Evolutionary Factors in Rehabilitation

by
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The australopithecine fossils discovered in South and East Africa, and described by Professor Raymond A. Dart in his "Adventures with the Missing Link", have made it possible for me to write this article on the associations between evolution and rapid results in rehabilitation. Until the recent interpretations of this fossil evidence were published, my ideas have been conjectural, but now that evidence is available in a form that is easy to utilize it seems appropriate that I should submit this article for publication in South Africa. A further reason for doing so, is that South African Physiotherapists are aware of the importance of Man's past history. Yet, we must go warily in using evolutionary evidence, because of the conflicting views of scientists who have studied our genealogy. I sent the draft of this article to Professor Dart, and he replied that it is very appropriate to have the attention of physiotherapists drawn to the bearing upon their remedial exercises of the phylogenetic information about human ancestry that has been accumulated during the past century. I am grateful for his amendments to my draft.

This article claims that there are great advantages if the patient utilizes trends which are implicit in his bodily and mental make-up, instead of trying to learn afresh by voluntary effort. We have become so used to learning by voluntary exercises that it is difficult to recognize that this presents any problems. Surprisingly, this is double time-consuming; firstly, using voluntary effort to learn movements which are normally automatic takes a long time, and secondly voluntary controlled movement may include awkwardness and rigidity which have to be unlearned. It is found that the conditions and behaviour from which sequences of muscular reflexes arose have been pushed back further into the past than was previously thought. Fortunately, as Sir Wilfred Le Gros Clark's book "Man-Apes or Ape-Men" (1967)* shows, sufficient fossil evidence has been interpreted to give us some clues worth following up as regards our remote ancestors' relevant muscular behaviour which was the basis of these reflexes.

Much useful work on reflex activities in connection with brain damaged individuals has been done in England, also in America (based on the ideas of Temple Fay). It seems to me that this approach should be more fully exploited with a wider range of patients. Personally, I was lucky, having been introduced to the subject many years ago; in 1929 Sir Arthur Keith explained to me his belief that rehabilitation treatment should follow the lines of evolution. In my experience the results from following this advice are assured and are often rapid.

Guiding Factors

Before describing some examples of this use of ancestral reflexes, it is necessary to mention two guiding factors which were discussed by Le Gros Clark in a lecture on "Sensory Experiences and Brain Structure" (*J.ment. Sci.*, Vol. 104, No. 434, Jan. 1958).

Factor A. For our present purpose, we must study reflex actions in groups and sequences. This contrasts with their study in Physiology in which they tend to be analysed into separate units, each of which comprises a sensory and a motor component. We can term this grouping of reflexes factor A, based on the following argument.

In his lecture, Le Gros Clark quoted experiments by G. E. Coghill, when discussing total responses to external stimuli in which the body and limbs act as a whole. These total responses occurred during a stage of development of the central nervous system, when the latter was composed of a diffuse network of nerve cells and fibres. This supports his point, that this "primitive foundation still persists in large measure in the adult brain — even in the human brain". He emphasized the above which is "in contra-distinction to the rather widely held view that it is the local reflex that is the primary unit of behaviour and that these reflexes become only secondarily linked up by some integrative mechanism at a higher functional level of the nervous system".

It is clear that in rehabilitation we cannot take advantage of reflexes which the human race has lost genetically, also that the physical existence of a primitive foundation of nerve cells is no evidence that we can make a practical use of them. Yet, if we can discover sequences of reflexes which we can trigger into action almost without training we can use them as preludes to the refined movements which we desire patients to acquire. If so, there will be an enormous saving of time and effort. It is therefore worth investigating the working conditions which encourage this link between far off past and the immediate present.

