Orthodox Treatment. Faith in authority as well as the habitually easy sticking-to-routine has had the result that in the treatment of the infantile cerebral flaccid-spastic syndrome there still exists one widely accepted method; and physiotherapy treatment (kinetic therapy) as a rule concentrates on isolated muscle contraction.

For example, House 1 directs treatment towards individual muscles. Phelps advises that "all exercises must bring into play only the desired muscles." 2 Levitt 7 writes, 'The child must acquire the components of movement before it can perform a whole action'.

Pohl 3 advocates concentration of the individual muscles controlling each joint. He says, 4 '... the first step is to establish in the nervous centres an awareness of the individual muscle. Proper contraction of the fibres within the muscle is next sought by a process of directing the neural impulse to the muscle tendon, where action is normally begun.' He gives 5 a typical example of how some schools of thought try to elicit such a single muscle contraction; also, for example, what they expect of a cerebral palsied child in training dorsiflexion of the foot, the tibialis anterior being flaccid. 6 'The attention of the patient is directed to the attachment of the tibialis anterior muscle and the foot is dorsiflexed by the therapist ... . The patient is instructed that this motion takes place as a result of the pull of the muscle beginning at the point of bony attachment.' Then the same procedure is followed concerning the attachment of the opposing calf muscles at the heel: 'The attention of the patient is focussed to the points of attachment of the muscles before each movement.'

It seems that the idea of concentrating on individual muscle contraction in the flaccid-spastic syndrome has its origin in the treatment of muscles paralysed through poliomyelitis. There we might hear the pediatrician properly prescribe: 'Stimulate faradically tib. ant.'

I.Q. and Treatment. To practise individual muscles or small muscle-groups, in other words, to practise isolated or highly skilled movements, is a difficult task even in the case of adults of average intelligence. How then can one expect children to concentrate on the attachment of a single muscle?—the more so as the intelligence of c.p. children of the flaccid-spastic type is often enough below the average. Josephy 8 explains: '... if the brain of an infant or child—that is, a brain which not yet has reached the stage of maturity—is damaged in any way, symptoms as a clinical response to such damage may appear in two fields, namely that of mentation and that of somatic, especially motor, performance.' The brain functions as a unit. Therefore every disturbance in one part is—more or less—felt in the whole brain.

Heilman 9 compares intelligence-test ratings of c.p. children determined by different observers in 5 recent studies. The percentage reported as mentally defective was as follows: 49% of 261 cases, 10 43% of 90 cases, 11 47% of 340 cases, 12 36% of 133 cases 13 and 47% of 178 cases. 14 Combining these data, 45% of 1,002 c.p. children were found to be mentally defective. Justly Heilman 14 adds, 'The intelligence of a child not only affects his ability to profit educationally, but it may also affect his ability to benefit from therapy.'

Besides the low I.Q. the short attention-span of these children also renders treatment difficult.

All this shows clearly enough that treatment methods which need an average or even high intelligence must of necessity be doomed to failure—unless one has a free hand in selecting suitable cases.

VOLUNTARY ISOLATED MUSCLE CONTRACTION

No doubt, to attempt a voluntary isolated muscle contraction—if such a thing exists at all—would be a most difficult task, and that even for highly intelligent and co-operative patients. But, if a voluntary isolated muscle contraction exists, for what practical purpose does one need an isolated muscle contraction? Does such a voluntary isolated muscle contraction really exist?

Since the days of the great pioneer of neurology, Hughlings Jackson, 15 we have known that the paralysis from a circumscribed lesion of the pyramidal tract is not of a single muscle but of a whole movement. For instance, the isolated opposition of the thumb may be impossible, while flexing and opposition of the thumb as part of clenching the fist remains possible.

Walsh 16 writes, 'The cerebral cortex is concerned with movements and knows nothing of muscles. 'Therefore a lesion of this mechanism causes a paralysis of movement and not a paralysis of individual muscles. Therefore also a muscle which takes part in two movements may function in the unaffected movement and not function in the affected one.

Specifically concerning the important protagonist-antagonist relation Hoefer 17 remarks, 'One does well, however, to remember that simple movements are to some extent a laboratory abstraction, and that for everyday movement the relation of protagonist and antagonist may change to one of synergism.'

