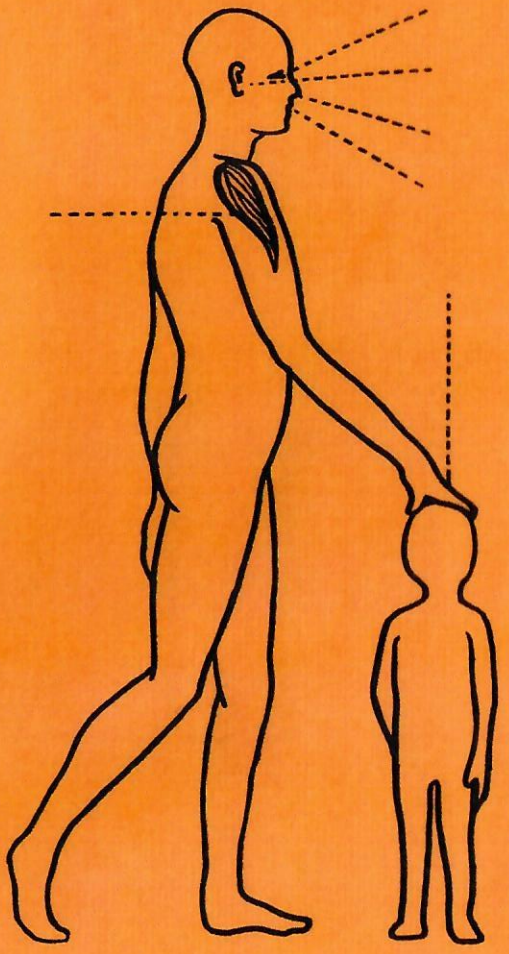
THE LOST Sixth Sense

A MEDICAL SCIENTIST LOOKS AT THE ALEXANDER TECHNIQUE



DAVID GARLICK

THE LOST SIXTH SENSE

A Medical Scientist Looks at

The Alexander Technique

David Garlick
BSc (Med), MB, BS, PhD

Laboratory for Musculoskeletal and Postural Research
School of Physiology and Pharmacology
The University of New South Wales

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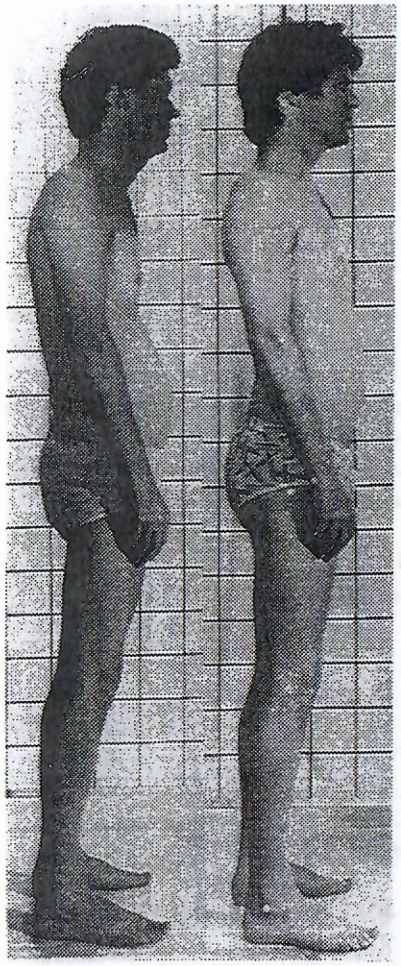

Figure 1. *The left hand panel is a subject before undertaking lessons in the Alexander Technique by a Teacher of the Technique in Sydney; the right hand pannel was taken after a series of lessons (photographed in the author's laboratory by honours student Sally Raine, May-June 1983).*

PREFACE

The Alexander Technique involves an awakened sense of one's muscles and how one uses them. That is, it is a personal and subjective experience. No amount of writing and talking about it can substitute for that direct experience. Nevertheless, there is value in putting into words our experiences. Alexander did it in writing and speech, complementing his unique technique of using skilled hands to awaken in a person a renewed sense of her/his muscles. One useful area to write about is to relate the information in the medical sciences, notably physiology (how the body functions), to the Technique and its concepts. There is a great deal of physiological information that relates to the concepts of the Alexander Technique. Various areas in psychology would also be relevant. I have written about physiology since that is my discipline.

I have some credentials as a student of the Technique. After reading in 1976 Professor N. Tinbergen's speech in 1973 on receiving the Nobel Prize in Medicine, I contacted Dr W. Barlow in London when I was there on study leave in 1977. My interest in the Technique was purely scientific, to look at this particular aspect of the mind-body interaction. I had no reason to doubt my abilities in sitting, standing and moving since my other area of personal and scientific interest was exercise.

Dr Barlow wisely suggested I undertake lessons for two reasons - one was that I would benefit from it since my posture and the state of my muscles revealed there was room for improvement; secondly, the way to understand the Technique was to experience it, not to observe it, since it deals with re-awakening one's muscle sense and with re-programming one's muscle control. I undertook frequent lessons in London, becoming impressed with the personal and scientific implications of the Technique. On my return to Sydney, one of my early contributions to the Technique was to organise a symposium of medical scientists whose work related to the Technique; the proceedings were edited by me in a book, Propioception, Posture and Emotion (still available from

me, cost, including postage, $25). Also, I have undertaken some research related to the Technique, some of which I refer to in this booklet and I continue to have lessons in the Technique in an advanced students' class.

This booklet represents really a work in progress. I welcome comments from readers so that a later edition can be more helpful.

David Garlick
March, 1990

Section I

INTRODUCTION

There are five senses that are traditionally described - as sight, hearing, smell, taste, touch.

To this the eminent anatomist of last century, Charles Bell added a "Sixth Sense"; that of the sense of limb and body position and movement. The technical terms for this sense are kinaesthesia (sense of movement with inputs from receptors in joints and muscles) and proprioception (sense of position with input from the organs of balance in the ear as well as joint and muscle receptors). The two terms are often used interchangeably.

The lost sixth sense - faulty sensory appreciation

There is evidence that this sixth sense has become 'lost', or suppressed, in our modern civilisation. A plausible explanation for this is the explanation by the romantic English poet of last century Wordsworth

"getting and spending
we lay waste our powers
naught that we have in nature that is ours".

That is, our minds become occupied with so many inputs and outputs to do with the outside world that signals from the body are suppressed or 'gated out' before reaching consciousness.

There are mechanisms for suppressing or gating out sensory inputs. For instance, light abrasion of skin can suppress dull pain. Strong emotion can suppress pain.

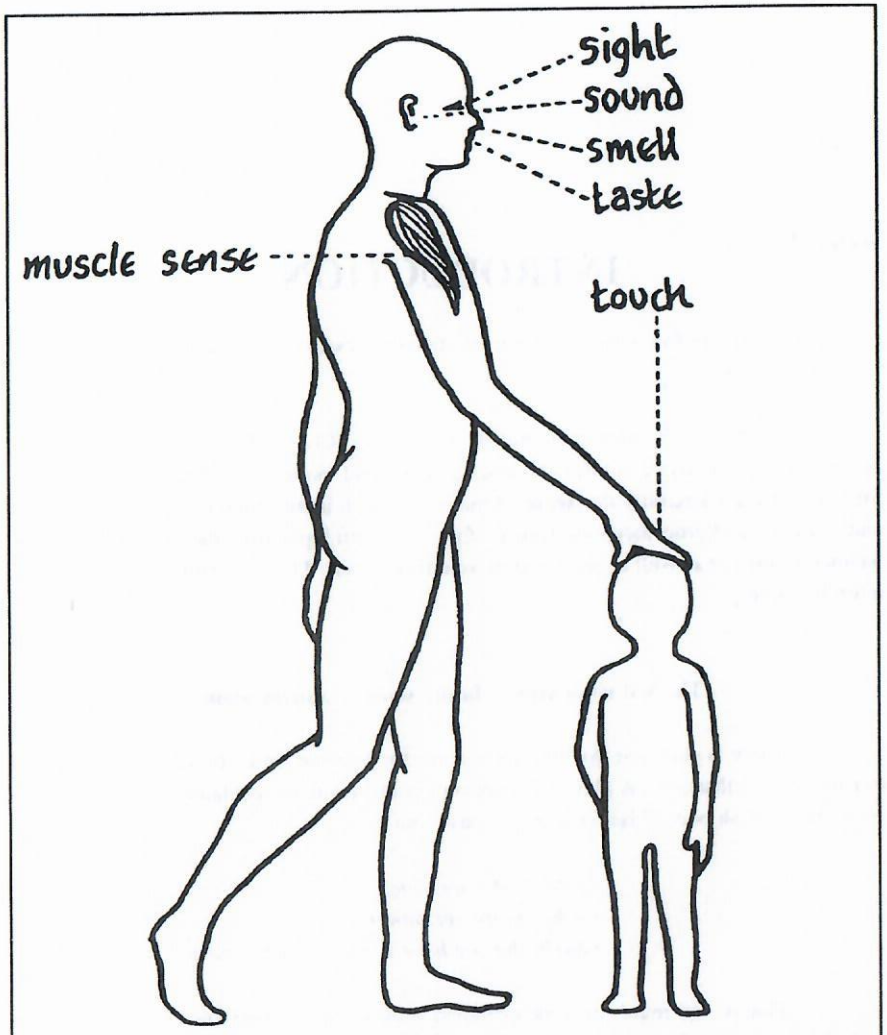

Figure 2. The five classical senses are listed on the right side. Sir Charles Bell, a 19th century Scottish anatomist and surgeon, identified the differences between sensory nerves (to the brain) and nerves supplying muscles (from the brain) and characterized the sensations from muscle (elongation tension, heaviness) as the "Sixth Sense".