Factor B relates to the sensory aspect of these reflex movements. Le Gros Clark's lecture discusses the significance of our brain's aptitude to sift, sort, and integrate the items of its sensory inflow, chiefly, as the title of the lecture suggests, in connection with sensory experiences, but this processing of the sensory inflow to the brain also determines motor responses. I have found that the addition of appropriate supplementary sensations to the sensory inflow sets going a sort of re-integration, which often creates an immediate improvement in co-ordination and a decrease of pain. These supplementary sensations often arise in the eyes and ears. They also originate from movements indirectly, because they arise in another part of the body which is affected by the movement. The following example of this occurs, when a patient has pain and difficult movement as regards straight-leg-lifting after an operation on his knee. He may in fact find that his quadriceps muscles refuse to act. If then he places the tip of an index finger against the proximal border of the patella with the pad of the finger on the tendon, and tries to discover whether he can feel minimal movements of the tendon, he is likely to be favourably surprised when his patella butts against the tip of his index finger. This movement, which is triggered by sensations from his hand, encourages its repetition on a "little and often" basis.

Some practical examples

The examples given below illustrate what appear to have been common-place behaviours of our remote ancestors, as suggested by fossil evidence and other considerations. If so, these items of behaviour are the origin of reflexes retained by Man. These examples include reflex responses by human infants, and show certain working conditions which permit supplementary sensations from other parts of the body to encourage the triggering of the desired muscular

**Man-Apes or Ape-Men? The Story of Discoveries in Africa* by Sir Wilfred E. Le Gros Clark. Holt, Rinehart & Winston, New York and London, 1967.

(Continued from page 7)

In most countries Prosthetic Research units, and units solely for the care of the amputee, are few and far between. In a great many countries they do not exist at all. Limbs and appliances are still required and it invariably falls to the lot of the physiotherapist to do something about it. The role of the physiotherapist in the successful rehabilitation of the amputee is vital, to keep the patient fit, to attend to the stump, and to educate in the use of the prosthesis. A sound knowledge of prosthetics is essential and can do much to keep those "skeletons" out of the cupboards.

responses. These examples show sequences and groups of reflex actions which are easy to repeat and examine.

Visual and auditory sensations

The muscular responses which are triggered by these distance receptors are often better co-ordinated and "smoother" than comparable actions prompted by voluntary efforts. A large proportion of the sequences and groups of reflexes which underlie the commonplace movements of everyday life are initiated by, and modulated by, sensations which stem from the eyes; especially by sensations arising from the visual reflex mentioned in the next paragraph. This fact, however, often fails to be realized, because these muscular responses throughout the body, including those of the hands and feet, occur at speed without the causative sensations having been consciously appreciated. The complexities of eye/hand co-ordination and eye/leg co-ordination, which are legacies from ancestral achievements, should be fully exploited during rehabilitation.

A visual reflex which suits our present discussion occurs, whilst driving a car, when another vehicle arrives unexpectedly at a road junction, so that the image of the latter impinges on the very edge of the car-driver's retina. This stimulus does not reach his consciousness, but triggers muscle action which brings the moving object — the other vehicle — into his central vision. An item in this response is the turning of the head towards the vehicle; and in the case of some individuals there is a violent defensive contraction of the homolateral abdominal wall; at this stage, of course, the driver is fully aware of the other vehicle and his own surprise.

The visual aspects of this sequence of reflexes are discussed by Professor R. L. Gregory, in his book "Eye and Brain" (1966). He also describes the antiquity of this reflex and the structure of the periphery, or very edge of the retina which is primitive, pointing out that this reflex would have enabled our remote ancestors, as a matter of urgency, to distinguish friend from foe.

In connection with rehabilitation, movements initiated as above, or visually under other conditions, are likely to be far smoother than those under voluntary control. By using supplementary sensations from the patient's hands, the reflex movements of the head can be limited in extent and direction appropriate to his condition. Only a patient with painful neck movements who has experienced this difference, which occurs naturally and without training, is in a position to recognize the difference. There is no merit in a patient's trying to recover normal neck movements by voluntary control "through pain".

This reflex is seen in the human infant. It is of interest to appreciate that a patient, recovering from a stroke with poor balance, may fall unexpectedly, if subjected to this reflex.

