be performed slowly and carefully with a strength proportionate to the muscle's power.

The results obtained will obviously depend largely on the nature and causation of the paresis. In general terms, cases of lower-segment paralysis are better suited to this form of treatment than cases of upper-segment paralysis. In order that the treatment may be of benefit, the affected muscles must not be absolutely paralysed, but must possess some trace of contractile power. But it must be remembered that a muscle, which in its over-stretched position may appear absolutely paralysed, may yet possess latent contractile power which may be obvious in its shortest position. In general terms, it may be said that if a muscle possesses any contractile power at all, that power may be increased by the persevering use of eccentric movements. This holds good even in long-standing cases; in such cases possibly the result is obtained by the hypertrophy of individual muscle fibres.

As mentioned before, treatment by eccentric movements may well be used in conjunction with electrical treatment and massage. Percussions and vibrations may also be used, and in certain cases the limb may be splinted so as to prevent over-stretching of the affected muscles. The writer, however, considers that eccentric movements are the most valuable single measure in the treatment of paresis.

Theoretical Explanations.

I suggest that an explanation of the above phenomena is to be found in the microscopic structure of striped muscle fibre. Schäfer's² views on the histology of muscle are here followed, but are only given in bare outline; the division of the muscle fibre into sarcofibrils and sarcomeres is omitted as not essential to the present question.

A striated muscle consists of fibres each of which is marked by transverse bands of alternate light and dark material. According to Schäfer, the dark bands are made up of longitudinal channels or tubules arranged parallel with the long axis of the muscle fibre. Each such channel or tubule is closed at one end (line of Hensen), but at its other end opens by means of a minute pore towards the light band, which is composed of clear translucent material. In Schäfer's view, when the muscle contracts, the translucent material of the light band flows or is drawn into the channels of the dark band, and becomes hidden from view. By this means each individual channel of the dark band becomes shorter and wider, and by the sum of similar processes shortening and widening of the muscle fibre occurs. The evil effects of over-stretching on a muscle may now be considered in the light of this minute structure.

Mr. Robert Jones³ has recently emphasized the injurious effects of over-stretching. He suggests that it has the effect of causing the nerve cells to become inactive, though not extinct. I put forward the view that the evil effects of over-stretching have nothing to do with the nervous apparatus of the muscle, but have their origin in certain changes produced by the stretching on the muscle itself.

When a muscle fibre is over-stretched its sheath (sarcolemma) is brought into a state of tension, causing lateral compression of its contents. By this lateral compression the longitudinal channels which compose the dark bands will be compressed one against the other, and this will have the effect of obstructing the orifices of the minute pores through which the translucent material gains entrance to the channels. This affords a simple

mechanical explanation of the ill effects of over-stretching; for since the ingress of the translucent material into the channels of the dark band is impeded, so also will physiological contraction of the muscle be hindered or prevented, even though the nervous mechanism of the muscle may be intact.

The same considerations explain why a muscle, which appears functionless when over-stretched, can yet exhibit contractile power when put into its shortest position; for in the latter position the sheath of the muscle fibre is relaxed, the channels of the dark band do not press on one another, and therefore their pores will be unobstructed and the ingress of the translucent material easy.

It will also be clear why physiological contraction is so important in the treatment of paresis, for it is the only means of causing ingress and egress of the translucent material to and from the channels, passive manipulations being powerless to effect this. The rapid improvement that sometimes takes place in a paretic muscle as the result of exercise (as in the case of wrist-drop quoted above) may be explained by supposing that through disuse the entrances to the channels may become clogged, and possibly the translucent material altered in consistence. A few physiological contractions may serve to clear the entrance to the channels, and thus bring about rapid improvement in the muscle's power.

CONCLUSIONS.

1. In order to perform eccentric movements, the manipulator first brings the affected muscle into its shortest position and then gradually elongates it, while the patient resists the elongation.
2. Such movements are of more value in the treatment of paresis than the more ordinarily employed muscular movements.
3. The explanation of the effect of such movements is to be found in the microscopic structure of striped muscle.

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RAYNAUD'S SYNDROME AND SYPHILIS.