Strongly contracted muscle can make a person less aware of what their muscles and limbs are doing.

Brain Programs

Also, the brain understandably has to reduce the information it has to handle so that it can be ready for new information. For a wide variety of acquired or learned postures and movements, the brain has centres at sub-cortical and therefore subconscious levels where programs are laid down. So, for one's characteristic postures in sitting and standing, sub-cortical programs can be used. One does not need to be aware in detail of how one is sitting or standing or moving provided one is generally aware of support from a chair and its arms, or from a desk, or a wall when standing and so on. As a result, one does not require sensory feedback in familiar situations; one can get by without the sixth sense of muscle and limb position.

The reality is that our postures of sitting and standing and our movements often have become inappropriate. The sixth sense is not being used to indicate, for instance, that this muscle is overcontracted, this flexor muscle should not be contracting at all, this extensor muscle is not contracting enough and so on. Since these patterns of muscle use and postures are programmed, we continue to use them. F.M. Alexander made the very pertinent observation that faulty sensory mechanisms seemed to be universal.

Common occurrence of poor posture

It is probably not an overstatement to say that all of us suffer from poor posture to a greater or lesser extent. The continual inappropriate use of muscles in posture and movement affects the musculoskeletal system overall. Most people show abnormalities of posture. My studies, and others, show this - asymmetries with shoulders or pelvis tilted, twisting of the spine, overarched neck, the lower back may be overarched or flattened with the pelvis tilted away from its normal angle, knees may be hyper-extended. Sometimes poor posture may arise from congenital causes or during infancy or from conditions such as polio. Nevertheless, inappropriate use of muscles against gravity in standing and sitting leads to poor posture - head thrust forward with an overcurved neck, sloping or hunched shoulders, humped back, over-arched or flattened lumbar curve, protruding abdomen, hyper-extended knees.

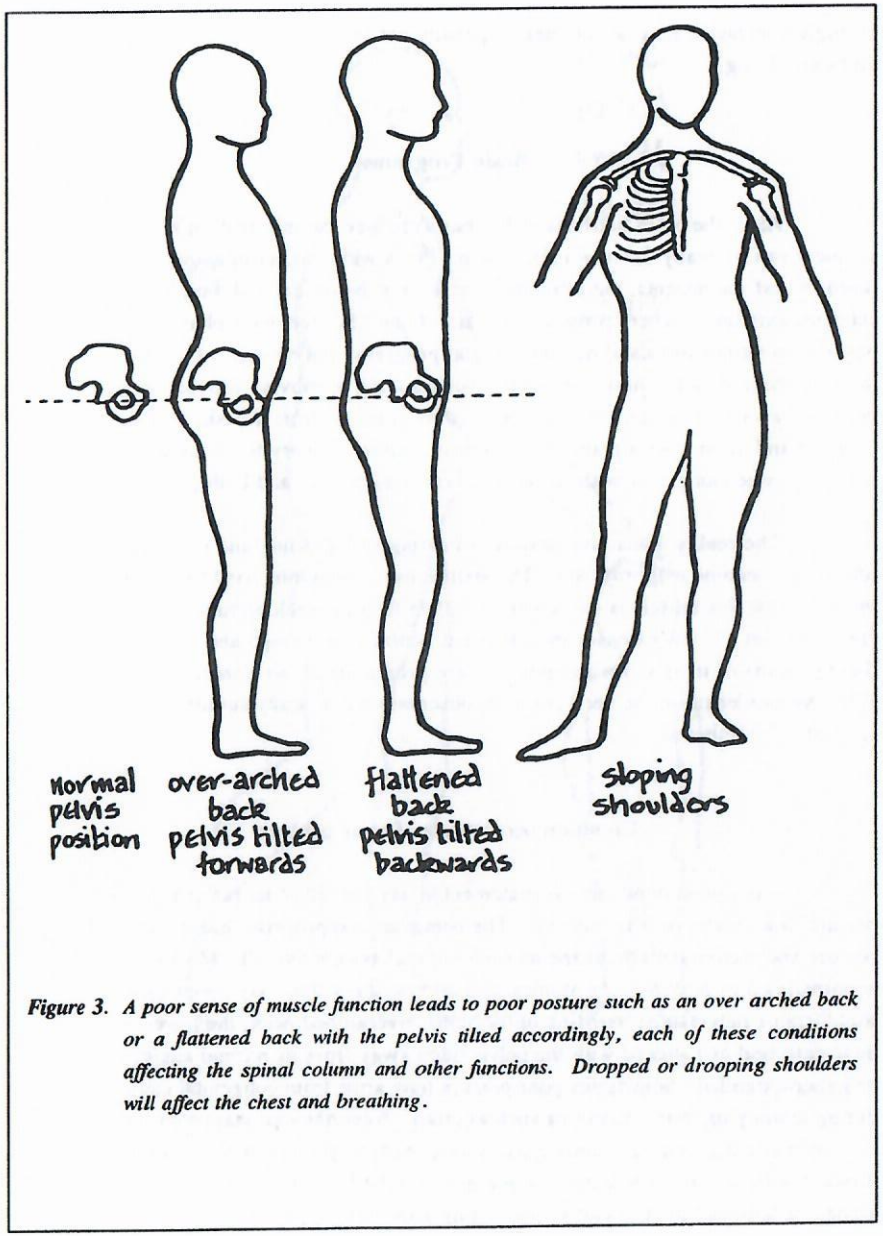

Figure 3. A poor sense of muscle function leads to poor posture such as an over arched back or a flattened back with the pelvis tilted accordingly, each of these conditions affecting the spinal column and other functions. Dropped or drooping shoulders will affect the chest and breathing.

This lays the basis for musculoskeletal problems - headaches (muscular), neck aches and pain radiating from the neck to the shoulders, lower back pain, joint problems and so on.

Poor muscle function arises from suppressing or gating out sensory input and relying on inadequate programs. Alexander termed it the faulty sensory mechanism and his observation in the first half of the century was that it was becoming increasingly a problem. That is true today.

Effects of lessons in the Alexander Technique

In a lesson, the pupil is encouraged to overcome this suppression of the sixth sense by becoming aware of the state of his/her muscles. My own experience in lessons early in my contact with the Technique have remained strongly with me. I become aware of overcontracted muscles of the feet, legs and buttocks. It became almost painful temporarily but then, the awareness of the overcontracted state of these muscles gradually resulted in their relaxation - as part of an overall process that is based on inhibiting established patterns for using one's muscles and of allowing a new, integrated mechanism of muscle function to be established. It is a matter of 'allowing' the process to happen since it involves sub-cortical, and therefore subconscious processes.

One of the unique features of lessons is that of the role of the teacher. Her/his hands are not only sensing the state of the muscles of the pupil but also the trained hands help the pupil become aware of the muscles as these are touched. The teacher, with heightened awareness of her/his own muscles, helps the pupil become aware. The awakened muscle sense of the teacher helps (over time) to awaken the muscle sense in the pupil.