SOME REFLEX ACTIONS IN THE FEET

Out of the many reflex actions which occur in the feet, when balancing the body, whilst standing, walking or running, a pair of reflexes in the forepart of the foot will now be examined. These reflexes press the pad of the big-toe against the ground and draw the lateral portion of the foot towards the hallucial portion. It is easy to do this, and is worth doing it carefully, because these reflexes are important components in several complicated and fleeting sequences of reflexes.

A chance observation, which I made in 1929, shows that this pair of reflexes can develop at an age when there is no conscious or learned control of the foot muscles. I watched a child of 16 months lift quite heavy objects, whilst balancing firmly in the standing position. The diagram (Fig. 1) shows the areas of wear and the creases which had already been made in the soft leather sole of her slipper; these relate purely to balancing, because, when the child moved across the room, she always insisted on shuffling along on her behind. The wear under the pad of her hallux was marked, showing that intrinsic muscles were active in making the hallux into a lever, whilst balancing. The longitudinal

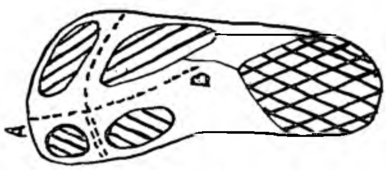

Fig. 1

crease (AB in Fig. 1) between the two distinct areas of wear under the transverse plantar pad showed that other intrinsic reflexes were involved.

Keith's Hypothesis

In 1929 I took my sketch of the infant's shoe to Sir Arthur Keith. He was most interested and gave me a reprint of a lecture which he had recently given on "The History of the Human Foot and Its Bearing on Orthopaedic Practice" (*J.B. & J.Surg.*, Jan. 1929). He had discussed his hypothesis regarding the first step in the transformation of our ancestors' arboreal foot into a terrestrial foot. In the former role the foot acted as a firm support on which the body balanced by reason of its grip on the bough. When on the ground, however, in contradistinction to the ancestors of the apes, our ancestors adopted the pair of reflexes described above, thereby helping to make the foot into a flexible and resilient support and lever. Keith also showed the diagram of a new-born baby's foot (see Fig. 2) on which I have drawn two dark lines to emphasize the angle between the axes of the tarsus and the forepart of the foot. Fossil evidence suggests that this is a legacy from the past.

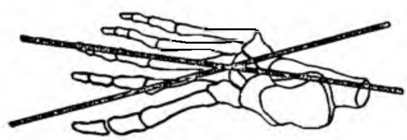

Fig. 2

Interpretation of Fossil Evidence. In his book, "Man-Apes or Ape-Men", Sir Wilfred Le Gros Clark discusses the australopithecine fossils discovered in South and East Africa by Dart, Broom and Leakey. When reporting on a talus bone found in South Africa, he writes that the "inward extension of the articular surface of the head, perhaps, allowed for a greater deflection inward of the body weight to the forefoot in association with a mobile big-toe capable of some degree of divergence from the other toes". I wrote to Sir Wilfred about Keith's hypothesis of an ancestral medially-directed big-toe pressed to the ground with the lateral portion of the forefoot adducted towards the big-toe, and he agreed with Keith's hypothesis. When describing the East African fossils, Le Gros Clark showed that the talus had the characteristics described above, also that " . . . there is a joint facet between the bases of the metatarsal bone of the big-toe and that of the second toe making it clear that there was no divergence between these toes as in the anthropoid apes". Thus, the fossil feet appear to have conformed to Keith's hypothesis and to the diagram of the new-born human babe. They emphasize this pair of reflexes, retained by Man.

Recovery of This Pair of Reflexes. It may sound a simple matter to tell a patient to press the pad of his big-toe against the ground; but this is exactly what he is unable to do. The reason for this inability is two-fold: structural changes in his foot due to faulty muscular habits and changes in his control processes (he can no longer exercise his normal voluntary control). In order to recover this pair of reflexes, the patient must take advantage of Factors A and B, mentioned above, and must choose working conditions which supply appropriate sensory impulses.