Only Fulton 18 continues to maintain that isolated movements, sometimes of single muscles, but more often of synergetic muscle groups, can be obtained by electrically stimulating the caudal surface of the precentral region (area 4). Individual responses may—according to him—be evoked in the biceps, triceps, flexor longus digitorum, and even in a single interosseus. On the other hand Bosma and Gelhorn 19 showed that, when they electrically stimulated various cortical foci in a monkey (Macacus rhesus) anaesthetized with 'dial', not single muscles or parts of muscles were activated, but functionally-associated muscle-groups. By stimulating an individual focus they elicited movements comprising more than one joint. Gelhorn 20 demonstrated for a limited number of muscles that on cortical stimulation of the foreleg area the muscles were activated in certain functional groups which were classified as biceps and triceps complexes respectively. He stated 41 that '... stimulation of the cortex frequently leads to activity of tibial and hamstring muscles, which is of special interest in connection with the paralysis of tibialis anterior referred to above.

More recently Gelhorn and Johnson 22 have greatly expanded these investigations on 'functional groups' and the complexes have been clarified. Gelhorn 23 holds that the organisation of the motor cortex cannot be represented by a cortical mosaic with different, sharply delimited, foci for different muscles but seems
rather to involve extensive overlaps of groups. Here we are back again at Hughlings Jackson's opinion of 75 years ago. 

The theory that slight stimulation might evoke single-muscle response and a stronger stimulus more complex movements was examined by Gellhorn, who found that, even under conditions of threshold stimulation the muscle response is multiple and appears in the form of activity in functionally-related muscle groups.

So nowadays Hughlings Jackson's findings are almost generally confirmed, namely that even the most individualizing motor neuron, the motor cortex, knows nothing of single-muscle contractions but only of very complex movements in each of which many muscles serve.

UNSATISFACTORY METHODS OF TREATMENT

The habitual physiotherapy treatment starts with passive motion, leading gradually to active-assisted motion—active motion with gravity eliminated—active motion against gravity—active resisted motion—and finally combined motion. Some medical men of this school of thought seem to accept the flaccid-spastic state as something completely irremovable by physiotherapy, and with that in view they carry out brain and nerve operations, tendon lengthenings, muscle transplants, etc., disregarding the possibilities of kinetic therapy before, after, or instead of the operation. On this point H. Jackson and Jackson very fittingly remark, "Even when surgery is contemplated it must be preceded by a long period of physiotherapy and it may well be found that operational treatment becomes unnecessary." And du Toit says, "Proper physical therapy after operation is usually more important than the operation itself."

An operation in this field of discussion should not be regarded as treatment, but as a means of removing an obstacle to the real treatment by muscle re-education.

Instead of kinetic therapy not only operations are carried out, but also calipers and braces are prescribed, special boots with irons and straps, splints and other devices and also drugs are administered. If these drugs work at all during the training period, then the carry-over value remains still doubtful. Abbott in an up-to-date review of c.p. methods, concludes, "Drug therapy is still in the experimental stage." The same impression is given by Perlstein and by Mitchell.

Progress with these methods are disappointingly slow, and it is small wonder that dissatisfied experts—foremost members of the medical profession, and also physiotherapists—searched for new ways of treatment. And this is what they found:

PRESENT-DAY TRENDS IN NEUROMUSCULAR RE-EDUCATION

These are based mainly on 2 principles: (a) the use of reflexes, and (b) developmental ideas. Neither tries to re-educate the 'involved muscles' directly. Thus they do not attempt to build up the tumbled-down top of the building ignoring its basement, but they make ample use of what there is left of the foundation. They first reinforce this thoroughly before they start to build up the top again.

(a) The Use of Reflexes. More and more treatment has been based on primitive reflexes, starting mainly from the research work done by Magnus and de Kleijn and their school on tonic neck and labyrinthine reflexes.