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It would appear that Sir Jonathan Hutchinson was the first to call attention to the relation of syphilis to certain cases of Raynaud's disease,¹ so that the idea of their possible association is by no means new. Since his paper (1889) there have been an ever-increasing number of reports of similar cases, and the occurrence of one in the out-patient department at the Great Northern Hospital, which Dr. Whitfield has kindly allowed me to make use of, and was the subject of an animated discussion at the Dermatological Section of the Royal Society of Medicine,² must be my excuse for once more calling attention to the importance of recognizing not only the syndrome which Raynaud described, but still more to the vital necessity, from the patient's point of view, of tracing to its ultimate cause or causes the etiology of the condition.

Inasmuch as the physician has in a majority of cases only the clinical evidence to go upon, it would be better to look upon Raynaud's disease, not as a disease *sui generis*—a tendency which is undoubtedly still generally prevalent—but rather as an associated clinical picture, a symptom complex, dependent, perhaps, on a variety of factors in which the angiospastic conception of Raynaud plays only a part, and for which some organic and structural change of the vascular system concerned is mainly responsible.

The case referred to is that of a woman aged 56, who has suffered for over seven years from symptoms which Raynaud would have called typical, and which in the present attack have terminated in gangrene (of the dry type) of the tips of the thumb, first, fourth, and little fingers of the left hand, and in local syncope as evidenced by cyanosis of the third left finger, and of the digits of the right hand. In none of these situations is more than the pulp of the distal phalanx involved, and the

nails, though scored by transverse dystrophic lines, the evidence doubtless of past attacks, show no tendency to separate at present.

There are no symptoms of Raynaud's syndrome elsewhere, although there is a history of a similar asphyxial affection of the toes, ears, and nose, without gangrene.

As far as can be ascertained there has never been hæmaturia, and at the present time there is nothing abnormal in the urine. The Wassermann reaction is positive.

The present attack began in the early part of September, 1912, when intolerable aching of the arms (a not unusual symptom in acroasphyxia of the upper extremity) first brought her to the hospital. On September 18th she presented herself, with gangrene well advanced, and although she had been taking mercury (hyd. & cret.) and iodides since the Wassermann reaction had proved positive, and had entirely lost her pain, the gangrene had supervened notwithstanding.

The points of importance in this case are the following: The woman can recall nothing suggestive of a syphilitic infection. She has had five children, one of whom died in infancy from bronchitis, and another at 9 years from lymphadenoma. There have been no miscarriages, and her husband, though not living with her, is alive and well.

It seems plausible to suggest that a more energetic antiluetic treatment (as, for example, salvarsan injection), commenced on the day the result of the Wassermann reaction became known, might have entirely prevented the onset of gangrene, and it is with the object of urging this procedure in similar cases that I have appended the following cases from the literature:

CASE I.—The symptoms were engrafted on hereditary syphilis in a boy, aged 4, who is reported by Krisowski³ in an exceedingly able article (1895), in which he takes an identical view of the position of Raynaud's syndrome, to have been the victim of a symmetrical gangrene involving the tips of the ears. The condition was very quickly brought under control by administration of iodides and energetic inunctions of mercury; but, of greater importance still, it never relapsed thereafter, in spite of intentional exposure of the child to cold weather, which had in previous years always brought about an attack of local syncope, thus proving that an essential factor in the production of the syndrome had been removed.

Krisowski took the view, and in that he was considerably ahead of his contemporaries, that the Raynaud syndrome is the product of at least three factors: (1) A disease which produces an organic structural change in the blood-vessel wall, and of all diseases syphilis is probably the most potent in this respect; (2) some poisonous substance or toxin which is able to produce spasm of the arterioles; and (3) the external influence of cold. Patients with Raynaud's disease are notoriously worse in winter, and the most exposed parts—namely, the ears, nose, and fingers—are those most subject to syncope and gangrene.

In his own case he removed, by his energetic inunctions of mercury, probably the whole of factor (2), and considerably alleviated the first. The third factor then, unsupported by the other two, became impotent, and the child was able to run about out of doors in all weathers.

Whether this attractive hypothesis is indeed the true explanation of certain cases of Raynaud's disease must be left at present undecided; it is sufficient if it forms the basis of therapeutic measures; and whether the first and second factors be syphilis (congenital or acquired) or, as has been claimed at other times, tuberculosis, rheumatism, malaria, and gout, the true underlying etiological causes should always be sought for, and such remedial measures as massage, galvanism, etc., relegated to a position of secondary importance.