When balancing the body on the foot, this pair of reflexes help to make the foot into a resilient lever, but this also requires activity in the Anterior Tibial muscle and the strap-like Abductor Hallucis, which strengthens the medial border of the foot. It is easy for the patient to notice with his fingers the activity of both these muscles. Thus, it is wise to choose working conditions which encourage activity in these two muscles, expecting that their activity will be associated with the desired pair of reflexes in the forefoot.

In addition to attending to this positive side of the recovery, there is activity which must be avoided; patients who have lost this pair of reflexes as a rule have faulty muscular habits in their feet. Instead of raising the forefoot by means of the Anterior Tibial muscle, they do so largely or entirely with the extensor muscles of the toes, and this misuse of muscles persists when balancing the leg on the foot. This bad habit must be adjusted before the appropriate ratio of activity between the long and the intrinsic muscles of the feet can be restored. Without this adjustment of muscular habits the pair of reflexes cannot be recovered, because of the above-mentioned structural changes.

Working Conditions. These are chosen so as to provide an appropriate sensory inflow to the patient's brain.

It will be a great help to the patient if he can reach his ankle with his hands when he is sitting with his heel and the pad (not the tip) of his big-toe each supported on, say, a piece of wood or a book. This leaves a depression between the two supports to accommodate the thickened plantar pad below his metatarso-phalangeal joints. Then he can use his hands to straighten out these joints and the inter-phalangeal joint of his big-toe. Should he find that tight skin on the dorsum of his foot or under all his toes prevents his efforts to straighten out his foot, he will require to soften the tight skin by applying an ointment and cautiously stretching the skin. By doing this himself, he will hasten recovery of the missing reflexes by improving their sensory aspect. The hands and additional movements of the foot supply supplementary sensations which aid voluntary control of the foot.

As soon as the patient has begun to overcome the mechanical obstruction of the shortened skin, he can place his foot, so that it forms a bridge between the above-mentioned heel and toe supports, and his fingers can hold the pad (not the tip) of his big-toe in position on the latter. With his heel well supported, he can place a finger on the front of his ankle over the tendon of his Anterior Tibial muscle and another finger on the strap-like Abductor Hallucis. He can now reduce the support of his foot by his fingers, using them to feel whether these two muscles come into action, when he tries to maintain the shape of the bridge formed by his foot. The physiotherapist can feel whether the intrinsic muscles are beginning to co-operate, as synergists; this is a prelude to the recovery of the group of reflexes which involves all these muscles.

Under these working conditions when the finger support for the foot is reduced, it is clear that various muscles become subject to 'stretch', and this is the stimulus that triggers the group of reflexes. These conditions supply the requirements of Factors A and B, without which progress would be slow. On the other hand, with these factors fully operative, patients with long-standing, faulty, muscular habits in their feet may make rapid progress.

The Next Step. Supplementary sensations from the fingers should be utilized from time to time with the foot operated as a bridge, until flexibility in the foot has been restored and the longitudinal crease (AB in the diagram) has begun to return. The fingers should raise the foot into the arched position with the arch high; then they should allow the arch to lower slightly (stretching the intrinsic muscles) and immediately the foot muscles should restore the height of the bridge. Under these conditions, reflex action soon takes over from voluntary control. The patient should avoid making any pronounced voluntary effort, because this will encourage the tip of the hallux to move laterally and to flex at the interphalangeal joint — relapses into previous bad habits.

A Sequence of Reflexes. Keith's hypothesis (op. cit.) on the history of the human foot includes the influences of the long muscles which balance the leg on the foot, stabilize the ankle, strengthen the instep and help to support the arch. In 1930 I investigated the pair of reflexes in the forepart of the foot, which we have been discussing, by observing the areas of contact when one foot is supported on a sheet of plate-glass; these conditions include the above influences of the long muscles and make the study of this pair of reflexes of the short muscles easy. After discussing the matter with Keith, I published a couple of diagrams which showed what occurred when the body-weight was transferred from being equally supported on both feet to full support by the foot on the plate-glass. Under full load, provided the big-toe was acting as a lever in aid of body-balance, the foot actually narrowed and the longitudinal crease (AB in Fig. 1) was emphasized.