Benefits of an active sixth sense

What are the benefits of a re-awakened sixth sense? I will come back to this in more detail later but two effects can be mentioned. As a person becomes aware of her/his muscle state, this lays the basis for better functioning of the musculoskeletal system and this will help to prevent or lessen musculoskeletal problems. Secondly, there is an important effect psychologically in being aware, even if only every now and

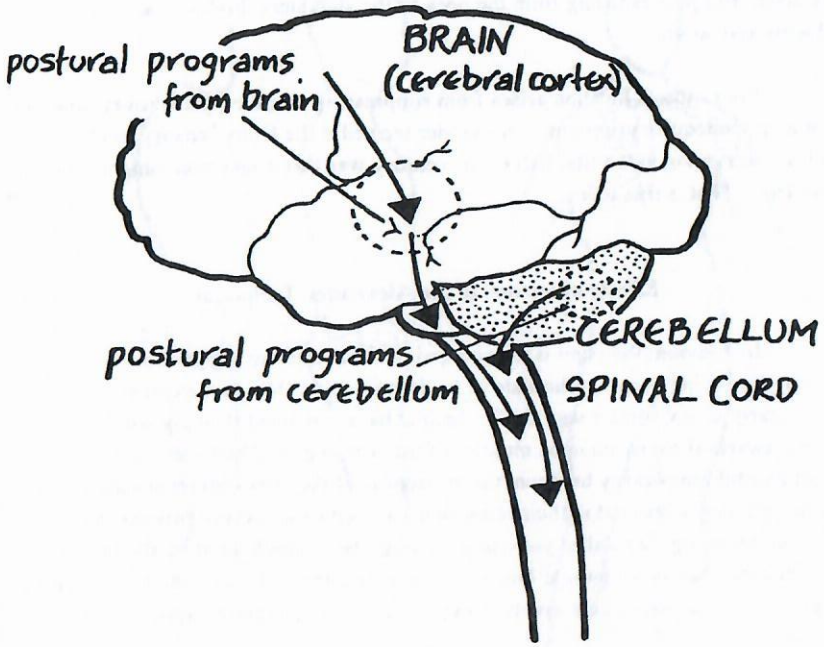

Figure 4. *Consciousness resides in the cerebral cortex of the brain. There we decide to do something - sit, stand, move. From the cortex nerve impulses go to centres deep in the brain or the cerebellum which activate programs for the appropriate muscles to act. These programs are - sub-cortical and therefore in our unconscious. Once laid down, the programs are not easy to change.*

again, of one's muscles. There develops a sense of individual unity, of being at peace with oneself, of being 'centred' in oneself. It gives a satisfying sense of integration. Further, one is more likely to be aware of moods that can affect muscles. It is not uncommon to notice one's state of muscles and their over-contraction, or their under-use, and then become aware of a feeling of anger or anxiety or sadness/depression.

Subtle aspects of the Alexander Technique

There are a number of subtleties to the Technique. One of these is that, in becoming aware of one's muscle sense, one should not at the same time try to tell or 'command' one's muscles what to do - but more of that later.

Another subtlety is to learn to stop using one's muscles in one's customary way if, as one's sixth sense awakens, these muscle actions are inappropriate. It seems almost a contradiction to stop contracting an over contracted muscle; one's attention is directed to that muscle or group of muscles and one simply (although subtlely) allows it to relax. If one tries too hard, one could end up contracting the muscle more.

The programs in our brain centres for posture and movement are automatically selected once we decide to do something. The programs will be activated instinctively or reflexly once a person moves into an erect position or starts to move. But the programs are likely to have inappropriate muscle actions.

Figure 5. The line of gravity passes through the ear and the centre of gravity, a point roughly between the lumbar vertebra and the umbilicus ("belly button"). Note particularly that the line passes near the front of the knee and clearly in front of the ankle joint. This means the natural tendency of the upright human person is to fall forwards. Hence the muscles at the back of the calves, thigh, trunk and neck (so called "extensor" muscles) need to be active to keep the person extended or upright. Muscles at the front of the body (flexor muscles, to hunch a person such as for heavy lifting) need to be much less active.

Section II

INHIBITION

The subconscious activation of a program for using muscles can be stopped by saying 'no, not the usual way'. Alexander discussed this at some length. He describes how he developed the procedure for repeating mentally a set of 'directions' (see later) for his muscles to be used appropriately in preparation for doing something; for instance, for speaking the line of a play. Firstly, he would stop or inhibit any immediate response within him to the idea of speaking the sentence; this, of course, was a shrewd way of stopping the usual program for speaking, stored in its unconscious centre, from being started - a program that made muscles act inappropriately such as pulling the head down and hunching and rounding the shoulders. Then he would mentally rehearse these 'directions' in which trunk extensor tone is enhanced and trunk flexor tone reduced. Then Alexander would make a choice of several options - not speak and do nothing outwardly while continuing mentally to give the 'directions'; or do something different, such as lifting his arm; or, go ahead and recite the sentence.

Alexander, although not trained as a physiologist, showed a shrewd understanding of how the brain worked. Our consciousness, in the cortex of the brain, is where our will to do something arises. After this the pathways go to centres deep in the brain which form the subconscious or unconscious. If nothing is done to stop existing programs being activated resulting in inappropriate muscle contractions, then a person's characteristic way of sitting, standing and doing things will occur.

Alexander found the key for stopping these unconscious processes from taking their pre-set paths. Once the impulse has formed in one's consciousness then one stops, or inhibits, the next step in activating the unconscious programs. One starts a new program which is laid down by using one's consciousness to give a set of "directions" to trunk and neck muscles with its emphasis on lengthening.

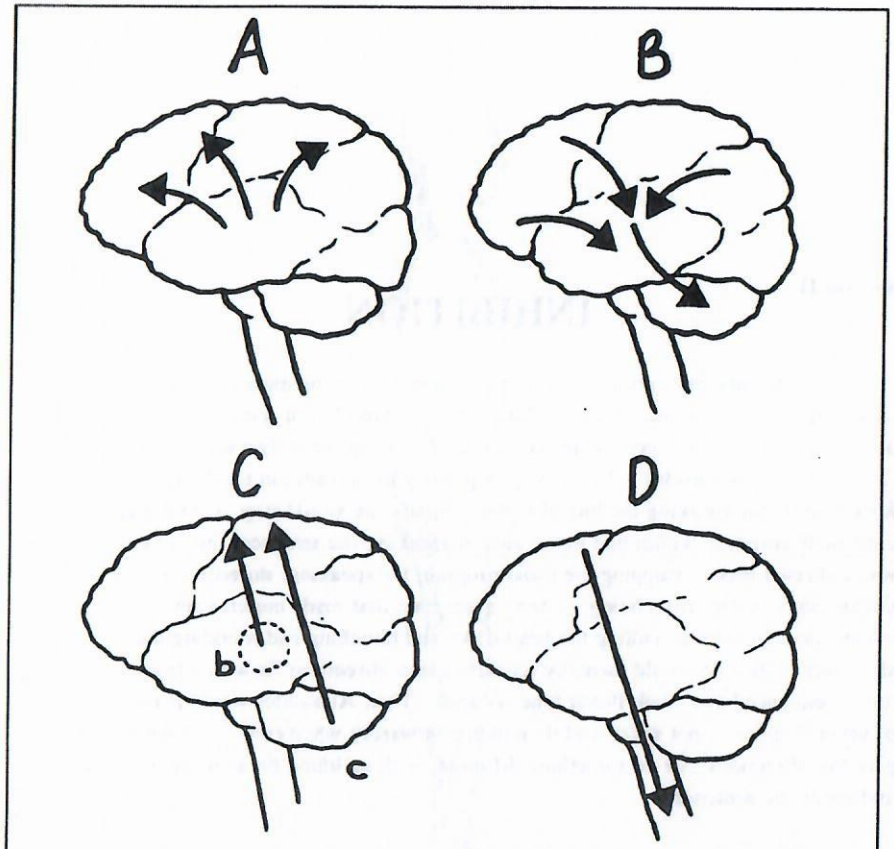

Figure 6 *This is a more detailed version of Figure 4. The impulse to do something (eat, drink, sleep. make love, run, seek warmth or cold, sit or stand and so on) arises from centres deep in the brain ("limbic" system) A. The impulses rise to the cortex and hence to consciousness. At this stage one can decide whether to act on this impulse or drive. To decide not to is an instance of Alexander's concept of "inhibition". A physiologist would also use the same term in its scientific sense. When one decides to act on the drive-impulse, nerves fire to the postural and movement programs deep in the brain and cerebellum B and the program is returned to the "motor brain" of the cortex C to activate long nerves from the brain to nerves in the spinal cord D which act directly on individual muscles (motor nerves).*

Alexander wrote about how intrigued he was by his observation - that, since 'willing to do' a familiar act in the characteristic way was so easy, then it would be equally easy to 'will to do' the same action in an unfamiliar way. In fact, as he found out, willing to do something called on the same program resulting in the usual inappropriate action. Alexander made the significant discovery that the way to interrupt the sequence was to 'will to do' something then stop (or inhibit) it which will allow a new 'program' to be developed subconsciously while consciously or mentally giving directions (see below) - letting the neck muscles relax while the head leads the body forward and up and using the trunk extensors to let the back lengthen and widen.

Alexander wrote about the experience which is not uncommon for those being introduced to the Technique. With an awakening sixth sense and with inhibiting old programs and giving directions to allow new programs to be laid down, the person finds that the new patterns (involved in sitting, standing and moving) do not feel right or at least feel unfamiliar. The person feels awkward. This is not surprising as a new program is being established to replace the old one. New sensory input may not only give a feeling of the new patterns being different but even a feeling of these being wrong. This is where the expert guidance and sensing by a teacher helps; as well as the person concentrating on the means whereby new programs can be established - an awakened sixth sense, inhibiting old programs, giving 'directions' to allow new programs to be established.