Thus, Kabat is of the opinion that postural and righting reflexes are valuable in the treatment of paralysis. Fay utilizes postural reflexes, reactions of defence, tonic neck reflexes, and pattern movements. Yamshon, Machek, and Covall emphasize the importance of tonic neck reflexes for treatment purposes. Yamshon again brings out the favourable influence of postural reflexes on the muscles of spastic hemiplegics. K. and B. Bobath make use of tonic neck and labyrinthine reflexes in all positions of the body in space as a principle of treatment in spastic paralysis. They however endeavour to break up the typical reflex patterns of posture and movement.

Ghiora and Adler report good results in the rehabilitation of hemiplegics through the use of tonic neck and labyrinthine reflexes.

I myself stressed the importance of mirror-synkineses for the neuromuscular re-education in infantile cerebral hemiplegia—plus 'mass movements', together with neck, optic and labyrinthine reflexes.

(b) Developmental Ideas. In close connection with the reflex treatment developmental ideas have come to the foreground. They are based mainly on the work of Gesell and his collaborators. 

Thus we find, for example, with the otherwise rather orthodox J. F. Pohl, the developmentally-founded principle of turning over, sitting up, etc. Similarly Shriners stresses the point that the natural development of motor control should be followed; thus, kicking reciprocally—rolling over—sitting up—creeping—standing—walking. And Denhoff, Smirnoff and Holden advocate building proper developmental patterns into useful activities. K. and B. Bobath insist on sticking to the developmental sequence of patterns of movement in treatment, and B. Bobath again strongly stresses the necessity of 'following closely the developmental scale of motor behaviour of the normal child'.

Besides these two main groups of ideas the concept that the most differentiated voluntary movements, being the phylogenetically youngest movements, suffer first and most, and come back last, now seems to be generally recognized, and is taken into account in training.

Some at least of the much-disputed new ideas seem justly to boast of successful application and at the same time proffer a scientific explanation for their methods. Here I speak of:

(1) The Mirror-Synkinesis Treatment in Hemiplegia. This basic form of treatment seems to be still generally unknown. As it has been amply described in a previous article I wish to concentrate here on the other successful basic method of group (a), viz.

(2) The Chain-Synergy Treatment.

THE CHAIN-SYNERGY TREATMENT

This method is usually called the 'mass movement' pattern method. By 'mass movement' one understands, not something great and solid, but an isodirected movement comprising several adjacent joints, as, for example, a total bending or a total stretching of one leg, comprising the hip, knee, and ankle joint. It is a compound movement which, although it consists of small single movement-units, is essentially one indivisible movementerged in and thus quite different from its component parts; it is gestalt. An isolated joint movement (e.g. independent dorsiflexion of the foot) or a single muscle contraction, is not a 'mass movement'.

In connection with neuromuscular disorders one understands under 'mass movement' an active movement of one joint by muscles which are unable to perform this movement when called on to do it alone, but yet are coerced to perform it as part of a more comprehensive movement comprising a chain of adjacent joints. Foerster calls this type of movement 'compound movement', taking it to be typical of an origin in extra-pyramidal areas. In this connection he also mentions flexor and extensor 'synergies'; for that is what these so-called 'mass movements' really are—synergies of related muscle groups.

According to Schaltenbrand such a 'mass movement' was first observed by some nurses of the Salpêtrière, famous since the days of the great Charcot. They had noticed that with patients suffering from spastic paralysis...
a forced plantar flexion of the foot reflectorily elicits a bending of the whole leg—a phenomenon now called the 'Marie-Fox reflex'.

Foerster 52 most clearly describes 'stereotype synergies' with hemiplegia (flexion and extension synergies). The flexion synergy, which falls under the present discussion, consists of simultaneous flexion (and often abduction) of the femur, flexion of the crus, dorsiflexion and supination of the foot (with adults, whereas with children pronation is often stronger), and dorsiflexion of the toes. Elicited by electrical stimulation of the extra-pyramidal cortical areas, these synergies also become apparent in epileptic seizures starting from extra-pyramidal areas. At first synergies are the only movements which can be performed actively by a patient who of his motor cortex has only the extra-pyramidal areas at his disposal.

Foerster emphasizes the point that these movements can be started on any point of the synergy, be it now the hip, or the knee or elsewhere. In any case, if a part movement is intended then either the whole synergy comes into being or nothing at all.