In this example the lever-action of the big-toe was triggered and automatically modulated by instability of the body on the single foot. If, however, this reflex action of the big-toe fails and there is a consequent failure to supply the necessary sensory impulses from the big-toe, stretch of the intrinsic muscles alone is inadequate to trigger the stretch-reflex action, and the foot remains wide under full load. Thus, in rehabilitation of the foot supplementary sensations are needed as a prelude to the stretch impulses. In brief, the lever-action of the big-toe against the ground helps to provide anchorage for the attachments of the long muscles which help to balance the leg on the foot, stabilized in part by the pulls of their tendons. In addition, this action of the big-toe provides a sensory prelude to the stretch reflex of the intrinsic muscles. This pair of reflexes in the forepart of the foot has become a normal sequence of reflexes.

THE HAND

An unexpected event forced me to make a renewed study of the reflexes of the hand, coupled with the use of supplementary sensations which help to increase versatility of movement and voluntary control over the fingers. Professor Raymond A. Dart sent a Professor of Music in an American University to discuss with me the basis of handskills for his music-making pupils, and overcoming postural defects which interfere with breath-control. I have found that a particular, near-reflex action in the hand forms the basis from which sophisticated handskills can be rapidly differentiated. Formerly, when I practised Physiotherapy, I found this action invaluable as a basis from which a variety of useful actions in rehabilitation can be developed. This raises a problem as to why this particular reflex is so potent, and this problem will be discussed.

Reflexes in the Hands. The reflex, mentioned above, rarely occurs in the behaviour of modern man, but it can be incorporated automatically as an item in an easily produced, generalized activity of the arms. This reflex consists of the thumbs being stationary, whilst the rest of the hand is being accelerated towards the thumb, the hand being somewhat opposed to the thumb. This contrasts with the commonplace action of moving the thumb and fingers towards each other when gripping an object — the "precision grip" (Napier). The muscle action in the two movements is somewhat similar, but the sensory inflows to the brain which trigger either action are in contrast.

If one experiences how this reflex can be simulated in one's own hand, it helps one to imagine the ancestral activities from which they are legacies.

In this article we are looking for ancestral activities which were significant, e.g., which were important for survival, and were adequately used but without undue specialization. This is because experts hold that our remote ancestors were agile, versatile creatures with various modes of locomotion through the forests involving their hands. Versatility has been an important feature in our evolution, yet this has not prevented the development of muscular reflexes.

Eye/Hand Co-ordination and the Brain. Before considering the simple procedure which enables this "hand-towards-thumb reflex" to be simulated in one's own hand, interaction of the brain, eyes, and hand must be mentioned. Both in evolution and in rehabilitation there is an interaction between

(a) the educative effect of eye/hand co-ordination on the brain and

(b) the effects of processing the sensory inflow to the brain on the reflexes and structures of the hand.

Thus, when considering either rehabilitation or evolution of hands, we must keep in mind both mental processes and actions in other parts of the body, including contributions from the eyes.

Simulation of This "Hand-Towards-Thumb Reflex". 'Stretch' of the intrinsic muscles which triggers the rest of the hand into a somewhat opposed position relative to the thumb can be experienced by the following simple procedure. This 'stretch' and the reflex response are implicit in a generalized activity of the arms (Factor A, above), and supplementary sensations from the eyes and the other arm (Factor B) help to guide variations of this reflex. These experiences make it easy to follow the argument as to why this reflex is a legacy from the behaviour of our remote ancestors in the trees. This is indirectly supported by fossil evidence. In fact, as has been pointed out to me, it is hard to envisage how this stretch reflex and the characteristic structures of the human hand could have developed independently of each other in any other manner. This activity is a far more useful prelude to the rehabilitation of other actions of the hand than the more usually practiced exercise in which the thumb is moved towards the rest of the hand.