Feeling of ease or lightness

As a new pattern is being established a not uncommon feeling is a greater sense of ease and of lightness. The enhanced use of trunk extensor muscles (back muscles) and decreased use of trunk flexor muscles (neck, chest and abdominal muscles) gives a reduced sense of pressure. In fact, there is likely to be a decreased pressure in the abdomen. Also, there is likely to be a decreased 'brain command' (or motor command - see below) since less trunk flexor tone is required, and less brain command means less sense of effort.

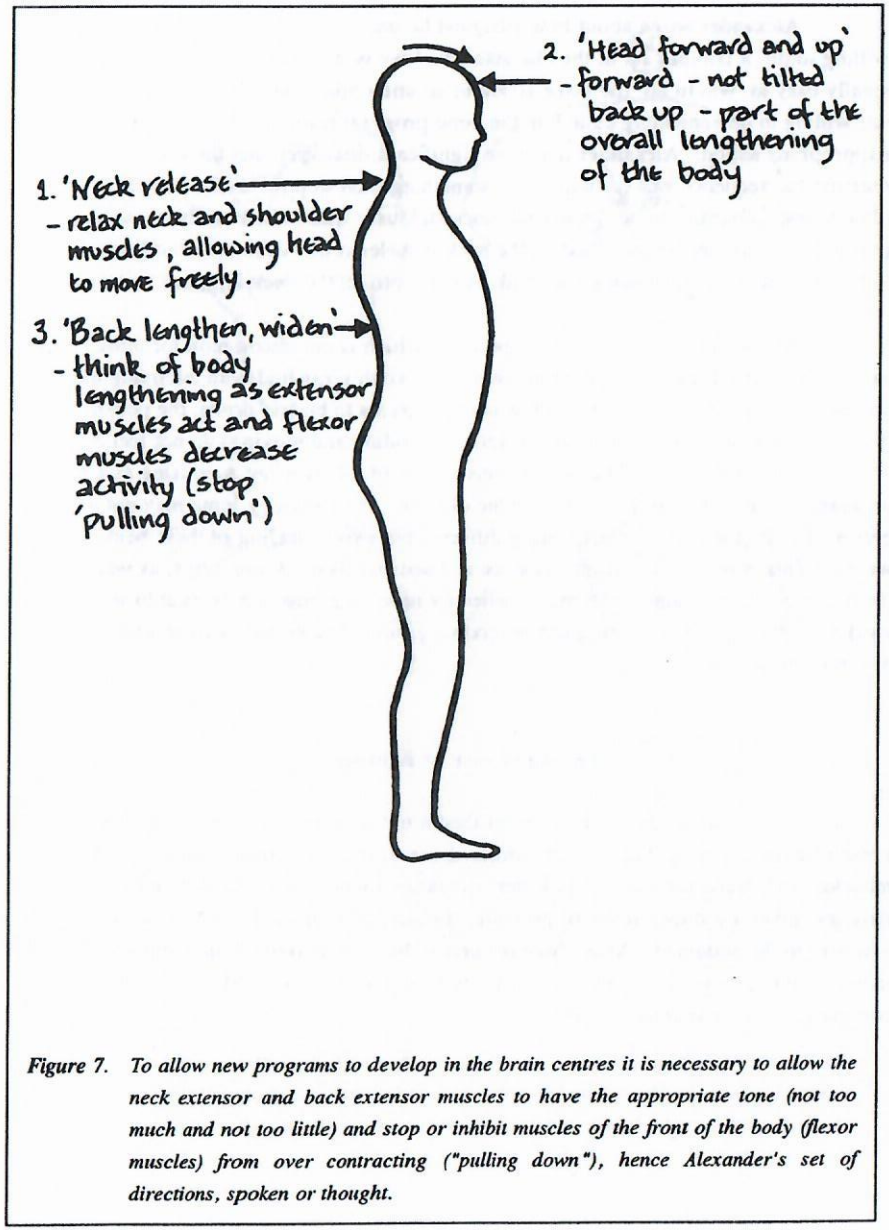

Figure 7. To allow new programs to develop in the brain centres it is necessary to allow the neck extensor and back extensor muscles to have the appropriate tone (not too much and not too little) and stop or inhibit muscles of the front of the body (flexor muscles) from over contracting ("pulling down"), hence Alexander's set of directions, spoken or thought.

Section III

DIRECTIONS

This is a technical term used by Alexander. He gave it a particular definition. The 'directions' are a series of statements repeated mentally (thereby allowing it to affect subconscious centres) to prevent neck muscles being contracted (relating to primary control - see below) and preventing at the same time the head being pulled down and enhancing the activity of the extensor muscles of the trunk and thereby decreasing contraction of trunk flexor muscles. The mental statement goes something like "neck release, head forward and up, back lengthen, widen".

The brain and spinal cord (or the central nervous system) controls muscles in an integrated way. Programs for standing and for movement involve a complex control of activating a series of muscles to steady the trunk and limbs to lay the basis for movement. There is a major demarcation between control of flexor muscles (in hunching the trunk or bending a limb) and extensor muscles, which cause a person to stand up, or to 'lengthen'.

Most of us, in carrying out any action or movement, would tend to contract neck muscles and pull the head back and use trunk flexor muscles. We exert more effort than is necessary. The simple movements used in lessons by Alexander teachers illustrates this. In standing from sitting in a chair, or the reverse, almost all of us will contract neck muscles and pull the head down and we will be contracting trunk flexor muscles as well as trunk extensor muscles.

It illustrates the poor programs we have laid down in our unconscious centres which have to be interrupted and replaced by new programs. Neck contraction and head retraction affect an important part of the brain's control of movements. Alexander termed this 'the primary control' -the effect on brain control by the state of the neck muscles with their effect on the angle of the head.

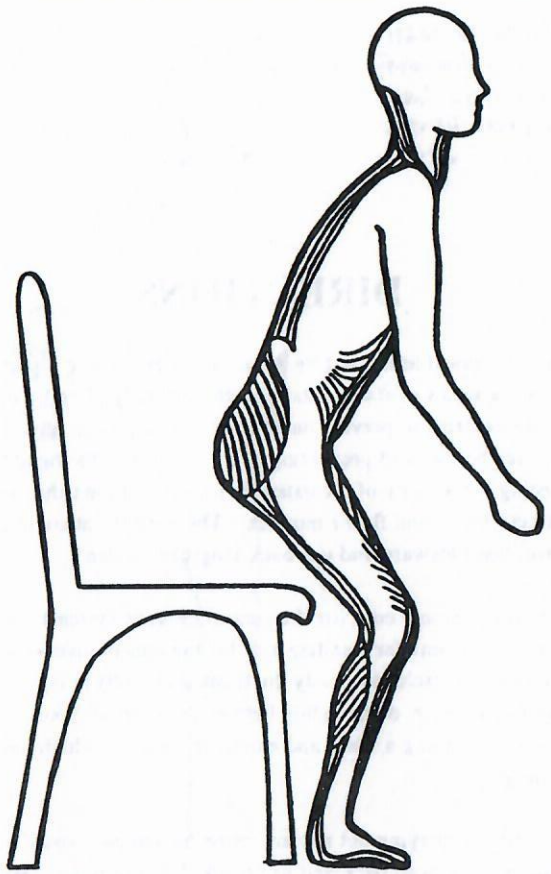

Figure 8. Rising out of a chair, or lowering oneself into a chair are simple movements, commonly used because of the simplicity in space and equipment, in Alexander lessons. The figure illustrates a poor program (common to most of us) for rising out of a chair. There is overcontraction of extensor and particularly "flexor" muscles with the neck pulled down and the head rolled back.

So the Alexander 'directions' or set of mental statements replace old programs of muscle control (by "inhibiting") and enable new programs to be laid down (by "directing") that are more appropriate. There will be less inappropriate contraction of muscles involved in the movement although there will be the non-fatiguing contraction of muscles supporting the trunk and other limbs during the movement. The movement will be carried out more simply and with less effort. Sense of effort is an interesting aspect of our brain's control of muscles.

Control of muscles used simply for posture in sitting and standing will also show this improvement as the pupil gradually learns 'sensory improvement' and uses 'inhibition' (of old programs for posture) and 'directions' (to allow new postural programs to be laid down). In sitting and standing the pupil becomes 'lengthened' or more erect but there is less sense of effort in this occurring. There are two reasons for this: the 'directions' enhance the use of the extensor muscles of the trunk and reduce the activity of the flexor trunk muscles which cause one to hunch and contract down; secondly, the enhanced activity, or more appropriate use, of the extensor trunk muscles involves the action of non-fatiguable muscle fibres (red fibres) whereas old programs for using muscles for posture may have involved fatiguable (white fibres). Breathing also becomes easier and this also contributes to a sense of ease.