CASE II.—Gaucher⁴ recently showed a young man who developed the symptoms of symmetrical acroasphyxia one month after the appearance of a chancre and a fortnight before the eruption of the roseola. The symptoms were typically spasmodic and involved the index, middle, and ring fingers of both hands, which during the crisis became painful and lost their tactile sensibility, whilst at the same time the distal phalanges were objectively observed to change their tint through red and violet to black. Cold water accentuated the syndrome, and stimulating lotions and friction relieved it. The condition completely cleared up in one month from the commencement of biweekly mercurial injections and did not recur.

CASE III.—At the same meeting Brocq⁴ reported a similar case in a congenital syphilitic, aged 30, in whom the condition had gone to gangrene of the toes of both feet after a prodromal history of Raynaud's disease lasting over several years. This case was also cured by iodides and mercurial inunctions.

Both these cases are interesting in that they are definite proofs of the possible association of both congenital and

acquired syphilis (even in its secondary stages) with the complex of symptoms described by Raynaud, and in themselves justify the examination of the blood for the Wassermann reaction in every case the etiology of which is at all doubtful.

In the American literature also the association of syphilis with the syndrome has not escaped observation:

CASE IV.—In 1906 Lustgarten⁵ showed a case of a young man who had had Raynaud's symptoms for two years, culminating in gangrene of the finger-tips. It does not appear that Wassermann's reaction was sought for (the test was published in the same year) in this case, but there was a suspicion of luetic infection in the history, and "leukoplasic patches" in the mouth supported the presumption. Under antiluetic treatment the pains were cured, but, as in my case, the gangrene was not arrested. Salvarsan was not in use at that date.

His demonstration was followed by the relation of three similar cases in his practice by Dr. Klotz. All three had shown the coldness and blueness of fingers with superficial necrosis of the tips, and they had entirely lost their symptoms under mercury. Two of them had remained well for years. In the discussion at this meeting the pathology of the condition was held to be an endarteritis obliterans of many small arteries of an ascending type. Exception has been taken to such a view on the ground of its unlikely manifestation in so symmetrical a fashion, but, if it be remembered that syphilis is undoubtedly a constitutional disease and that evidence is rapidly accumulating that the organism, in one stage at least, is present in the circulating blood, the difficulty in accepting the premise should vanish.

The literature on Raynaud's disease is exceedingly voluminous, and it has been found impossible to do more than select for my purposes just those cases in which the etiology of syphilis was undoubted. But those are not the cases which are commonly met with in practice or in the out-patient departments of hospitals. If Raynaud's syndrome can be caused by florid syphilis—and of that there would seem to be no doubt—it would be very difficult to disprove its inability to produce the same train of symptoms at later and less obvious stages, and therefore I would urge that in every case of the syndrome Wassermann's test should be applied; that the physician should not be satisfied with one negative result, but should institute a second inquiry at some interval of time, with or without a provocative injection previously of salvarsan or mercury. As far as I am aware, salvarsan has not as yet been administered in these cases, but in view of the vascular involvement and the occasional concomitancy of hæmoglobinuria, which is now admittedly in its paroxysmal variety often found associated with a positive Wassermann reaction, the intravenous injection of the drug should prove a valuable adjunct to the treatment of the condition.

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- ⁴ *Maladie de Raynaud d'origine syphilitique* (Gaucher, *Bulletin de Soc. Franç. de Derm. et Syph.*).
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In a paper read at a meeting of the British Medical Association at Capetown last October, Dr. Bayon summed up the present position of leprosy research. He believes that the isolation and artificial cultivation of Hansen's bacillus has at last been successfully achieved, and the definite etiological relationship of the culture to leprosy conclusively established by morphological examination, animal experiments, serological tests, and by the observation that a specific reaction follows upon an injection of a filtered cultural extract. The micro-organism of human leprosy only reaches its bacillary acid-proof stage after injection into animals, but retains these properties in further artificial cultures. Vaccine treatment by killed cultures is not to be recommended in leprosy because the bacilli remain absolutely quiescent in the tissues, and the production of antibodies does not follow. Bayon said that the existence of an insect vector of the disease has not been established, and expressed the belief that investigation on these lines should be preceded by the acquisition of a thorough knowledge of the complete life-cycle of the micro-organism in man and rats, and the similar bacteria found in cattle and horses.