The patient should raise his left arm across the front of his chest with the elbow bent, and should retract his right arm, so that his right hand is level with his left. He should then look at a point on his left forearm about 4 in. proximal to his wrist, and should carry his right hand forwards, so that the pad of his right thumb makes contact with the point at which he is looking, allowing his right fingers to over-shoot his left forearm. This will cause a 'Stretch' of the intrinsic muscles which will encourage the rest of his right hand to be adducted towards the thumb, and the fingers to flex around the forearm. The hand is somewhat opposed to the thumb, the amount of this depending on the direction of thrust by the right arm. The combination of reflexes is modulated by the influence of the eyes which includes impulses due to the graspable appearance of the left forearm.

It may help to improve eye/hand co-ordination, if the example on peripheral vision, described above, is incorporated as a prelude to looking at the prospective point of contact on the left forearm.

Rehabilitation. If the disability in the right hand is considerable, movements of the arm will have to be restrained; even so, it is better to start with a generalized activity in the hand instead of aiming at the use of only a few muscles. This elementary eye/hand co-ordination under visual influence is of definite value.

I have found that it is the sequence of the sensory input to the brain, not its intensity, which is effective. Accordingly, it can be of value to patients who have damaged and painful hands capable only of restrained movements.

After one or two experiments with this example, the patient can rest his right hand and forearm on a table or on his thigh, and, holding his right thumb still with his left fingers, he can slide his right fingers towards his right thumb, using various combinations of muscle action, as instructed; these should include arching up the dorsum of the right hand, so that there is some opposition relative to the right thumb. If desired his left hand can stretch his right intrinsic muscles, before they are activated.

ANCESTRAL BEHAVIOUR

The aim of these final remarks is to show how these reflexes may have arisen as a result of our ancestors' commonplace behaviour, and thus demonstrate why this hand-towards-thumb reflex is potent.

In his "Antecedents of Man", Sir Wilfred Le Gros Clark (1962) postulated that the ancestors of Man had developed swinging by the arms as a means of travelling through the forests only to a moderate degree. Dr. John Napier in an article in *New Scientist* (12th July, 1962) suggested that "the remote ancestors of man had developed as specialized arboreal forms capable of leaping through the forests with a certain amount of swinging by the arms, . . ."

Fossil Evidence. This is discussed in "Man-Apes or Ape-Men" by Le Gros Clark, throwing light on the hands of these creatures, and suggesting the activities of their ancestors. He reviews the fossil evidence brought to light in South and East Africa by Dart, Broom and Leakey. He suggests that the ancestors of man began their terrestrial life at a time when drier climatic conditions were thinning out the forests, forcing our ancestors to scamper from one group of trees to the next. This would have supplied the need to jump onto and over slender boughs near the ground, enhancing eye/hand co-ordination.

The fossil evidence includes a robust, well-developed and curved 1st metacarpal bone and a 4th metacarpal with strong interosseous markings (Napier), showing that these interosseous muscles were well developed. At another site there was evidence of an opposable thumb capable of finer manipulative activities. The characteristics which can be deduced from this fossil evidence compare with those found in human hands, but are in contrast with the specialized features of the apes which are used for swinging from branch to branch through the forests.

Landing on Slender Boughs. The next step in this discussion fits in with the "hand-towards-thumb" reflex, triggered by 'stretch' of the intrinsic muscles. This 'stretch' will be shown to have arisen from landing safely on a slender bough after a leap or fall, as part of commonplace behaviour, when playing, fighting or reaching out after fruits. Success in landing must have encouraged further leaps, if we accept Le Gros Clark's contention that our ancestors were agile creatures. In the above-mentioned simulation the left forearm represents the slender bough of our remote ancestors. Landing successfully on a slender bough must have involved two visual influences which attained survival value. The first related to the selection of a suitable slender handhold which could be grasped, and the second to aiming the thumb appropriately at the near side of the bough.