Section IV

ENDS AND MEANS

Another phrase that is important in Alexander's method is the need for pupil (and teacher) to employ the 'means whereby' a new process and program can be established, i.e. using the mental sequence described above whereby, with the assistance of the teacher's delicate touch by hand, there is an enhanced sixth sense; there is inhibition in acting unthinkingly and hence allowing the old programs to be used; and the 'directions' are used to allow the new program to be established. If the pupil, in wishing or willing to do something, unthinkingly proceeds to achieve the end result (I will stand up; I will speak etc) then the pupil has not used the means whereby, as described above, a new program can be established with its mental 'directions', but the pupil has unthinkingly gone for the end result or gained the desired end - 'end-gaining' is Alexander's term.

'End-gaining' is an important concept in the Alexander Technique. One of the various subtleties and challenges in experiencing the Technique relates to directing one's attention to recovering the sixth sense, of enhancing one's sensory awareness. One has to become aware and one has mentally to give 'directions'; but one is in danger of mentally achieving the end result, for instance, of sitting up more erect, but being stiff in doing this. One puts oneself into what one considers to be a good upright sitting position. One has taken a short cut or 'end gained' rather than employed the 'means whereby' there will be appropriate muscle tone or contraction for sitting upright. With trying to achieve a good position by shortcuts there will be inappropriate contractions of neck and trunk muscles and this results in stiffness. The person is worse off than before. Breathing, incidentally, will not be slow and deep but irregular, quicker and more shallow.

Here is a subtlety. One has to employ one's consciousness to give the mental set of 'directions' but one does not consciously tell, or order, the muscles what to do - the position or movement occurs, at least to a certain extent, at an unconscious and reflex level.

The role of the teacher

In practice it is only through the practical experience of a lesson with a teacher's expert hands that a person is given the awareness of deficiencies in her/his sensory awareness. As the teacher's hand touches muscles of the trunk and of the neck, the teacher senses the muscle state (over- or under-contracted muscles causing the person to be pulled down due to increased flexor tone) and at the same time directs the pupil's attention to the state of her/his muscles. When the pupil is about to undertake a movement, the teacher's hand may be gently placed at the neck to assist the pupil's sense of the neck and body muscles.

Section V

PRIMARY CONTROL

Alexander found that the state of the neck muscles which determines the relation of the head to the trunk was the central factor in affecting how muscles elsewhere were used. Control of muscles in posture and movement was primarily affected by the state of neck muscles with their strong sensory input to the brain. When the head is turned, caused by contraction of neck muscles, the effect is to prepare trunk and limb muscles for action.

The primary control is the brain mechanism (with an important input from neck muscles) which allows the trunk of the person to lengthen (extend) and widen, with the neck muscles releasing or relaxing and the head going in a forward and up direction so that the breathing is functioning efficiently (adapted from "Walter Carrington on the Alexander Technique, in discussion with Sean Carey", London: Sheildrake Press, 1986).

When Alexander made his first observations on himself he noticed that when he was about to speak he contracted his neck muscles and pulled his head back and down toward his chest. 'Back' in this context is a back rotation. After experimenting with himself, Alexander found that to prevent his head rotating back he needed to make a gentle forward rotation and extend, not contract, the neck as well as the trunk being extended. This was the origin for the 'directions'; namely "neck release, head forward and up, back lengthen (extend) and widen".

Interestingly but not unexpectedly, sensory input from the neck muscles are very important physiologically. The number of nerve receptors in neck muscles (muscle "spindles" - see below) is much higher than in other muscles. Thus there are many more sensory nerves from neck muscles which therefore will have important effects on the brain control of muscle.

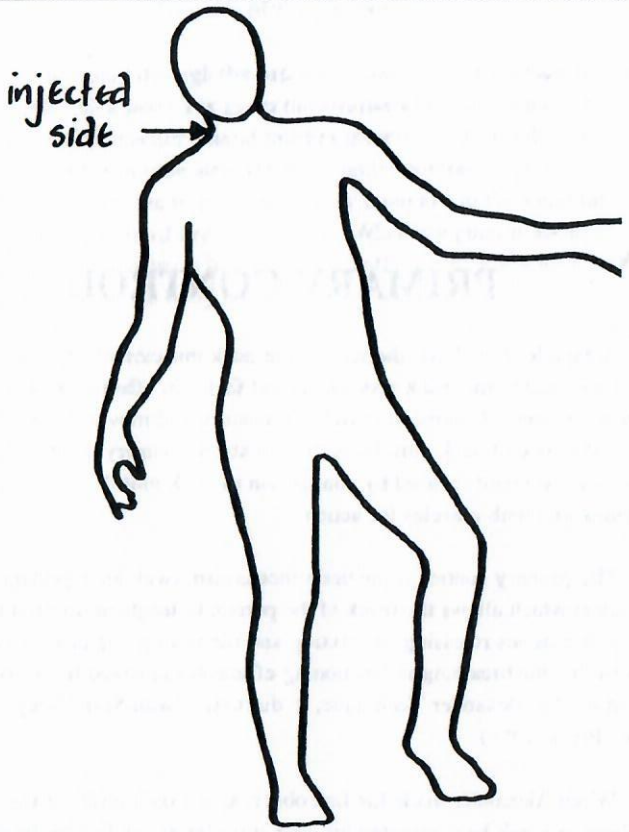

Figure 9. *An experiment on a volunteer (often the scientist) in which a local anaesthetic was injected into the muscles on one side of the neck. This anaesthetised (temporarily) the sensory nerves from the many sense organs ("spindles") in the neck muscles as well as anaesthetising the muscle nerve. The loss of muscle sensation and of muscle tone on the injected side gave an illusion of falling to that side. The person struggled to retain her/his balance. The experiment shows how strong the muscle sensations are from neck muscles normally comparable to inputs from the semicircular canals. When the semicircular canals are affected by a viral infection or unaccustomed movements, then they also give rise to dizziness, vomiting or inability to stand.*

A colleague of mine, Professor V. Abrahams (Queens University, Kingston, Ontario, Canada) is one of the leading medical scientists undertaking research on neck muscles and their function. His statement is, "the evidence then that the neck plays a critical role in posture is overwhelming". He and his co-workers have found that the small deep muscles of the neck are important since these muscles contain large numbers of receptors (spindles) which can be spontaneously active. Another line of evidence Professor Abrahams cites is the effect of injecting local anaesthetic into neck muscles of a human subject. (Let it be noted in parenthesis that the human subject is usually the chief research worker with a postgraduate student or a younger colleague carrying out the procedure. This occurs in my experiments).

When local anaesthetic was injected into one side of the neck muscles of the human subject, the person reported he felt drawn to one side 'like a bar of iron to a strong magnet'. The subject was unable to walk with any co-ordination but very much like a drunken person. When lying down he felt as if 'the couch was toppling over toward the side of the injection'.

This is dramatic evidence of how important sensory nerve inputs from neck muscles are, affecting as they do the brain's control of posture and movement. The effect of neck muscle inputs are comparable in importance to the inputs from the organs of balance in the inner ear (semi-circular or vestibular canals).

The head contains the important special sense organs of sight, hearing, smell, taste. As stimuli act on these senses, the head is turned to detect better a particular stimulus. Any movement of the head is detected with exquisite sensitivity by the neck muscle receptors. The strong inputs from the neck muscles then affect the muscles of the trunk and limbs to prepare the person to respond to the stimulus.

Neck reflexes

There are well-described neck reflexes in which inputs from neck muscle receptors combine with inputs from the organs of balance. For instance, the tonic neck reflexes relate to observations on cats (true also for human subjects); when the head is raised forelimbs extend or become straighter and hindlimbs flex or become bent. Another example is the righting reaction, much better developed in cats than human beings; when the cat is allowed to fall upside down from a height (onto a cushion) the combined inputs from the organs of balance and from the neck muscle receptors very

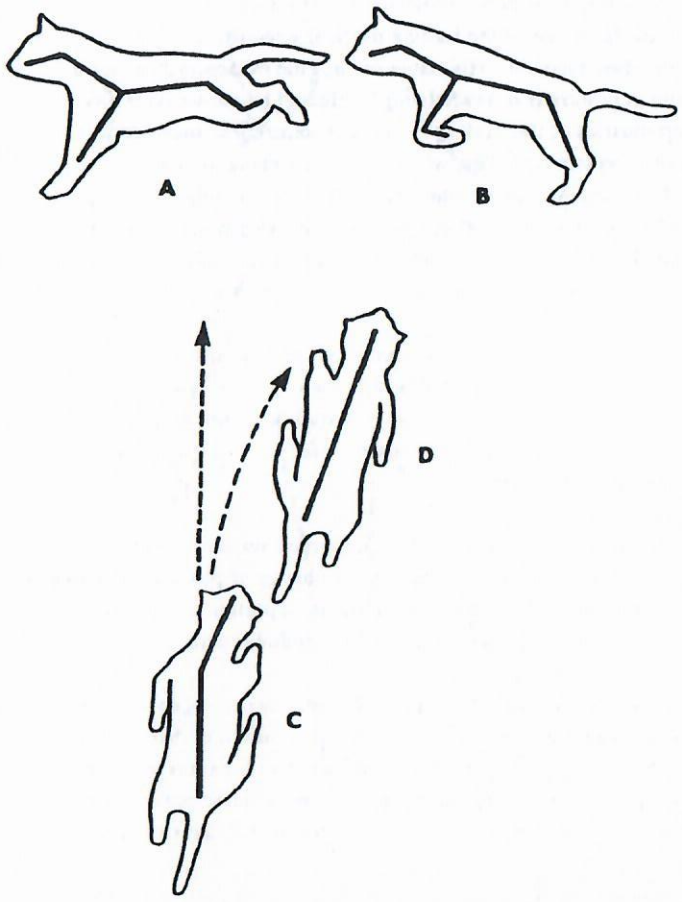

Figure 10. *This shows how inputs from the neck muscles affect the limbs due to the position of the head being changed in relation to the trunk of the cat A. When the cat's head is raised relative to the trunk, the front legs are straightened or extended and the back legs are bent or flexed B. Conversely, when the head is bent down from its normal position the front legs are flexed and the back legs extended C and D. When the cat is running and it turns its head to the right, reflex effects from neck muscles cause the limbs to bring about a change in direction of the trunk (from R.M. Berne and M.N. Levy editors, "Physiology", St Louis, Miss C.V. Mosby Co, 1983, p274.*