Foerster affirms that these flexion and extension synergies were described by L. Mann (1895) 53 before Struempell (1897). This, however, is not quite correct; Mann does not mention the 'none or all' flexion or extension contraction of an extremity, while Struempell had described his 'tibial phenomenon' as early as 1887. 54

A sort of resisted 'mass movement' method has been extensively used by W. M. Phelps' U.S.A. pioneer school of physiotherapeutic treatment for cerebral paralysed children. From there it has spread to many other countries. The name given to this treatment was 'Confusion Motion Treatment', or 'Confused Motion Treatment'; other names are 'Confusional M.T.', 'Automatic M.T.', and 'Sympathetic M.T.'.

**Confused Motion Treatment.** This treatment is clearly described by 3 outstanding physiotherapists out of Phelps' school: E. Collins, who introduced Phelps' methods of training c.p. children to England, P. F. Egel, and P. St. James. Collins 55 speaking of muscles which do not respond to the exercise of conscious control in some spastic cases, writes, 'It has been found that such 'flacid' muscles can be trained to respond to resisted motion elsewhere in the body. After consistent training, 'sympathetic' or 'confusional' contraction results in automatic function.' Egel 56 mentions that this sort of treatment is used only for treatment of O.C. (zero cerebral) muscles, i.e. muscles which have no ability to contract at will.

P. St. James 57 writing of 'confusion motion', says that it indicates the resultant contraction of one muscle or group of muscles by resisted motion to an unrelated group. From this definition it is apparent that this school does not aim at 'mass movement' in the sense explained above, because it claims to elicit muscle-contracture by resisted motion to an unrelated group. Although this is possible it certainly cannot be applied to the paradigm which is generally cited by Phelps' school. They speak of the contraction of zero cerebral or the surgically-weak anterior tibial by resisted knee and hip flexion. 58 Certainly knee and hip flexion are very much related to ankle flexion; they are isodirected movements. The term 'Confused Motion', therefore, is confusing when used in connection with coercive 'mass movements' elicited by the contraction of one or more muscle-groups spreading to a neighbouring, functionally related, O.C. muscle-group.

Kraus 59 also recommends 'confusion movements'. The term 'confused motion' and similar terms should in my opinion be confined to cases which really respond to the definition given by R. St. James: e.g. resistance to an infraspinaus eliciting contraction of an O.C. tibialis anterior. In contradistinction thereto, eliciting contraction of an O.C. tibialis anterior by resisting ipsilateral hip and knee flexion should be called either 'mass movement' or a still better term, to be proposed later on, should be used.

This 'mass movement' was introduced into training of c.p. children by Phelps. He writes, 60 'I first became aware of it in 1927-28 while examining a spastic hemiplegic boy who had no apparent power in the dorsiflexors of the affected foot. This boy was extremely co-operative and would dorsiflex the other foot on command but was physically completely unable to dorsiflex the affected one, and no power could be felt in the muscles. During the examination he lifted a heavy box with his knee to place it on a table and I saw the dorsiflexors contract. I then tested him out for resisted knee flexion in the sitting position and could always get a contraction in these muscles.'

In the abovementioned paradigm we recognize the well-known Struempell's Phenomenon—also called 'tibial phenomenon' or 'tibial sign'. Adolf von Struempell (1845-1900), professor of neurology at the University of Erlangen, found in hemiplegics that with a fully-extended leg dorsiflexion of the foot is impossible. When, however, the knee is flexed and the patient flexes his hip against resistance, the foot dorsiflexes and supinates. 61 In Struempell-Seyfarth 62 we read, 'Most often we find associated movements in the muscles of the same limb. Especially often with hemiplegia or with spinal paralysis one observes that the patients are unable to draw up the leg towards the body without at the same time performing a strong dorsiflexion of the foot as an associated movement (tibial phenomenon). In this case often an isolated dorsiflexion of the foot is impossible, whereas with the generalized flexion of the leg the foot is always co-flexed. Thus a so-called group innervation takes place here.'