D. Denny-Brown's book* shows that, when falling or landing in the "head-down" attitude, mammals have their fore-limbs out-stretched reflexly, and that monkeys retain this reflex action with their hands open and thumbs widely divergent. The sensory input from the neck helps to trigger this response, when the head is held so that the line of sight is directed onto the landing area. When the animals began to land on slender boughs, clearly the visual placing of the hands must have been far more exact, so as to avoid accidents and to control the travel of the body. This must have enhanced eye/hand co-ordination, and strengthened the structure and versatility of the hand.

During this behaviour, the reflexes of the intrinsic hand muscles contrasted with the reflexes of animals which swung from bough to bough. As soon as the thumb came into contact with the near-side of the slender bough, the intrinsic muscles which joined the rest of the hand to the "fixed" thumb must have received a 'stretch' and would have contracted smartly.

This, then, is one of the features which made our ancestors different from the ancestors of the apes. It has produced reflexes which are the basis of our handskills.

I wrote to Sir Wilfred Le Gros Clark about these suggestions concerning the hand, and he replied that they were

*"The Cerebral Control of Movement" (Liverpool, 1966).

relevant to the evolutionary development of the mechanism of the hand. This opinion supports the idea that this stretch reflex of the intrinsic hand muscles had its origin in ancestral behaviour which included eye/hand co-ordination, survival value and stretch of the intrinsic hand muscles. The innate muscular co-ordination which this evolutionary way of thinking revives includes flexibility of the hand, an essential prelude to hand skills and to refined movements during rehabilitation. This is in contrast to the rigidity and awkwardness of movement, often seen as a result of voluntary exercises.

CONCLUSION

The above examples show how these reflexes can be elicited and utilized to hasten rehabilitation, provided their application is modulated by certain other inherited factors. The role of the patient's consciousness is to arrange appropriate working conditions and to check results rather than to exercise a detailed control over muscle action.

Procedures, based on the above principles, can be applied to a variety of automatic activities, such as breath-control or head-, neck- and shoulder-carriage. The results are quicker and more assured than when using conventional voluntary exercises, because the working conditions discourage faulty muscular habits, whilst encouraging those which are desired.

ABSTRACTS — SECOND QUARTER, 1970

Acta Neurol. Scand., 46, 2, 1970:

FOG, R., and PAKKENBERG, H.: Combined Nitoman - Pimozide Treatment of Huntington's chorea and other hyperkinetic syndromes.

Summary: On the hypothesis that, in contrast to Parkinson's disease, hyperkinetic syndromes are characterized by an increased sensitivity of dopaminergic receptor cells to a normal level of dopamine (or by increased dopamine turnover), the authors treated 16 patients with drugs which are known to have a strong anti-dopamine effect. The majority of the patients suffered from Huntington's chorea. Encouraging results were obtained, with striking reduction of hyperkinesia in 9 patients and moderate reduction in 5.

Acta Neurol. Scand.: Supplement No. 43, 26, 2, 1970:

This supplement, which is the Proceedings of the Nineteenth Congress of Scandinavian Neurologists, includes several interesting short papers on the pharmacology of Parkinson's disease and its treatment by L-dopa and other drugs.

Arch. Neurol. 22, 4, April, 1970:

KLINKERFUSS, G. N., and HAUGH, M. J.: Disuse Atrophy of Muscle.

Arch. Neurol. 22, 6, June, 1970:

COHN, R.: Amnestic Aphasia and other Disturbances in Naming.

Develop. Med. Child Neurol., 12, 3, June, 1970:

HALPEM, D., *et al:* Training of Head Posture in Children with Cerebral Palsy.

Summary: A group of 14 children with poor head posture due to cerebral palsy was observed during a prolonged therapeutic program, which included a variety of techniques of stimulus application, as well as a number of orthotic devices for head support. Responsiveness to devications from correct head posture was improved and maintenance of head orientation was increased with the use of dynamic head suspension. The authors discuss their methods and results.