rapidly bring the head into the upright position and then promptly re-align the body into the upright position. The cat lands on its feet.

Thus the scientific evidence accords with Alexander's observation that the state of the neck muscles, and therefore the relation of the head to the trunk, is of primary importance. The dominating nerve inputs from neck muscles helps to determine how the brain controls muscles in posture and movement - primary control.

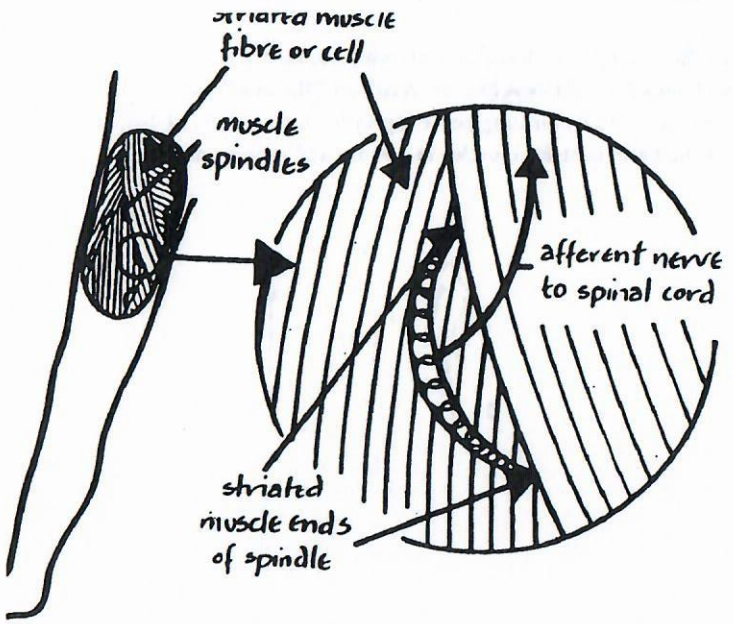

Figure 11. *The left hand illustration shows some muscles of the thigh. Muscle spindles are only a few millimetres long and are attached at a variety of points to the muscle fibres making up a muscle. On the right side is an enlarged view of a muscle spindle attached to a muscle fibre. The middle of the spindle is occupied by a nerve receptor sensitive to stretch and this gives rise to a sensory nerve which goes to the spinal cord and thence to the brain. The ends of the spindle are made up of very small lengths of muscle fibre. When the whole muscle is stretched (for instance when the thigh is stretched or the knee is bent), all the spindles in the muscle become stretched, their length-detection receptors are activated and their nerves fire. They act on the motor nerve to the muscle to activate it so that the muscle contracts which will stop or slow down the lengthening of the muscle.*

Section VI

PHYSIOLOGICAL MECHANISMS RELEVANT TO THE ALEXANDER TECHNIQUE

Muscle spindles

There are small receptors in muscle only a few millimetres long, called muscle spindles; muscle fibres themselves may run the length of a limb, say 40 centimetres long. The spindles have a complex structure but suffice it to say that, with their ends attached to the covering or sheath of the long muscle fibres, they become stretched when the muscle is stretched, causing the nerve from the receptor to 'fire' or send impulses to the spinal cord and so to higher centres and the brain. The first effect, however, occurs when the spindle is stretched and its nerve activated which then activates the nerve to the muscle causing the muscle to contract which results in the spindle become less stretched; so its nerve stops firing, no longer activating the nerve to the muscle and the muscle stops contracting.

This is the basis for the tendon reflex. A tap to the muscle tendon momentarily stretches the muscle with its spindles which then are momentarily stretched. Spindle nerves are activated when they activate the nerve to the muscle causing the muscle to momentarily contract.

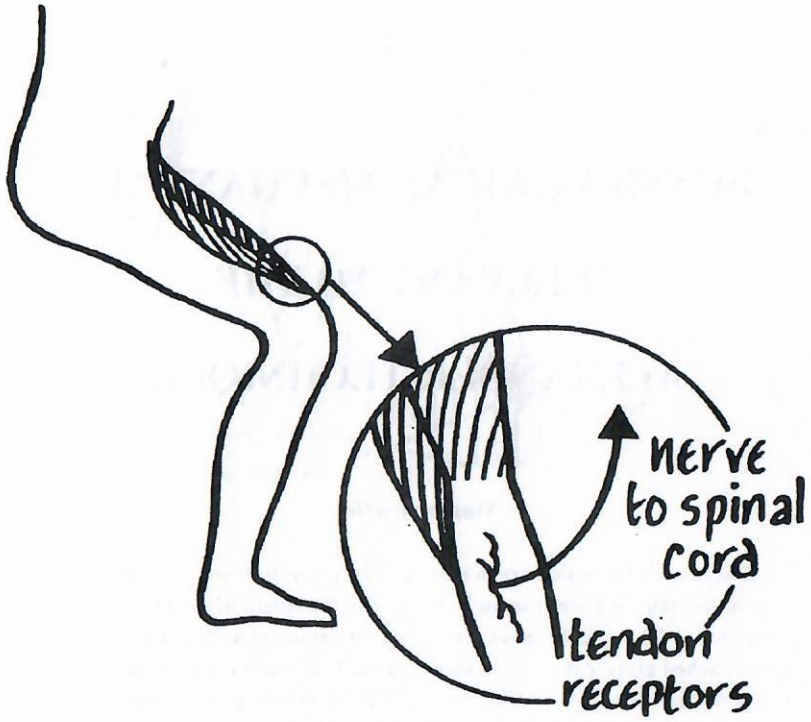

Figure 12. *The ends of muscle merge into tendons before being attached to bones. In the tendons are scattered receptors which are sensitive to the pull of the muscle when it contracts. When this happens, the nerve from the receptors is activated and acts in the spinal cord to decrease the firing the motor nerve to the muscle which will decrease the muscle contraction.*

Tendon receptors

There are specialised receptors in the tendons of muscles which are activated by tension on the tendon. As the muscle contracts, tension in the tendon activates the tendon receptors (Golgi tendon organs) and their nerves. These act via a connecting nerve in the spinal cord which has a negative affect on the nerve to the muscle, stopping or decreasing the nerve impulses so that the muscle contraction decreases or stops. The tendon receptor guards the muscle from overcontracting.

Skin and joint receptors

Skin strictly is the epidermis and underneath that is the connective tissue of the dermis in which are located receptors and their nerves and blood vessels. There are a number of specialised receptors which respond to vibrations and to pressure (or touch). These latter have important inputs for the sixth sense since pressure on the sole of the foot and stretching of skin over joints will contribute to the sense of position and of movement.

Muscle fibre types

Skeletal muscle is made up of muscle fibres which are actually cells. They have a membrane and a nucleus and chemical reactions for producing energy. The muscle cell/fibre is specialised for its work. It is a very long cell usually running the length of a muscle and it is packed with parallel arranged fibrils running the length of the cell. These fibrils within the cell/fibre have regularly spaced bands across them, hence the name striated muscle as opposed to smooth or non-striated muscle as found in the gastro-intestinal tract and in blood vessels. The striations are due to the arrangements of the basic units of the fibrils, the myofilaments, which are the units of the contractile process. When the nerve fibre is activated (or it fires) it activates or fires the muscle fibre. This releases calcium in the fibre and causes the repeating units of filaments to "pull" on each other, causing the muscle to increase its tension or to shorten.

There are two main muscle fibre types. In animals there is usually a preponderance of one or other type; that is, the red meat of beef or the white meat of poultry. In human beings the two types are usually evenly mixed in most muscles; most muscles in a majority of people have 50% of each of the two fibre types.