Walshe 63 mentions this phenomenon, thereby rejecting the opinion of Marie and Foix 64 (also expressed by Struempell and Babinski) that this phenomenon is to be regarded as an 'associated movement', as here dorsiflexion of the foot occurs as an integral part of another movement. Walshe continues, 'We know that isolated movements, especially of the distal segments of the limbs, are the first to suffer in a condition of hemiplegic weakness, while the more deeply organized mass movements of the limbs, which have a complete representation of the reflex levels of the neuron system, are very much more resistant.'

Foerster 65 writes, 'The various parts of the flexion or extension synergy become the more outspoken the stronger the cortical impulse is. Dorsiflexion of the foot within the flexion synergy becomes more abundant if the flexion of the leg is done against resistance, whereby also supination becomes more prominent (Struempell's tibial phenomenon).'

As Struempell 66 first pointed out the role of resistance and drew the attention of the medical world to the phenomenon, while it was Phelps who showed its wide practical therapeutic use, it would be only fair to term this valuable resisted leg flexion synergy 'Struempell-Phelps manipulation.'

In resisted hip and knee flexion (eliciting active dorsiflexion plus eversion and pronation of the ipsilateral foot) it is in my experience characteristic that the hip, knee and ankle do not flex simultaneously, but writhes in a wormlike manner, or as a chain which is being moved.
from one end. The movement begins with hip- and knee flexion, thereafter taking hold of the ankle, whereby the foot goes first into dorsiflexion, being held in supination and inversion; thereafter screwing into eversion and pronation. I have already given some reasons why I think the term 'mass movement' does not fit this phenomenon. Here I propose a more adequate term. As it is a sort of a synergy movement and as it progresses chainwise I propose the term Chain Synergy.

The return of the full voluntary dorsiflexion movement in its various parts takes place in the same sequence as the movements in the chain synergy.

Why is it that dorsiflexion of the foot is so difficult? Foerster's answer is, 'No doubt the reason for the extremely little efficiency of the foot dorsiflexors is the strong spastic resistance of the antagonistic muscle group.' Yet the Struempell-Phelps manipulation does work with O.C. or weak C. foot dorsiflexors even if the antagonistic muscles appear to be severely spastic and the tendo Achillis seems to cry for the 'healing knife'.

In a supine position, with straight knees, the foot cannot as a rule be passively dorsiflexed to the degree to which dorsiflexion can be carried out actively by means of the Struempell-Phelps manipulation. But in the case of a spastic gastrocnemius one can do away with the resistance by flexing the knee (though the dorsiflexors of the foot are still unable to contract independently at will).

The lion's share in the chain synergy movement, resulting in dorsiflexion of the foot, seems to be taken by the hip flexors. Resisted knee flexion in the sitting position (when the hip is of course flexed), as described by Phelps, may elicit dorsiflexion of the foot; but if you then test resisted knee flexion in the prone lying position, when the hip is straight, it becomes quite apparent that this cannot be done without at the same time flexing the hip. Hip flexion alone works much better than knee flexion alone. I do not think that any link of the chain can be left out, without weakening the whole chain synergy and especially its object.

I have dilated on this seemingly small movement of the active dorsiflexion of a foot through a chain synergy for the reason that I believe it to be of great practical importance. In the flaccid-spastic syndrome the foot dorsiflexors are the locus praedilectio1is of paralysis (see Walshe, Hughlings Jackson, and Schaltenbrand) and dorsiflexion of the foot is so often either paralyzed or weakened that methods of its neuromuscular re-education are of great importance. Moreover other methods are not so successful as the Struempell-Phelps manipulation; and this manipulation is an example of how chain synergies can and should be used in order to regain a lost movement.

Upper Limb. We have spoken of the therapeutical use of the flexion chain synergy of a leg bringing into play linked flexion of the hip, knee and ankle in order to counteract paralysis in extension. In the arm the corresponding picture is paralysis in flexion—briefly a linked flexion of the shoulder (adduction), elbow and wrist (plantar). So in the arm we aim at extension in a manner similar to that in which we aim at flexion in the leg: We attempt a complex stretching movement by pushing against resistance. This can be further facilitated by tonic neck reflexes, i.e. by turning the face towards the involved side. Thereby the whole arm tends towards innervation of the extensor muscles and it is not only the triceps which contracts. Mirror synkineses may also be helpful.