Experimental Brain Research, 10, 5, June, 1970:

STUART, D. G., *et al:* Stretch Responsiveness of Golgi Tendon Organs.

Summary: Whilst not denying the importance of recent work which has shown the Golgi tendon organ to be an important contraction receptor, the authors' experiments show that the soleus tendon organs are sufficiently sensitive to passive stretch to influence Ib input during normal postural and locomotor activity. The functional significance of this is discussed, although it is not clear whether the authors consider soleus to be active during the stance phase of walking or not. The article warrants study by those physiotherapists interested in neurophysiology.

STUART, D. G., *et al:* Selective Activation of Ia afferents by Phasic Muscle Stretch.

Summary: Gives further evidence in support of other studies which have emphasized the usefulness of brief stretch for the selective activation of the primary (2a) endings of muscle spindles.

J. Applied Physiol., 28, 5, May, 1970:

DAVIS, C. M., and BEALE, D. K.: An apparatus for isometric study of the human kneejerk.

J. Applied Physiol., 28, 6, June, 1970:

BARNARD, R. J., EDGERTON, V. R., and PETER, J. B.: Effect of Exercise on Skeletal Muscle I: Brochemical and Histochemical Properties. II: Contractile Properties.

J. Neurol. Neurosurg. Psychiat. 33, 3, June, 1970:

GASSEL, M. M.: A critical Review of evidence concerning Long-loop Reflexes excited by muscle afferents in man.

J. Physiol. 208, 3, July, 1970:

HILL, D. K.: The Effect of Temperature in the Range 0-35°C on the Resting Tension of Frog's Muscle.

Summary: Experiments conducted on the sartorius of a frog showed a more or less constant increase of tension per 1°C rise in temperature for temperatures in the range 0-23°C. It was evident that this tension was active rather than passive in nature. At temperatures between 28 and 35°C a "heat contracture" was produced, occuring at progressively lower temperatures the more the muscle was stretched.

Neurology, 20, 5, May, 1970:

KENNEDY, W. R.: Innervation of normal human muscle spindles:

This paper describes the detailed anatomy of spindles from normal human intercostal muscle.

J. Neurol. Neurosurg. Psychiat. 33, 2, April, 1970.

BURKE, D., GILLIES, J. D., and LANCE, J. W.: The Quadriceps Stretch Reflex in Human Spasticity:

Summary: The stretch reflex in spastic quadriceps was found to be dependent upon the speed of stretch (increased velocity producing an increased reaction) and the length to which it was stretched (producing inhibition, i.e. the "claspknife" phenomenon). It was also subject to fatigue.

Pointing out that the Golgi-tendon organ is primarily sensitive to shortening and not lengthening, the authors produced reasons for their belief that the length-dependent inhibition of the stretch reflex arises in the secondary endings of the muscle spindle.

J. Neurophysiol., 33, 3, May, 1970:

GOTTLIEB, G. L., AGARWAL, G. C., and STARK, L.: Interactions between Voluntary and Postural Mechanisms of the Human Motor System.

Summary: Two possible theories attempts to show why voluntary movement is not interfered with by the consequent reaction of the antagonistic muscle groups to stretch. The first is that of temporary "disablement" of the proprioceptive loops during volition (termed x-control), the second that of the servomechanism of the y-loop. The probable inter-action between the two is termed x-y linkage.

The authors attempted to investigate spinal mechanisms of control by studying the interaction of the H-reflex in the soleus-gastrocnemius complex with changes of muscle tension produced by voluntary plantar-flexion. (The H-reflex, or Hoffman-reflex, is a monosynaptic reflex produced by electrical stimulation of Ia afferents and is therefore independent of stretch mechanisms.)

From their results they concluded that there is an independent mechanism regulating monosynaptic reflex arcs, which occurs centrally within the spinal cord. This supports the concept of an x-y linkage for voluntary motor control, implying that the servocontrol theory is not the only operational mechanism of the human motor system.