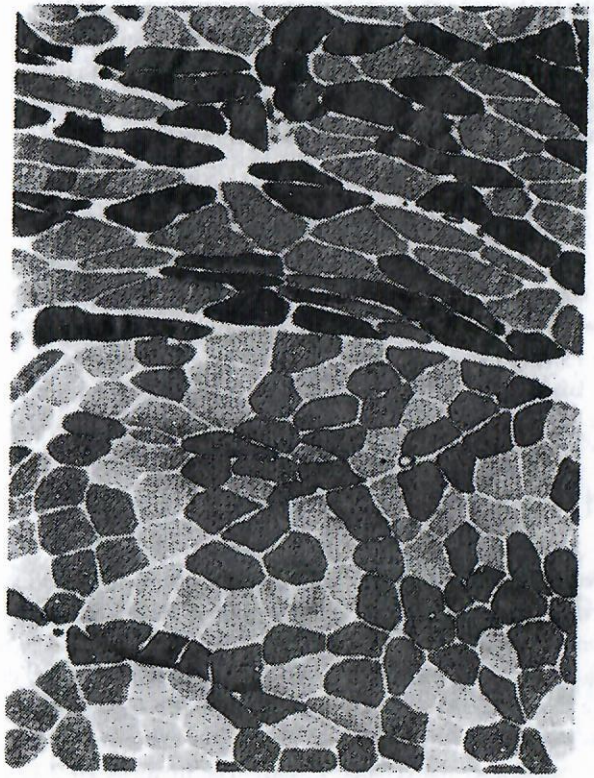

Figure 13. *This is a cross-section (muscle cut at right angles to its length) of a thigh muscle stained for an enzyme ATPase which is in high concentrations in white muscle fibres (here staining dark) and in low concentrations in red fibres (here staining light). The illustration is part of a study by Dr. T. Ly and the author on athletes.*

One type is the red fibre which is smaller and not as strong as the other type, the white fibre. The red fibre is not fatiguable (theoretically) because it uses oxygen to burn glucose and fat for energy and it gives off carbon dioxide. White fibres are larger and stronger but fatigue more or less quickly, using up their energy stores and producing lactic acid.

The red fibres are well suited for sustained contractions necessary for the upright posture, as well as during lower levels of rhythmic contractions. The postural role of the red fibres is important to emphasize in relation to the Technique; it is perfectly possible to use muscle at the low levels necessary to maintain the upright position, sitting and standing, without a sense of fatigue. Joints and other non-muscular tissues may give rise to discomfort if a person sits or stands motionless but red muscle fibres themselves will not fatigue.

For the average person with inappropriate muscle function, some muscles may be overcontracted hence bringing into play fatiguable white fibres; other muscles such as the back muscles may be under-used and the red postural fibres are not used adequately and may be atrophied. In the course of lessons the pupil is encouraged to "lengthen and widen" the trunk thereby beginning to use the red postural fibres". If these have not been used and are weak, it will take some time for the red fibres to recover their function and strength.

Of course, if the person tries too hard or self-consciously aims to be erect she/he may well become stiff; the result of "end gaining". Under these circumstances joints and associated tissues will become uncomfortable and also the white, fatiguable fibres may be activated. The person ends up worse than before. It reflects part of the subtlety of the Technique.

Thus the Technique is not about relaxation and or relaxing muscles. It is about using muscles, and their component fibres, appropriately and actively while avoiding over-contraction and stiffness.

A good indication of 'end-gaining' and of stiffness is the breathing pattern (see below). The more one stiffens or contracts one's muscles the more it tends to make breathing more shallow and quicker or more irregular. Slow deep, relaxed breathing is an indication of appropriate postural use of muscles.

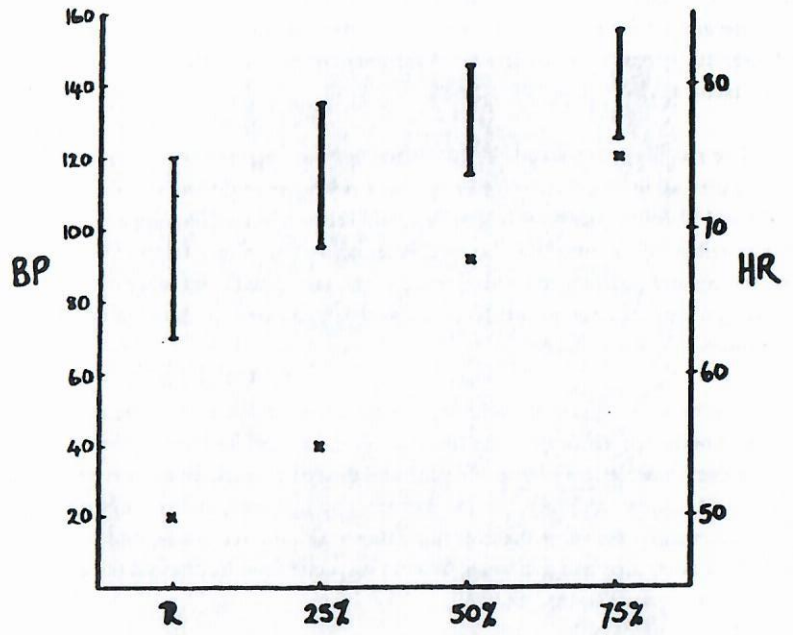

Figure 14. *Results of a simple experiment by the author on a member of staff (G. Shepherdson). With a handgrip strength tester (dynamometer), the subject's maximum grip was determined (52 kg). Then the subject's blood pressure (BP in millimetres of mercury represented by columns, I) and heart rate (HR in beats per minute, represented by cross, X) were measured at rest (R) and at 25%, 50% and 75% of his maximum handgrip. His resting BP was 120/70 and HR 50. With a handgrip at 25% of maximum his BP rose to 135/95 ant HR to 55 and so on. Note that only a modest muscle contraction at or even below 25% of maximum results in a marked rise in BP, more so for the lower (diastolic) pressure than for the upper (systolic) pressure indicating constriction of small blood vessels (arterioles) when the HR is not markedly raised.*

Breathing

The heart and blood vessels (cardiovascular system) and the lungs and airways (respiratory system) are two of the essential systems for life. Oxygen must be continually delivered to cells throughout the body and carbon dioxide removed. Both systems are under automatic control so that they continue with their rhythmic functions whatever the person's state of consciousness or unconsciousness. The nerve centres integrating the variety of inputs and outputs ("control" centres) are at the upper end of the spinal cord (brain stem) so that they continue to function even when the functions of the brain (or the cerebral hemispheres) are suspended.

Conscious control of breathing. One marked difference between the cardiovascular and respiratory systems is that it is not normally possible to affect consciously the functioning of the heart or the blood vessels. One cannot easily affect heart-rate and one cannot easily control blushing. On the other hand, conscious control is super-imposed on the automatic rhythmic function of breathing because of speech and singing and vocalization in general. We cannot stop our heart beating (that is, most of us cannot) but we can certainly stop our breathing, at least temporarily. There are, fortunately, irresistibly strong sensory inputs that make us start breathing again. Normally, of course, breathing is under the automatic control of a centre in the brain stem as well as under the control of the speech/singing centre, part of the conscious function of the brain.

Breathing, however, is also affected by other factors.

Muscle contraction, breathing and blood pressure. When one steadily contracts limb muscles for a period, it results in increases in heart rate and blood pressure and in breathing rate (respiratory rate). The greater the contraction, the greater the effect on these functions. Parenthetically, this is where a cautionary note should be sounded for those undertaking strengthening or body-building exercises. Heavy muscular contractions greatly increase the blood pressure which is a stress that a healthy cardiovascular system can cope with but it is much less desirable in an older person in whom the cardiovascular system may not be able to cope so well.

Trunk muscles and respiration. Research that I and my colleagues have been doing is to measure how much a person uses her/his back muscles (erector spinae) when standing and at the same time measure rate and depth of breathing. One group of subjects were Alexander teachers and another group untrained subjects. The Alexander teachers showed more activity in their back muscles when standing and their breathing was deeper and slower than the untrained group.