If dorsiflexion of the hand is paralyzed by flaccidity of the antagonists as well as by spasticity of the antagonists, and there are similar symptoms more proximally, then it is useless to try to elicit directly any independent voluntary dorsiflexion of the hand. It is a widely-accepted principle that these symptoms should be tackled step by step from proximal to distal, in the same way as restoration by nature takes place. With the chain synergy method, however, all joints of the extremity are treated as one whole and thus simultaneously.

Dorsiflexion of the hand is sometimes strikingly facilitated by resisted mirror synkineses. In my opinion the chain synergy method is superior to the mirror synkinesis method for rougher movements; while for finer movements the opposite holds good (notwithstanding that according to H. Jackson, in the cortical hemisphere the proximal muscles of the extremities have a greater bilateral representation than the distal muscles). A combination of the synergy and the synkinesis method should be tried. A sort of correction or modification of synergies through synkineses is recommended by Foerster, who also strongly recommends the use of synkineses—homologe Mitbewegungen—in the treatment of hemiplegias, a fact of which I was not aware when writing my article on synkineses.

RESISTANCE IN CHAIN SYNERGIES

The above-described chain synergies should, in severe cases, first be carried out with a good deal of resistance. Later on, less and less resistance is required until the patient is independent of resistance through the outside world as well as of chain synergies and mirror synkineses. In mild cases, e.g. paralysis of foot dorsiflexion, no resistance may be necessary through the physiotherapist's hand or through weights or pulleys, but gravity alone may suffice to elicit dorsiflexion; so also in an exercise like climbing a ladder. Even in crawling the desired contraction of the dorsiflexors often appears spontaneously in mild cases. Crawling is a developmentally important item.

Resistance in these cases should preferably be given manually. The sensitive hand of the physiotherapist does much better than any pulley or similar mechanical means and is able to vary resistance far more adequately and with quicker reaction. Kabat drives this point home with the words, '... manual resistance allows the greatest range of technical procedures for facilitation and is essential for effective treatment of paralysis.' Besides resistance he recommends Stretch and Reversal of Antagonists as facilitation procedures.

In chain-synergy treatment as in synkinesis treatment resistance plays a most important part in eliciting the contraction of an otherwise cerebrally weak, or even paralyzed, muscle. The same holds good for tonic neck reflexes. The weaker the original response to voluntary
muscle contraction the more resistance must be applied to the other links of the synergy chain.

THE NEUROPHYSIOLOGICAL BASIS OF RESISTED CHAIN-SYNERGY TREATMENT

This resistance seems to work on the basis of proprioceptive reflexes in the same way as, according to Gellhorn and Johnson,78 proprioceptive reinforcement of cortically induced movements is affected by muscle stretch, and (still nearer to the problem under discussion) particularly by tension produced during isometric contraction resulting from activity of muscles under fixation. And the chain synergy also conforms to what Gellhorn and Johnson found for muscle stretch and isometric contraction, namely, that the resistance to other links of the synergy chain increases the responsiveness in the paralysed muscle and in functionally-related muscles, while that of the antagonists is diminished. Here then we have a case of pathological overflow.

Thus resistance treatment works under the assumption that through maximal resistance—plus other facilitating mechanisms—a summation takes place between the weak cortical stimuli and the proprioceptive impulses, whereby all available motor units of the muscles are excited with each voluntary effort. Overflow from adjacent unaffected links of the synergy chain strengthens the stimuli to the affected link and so might make sub-threshold stimuli potent. Naturally, if the functionally-related adjacent muscle-groups are weak or flaccid we cannot expect an overflow from them to others. Therefore, in this case, we shall not register a response from an O.C. muscle.

But what takes place in the upper motor neuron? Foerster77 says, 'With most of the interruptions of the pyramidal tract by no means all cortico-spinal tracts fall out. As a rule there is a remainder of extrapyramidal-subcorticalspinal commissures left, but also very often a remainder of the pyramidal tract, and with hemiplegias even the whole homolateral pyramidal tract.'

It seems that, like mirror synkineses, chain synergies have their proper place, and that more in hemiplegia than in paraplegia. I am therefore inclined to assume that these chain synergy movements are executed—at least in the beginning—by ipsilateral motor neurones. Penfield and Rasmussen79 in studying supplementary motor representation have recently succeeded in finding 'an area from which bilaterally synergic movements may be produced.' This area is in the superior intermediate frontal region within the longitudinal fissure.

Concerning the topography we expect more enlightenment in the near future through the new American 'cerebral palsy brain registry,' under Prof. H. Josephy, where brains of the cerebral palsied with reliable histories and clinical observations are studied and correlations are sought between the anatomical-histological findings and the symptoms.

MOTIVATION

We have mentioned various procedures for facilitation. 'Motivation', however, is rarely mentioned as it is physiologically not so easily conceivable as, for instance, the stretching of a muscle. It belongs to a region 'beyond' physiology. It simply means: Make the patient want to do it because he gets satisfaction or pleasure in doing it. The co-operation of the child is thus ensured, and this is most important for his progress (also see Smithoff). To find motivation for the desired movements pays rich dividends to the inventive physiotherapist. As a rule purposeful movements are preferred by young and old to meaningless ones. Therefore the physiotherapist receives most valuable assistance from the occupational therapist. Carlson80 advises, 'Train his muscles but keep his mind off his muscles.' This is best done by purposeful movements.

CONCLUSIONS

In the neuro-muscular re-education of children showing the flaccid-spastic syndrome of cerebral origin the widely-used direct single-muscle contraction method is erroneous. Better results can be attained by means of the (resisted) chain synergy treatment method. This is one of our two basic and most efficient methods. The chain synergy method should whenever possible be linked with the other basic treatment method, the mirror synkinesis method. Other facilitation agents should not be omitted.

The physiotherapist should try to attain the required movements through tasks both purposeful and enjoyable for the patient, i.e. motivation should be applied. In this the occupational therapist is helpful.

SUMMARY

The orthodox treatment-method of the infantile cerebral flaccid-spastic syndrome is briefly described mainly in so far as kinetic therapy is concerned.

The habitual concentration on eliciting immediate isolated muscle contraction is erroneous because (a) it requires good intelligence and a fair attention-span, which are rarely found in cerebral flaccid-spastic children, and because (b) in neuro-physiology such isolated muscle contractions seem to be a pure assumption.

The present-day trends in neuro-muscular re-education are reviewed. They can be divided into two main groups, based on (a) the use of reflexes, and (b) evolutionary ideas. Both groups accept the neuro-muscular state as they find it, and, starting from the existing primitive and reflex movements, they develop more differentiated movements.

From group (a) the mirror synkinesis method and the (resisted) chain synergy method ('mass movement' method) are regarded the most important basic methods. As the former has been described in a previous article, only the chain synergy method is expounded. It is explained through Struempel's phenomenon. It is shown that this should not be mixed up with 'confusion motion'.

The great role resistance to the unaffected links of the synergy chain plays is disclosed. Resistance is also important in the synkinesis treatment and in the facilitation through tonic neck reflexes.

It is stated that the (resisted) chain synergy treatment method can be used in connection with the mirror synkinesis treatment method and further facilitated by other agents.

A neuro-physiological explanation of the (resisted) chain synergy treatment method is sought. Finally the importance of motivation and the consequent value of occupational therapy are stressed.

I wish to thank Dr. C. H. de C. Murray, Senior Psychologist of the School for Mentally Handicapped Boys at Kimberley for his tireless assistance in providing literature relevant to this article.

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THE EFFECTS OF HEAT STRESS ON PATIENTS SUFFERING FROM CARDIAC FAILURE AND INFANTILE MALNUTRITION*

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It is the object of this paper to show that hot summer weather, which is rarely more than a nuisance to healthy individuals in South Africa, is potentially dangerous to patients suffering from certain circulatory disabilities.

* Part of a Symposium on Heat Stress held by the Baragwanath Medical Society on 29 October 1953.

Cohn and Steele observed that in hot and humid environments patients in congestive cardiac failure show a rise of body temperature. Subsequently Burch demonstrated that this pyrexia is associated with an impairment of sweat secretion. Patients in congestive cardiac failure who were experimentally exposed to...