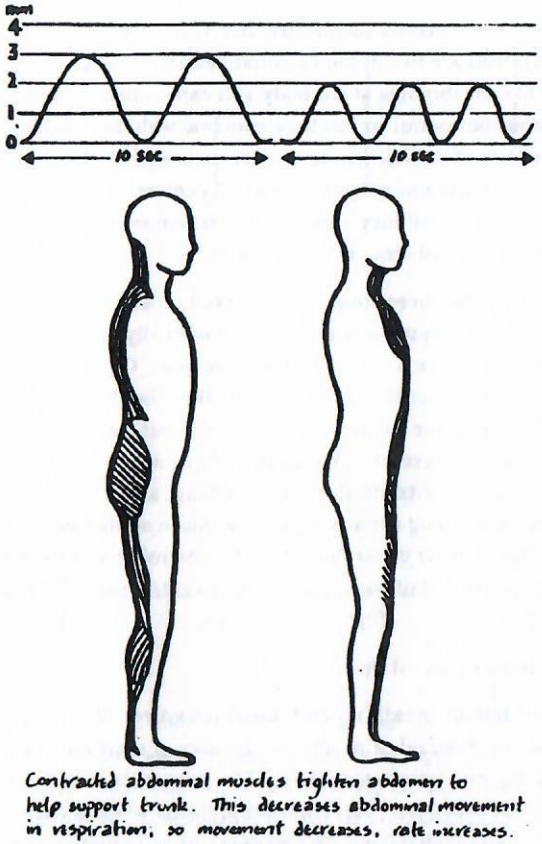

Figure 15. *The figure on the left represents a person with appropriate activity or tone in the extensor muscles and less tone in the flexor muscles; the figure on the right shows greater flexor-muscle activity. Above the figures, their respective respiratory movements are shown. For the left figure respiratory movement was 3 millimetres with 2 breaths in 10 seconds (12 breaths per minute); the right figure respiratory movement was 2 millimetres with 3 breaths per 10 seconds (18 breaths per minute). These observations were made by Ms. R. Robinson and Dr. S. Saraswati in my laboratory on Alexander-trained (left side) and non-trained (right side) subjects.*

This can be explained by proposing that if the back muscle is not contracting enough to keep the trunk upright then the abdominal and chest muscles are stiffened or contracted to assist in stabilising the trunk. If this happens, breathing movements are restricted and breathing becomes shallower and more frequent.

The quality of breathing is a good indication of the state of one's muscles. Slower deeper breathing is associated with appropriate use of trunk extensor muscles and no unnecessary over-contraction of flexor muscles. A recently reported study has pointed to the connection between mood and breathing. It was found that an improved mood (feeling well and confident and so on) occurred in those undertaking both aerobic exercise programs and hatha yoga. The feature common to both activities is that of deeper abdominal respiration. One's own observations are in line with this; when one is breathing easily so that one's breathing is slower and deeper than at other times, then one is also in a more relaxed and easier state of mind.

It is interesting in this regard to note the description of 'the breathing doctor" applied to Alexander early in his career. His technique resulted in improved breathing.

Sense of effort

A sense of effort is something we all experience frequently. It occurs when unaccustomed effort is required -- walking up more stairs than one is used to, running faster than usual for the bus, pedalling up an unusually steep hill, lifting something a bit heavier such as carrying a heavy suitcase. One becomes aware of the stress and the strain of the greater contractions of muscles as the muscles work harder and we become aware of fatigue if the effort continues.

There is some interesting physiology involved in this. There are specialized cells in the brain (from a specialized area of the cortex, termed the motor cortex) which run down the spinal cord to connect directly or indirectly with the nerves that act on muscle, called the motor nerves or motoneurones. Significantly, these brain motor cells have direct connections only with the nerves controlling the fine muscles of the hands. Our "will to move" our fingers has a direct line. Since the brain cell connections are indirect to the nerves of other muscles, our "will to move" these other muscles is correspondingly less direct. Of course, it requires sub-conscious programs to integrate the actions of all the muscles involved in an action - muscles to stabilise the trunk and to stabilize the joints of the moving limb as well as contractions of the active (agonist) and opposing (antagonist) muscles.

These brain cells have a feedback in the brain itself that conveys the message of the sense of effort. As muscles fatigue in carrying out a task, so more brain cell impulses are sent (termed the motor command) to activate more strongly the muscle or motor nerves to activate more muscle fibres to contract because of fatigue affecting the muscle fibres already contracting. As one sends more brain cell impulses so there is a greater sense of effort. That sense of effort comes from the feedback loop from the firing brain cells back to the cortex - a simple mechanism for the brain to check on the amount of activity of these brain motor cells. The more the muscles carrying a weight become tired, the more the brain motor cells fire and the greater is the feedback to the brain occurs and the greater is one's sense of effort.

A simple experiment can be done with the use of a physiotherapy vibrator, the head of which is a flat disc several centimetres across which the motor can vibrate at, say, 100 cycles per second. When this level of vibration is applied to the tendon of a muscle, the vibrations transmitted to the muscle activate the muscle spindles. As soon as the spindles are activated, they act via their direct reflex path on the motor/muscle nerves to the same muscle causing the muscle fibres to contract if these are at rest or contract more if they are already contracted.

Let us set up the experiment so that the subject is standing still (to make it simple) and holding in one hand a suitcase containing books. The muscles of the arm begin to fatigue, motor cells of the brain increase their firing and the subject has a greater sense of effort. If you ask the subject what he/she senses about the suitcase, the reply is likely to be, "the suitcase seems to be getting heavier". Of course, the weight of the case with its books remains the same. There is an illusion of an increase in weight because fatigue causes more brain cells to fire and more feedback and a greater sense of effort.

Now we apply the active vibrator to the tendon of the biceps muscle of the arm which is one of the main muscles involved in contracting against the weight of the books in the case. Immediately the subject says, 'Oh, it feels lighter'. Why? The vibrator activated the spindles which reflexly activated muscle fibres in the biceps muscle to contract thereby decreasing the impulses required from the brain cells, thus reducing the feedback so that the sense of effort becomes less.

Sense of effort and the Alexander Technique. It is tempting to speculate about the above mechanism in relation to the Technique.

The trouble with our untrained postures is that our muscles tend to be under- or over-contracted. Extensor muscles of the trunk (the back muscles of the erector spinae) are under-contracted; hence the Technique direction or order, "back lengthen and widen". At the same time, flexor trunk muscles (abdominal and neck muscles) may well be over-contracted, tending to pull one down and to hunch over. This may well also involve overcontracted muscles in the buttocks, pelvis, thighs, feet.

The sense of over-contracted muscles is suppressed, partly by habit and partly because the more a muscle is contracted the more it can suppress the muscle sixth sense.

Nevertheless, some impulses from the brain motor/muscle cells are necessary to keep the trunk flexor muscles contracted.

As the person undertakes Alexander lessons so the trunk extensor muscles become more active at a reflex level (partly due to muscle spindle activation) so that activation of cortical motor cells (with its feedback of a sense of effort) is not required. Also, there will be a reduction in the over-contracted trunk flexor muscles which reduces intra-abdominal pressure. Both factors are likely to give the person a sense of decreased effort in standing, sitting or moving. There is a sense of lightness and of ease.

Slow and quick movements

Although limb and trunk movements can be graded from very slow to very fast, a simple classification can be made between slow and fast movements. In Physiology these are given the names of ramp-like and ballistic movements.

Programs are laid down for controlling and organising such movements and the centres for the two types are in different centres. One centre is deep in the brain (in both cerebral hemispheres; the anatomical name for these centres is the basal ganglia) where programs for slow movements appear to be stored. The other centre is in that small brain for posture and movement called the cerebellum where programs for fast movements appear to be stored.

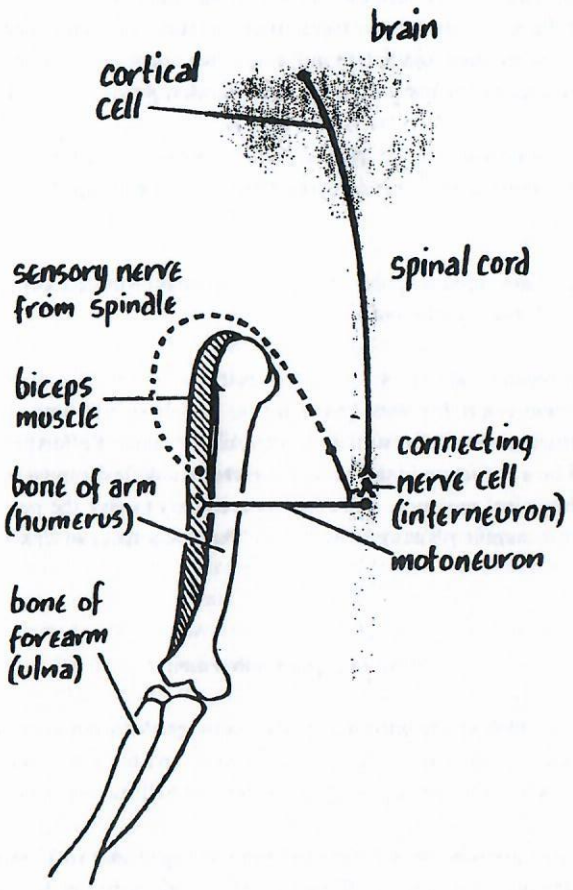

Figure 16. *The brain and the spinal cord are shown, together with the bones of the arm - humerus (upperarm) and radius-ulna (forearm) together with the biceps muscle. From the motor brain there descends a nerve down the spinal cord to end, via a small nerve or interneuron, on the motor nerve to the biceps muscle. From the biceps muscle spindles is the dotted course of the sensory nerve which enters the spinal cord to end on the motor nerve.*

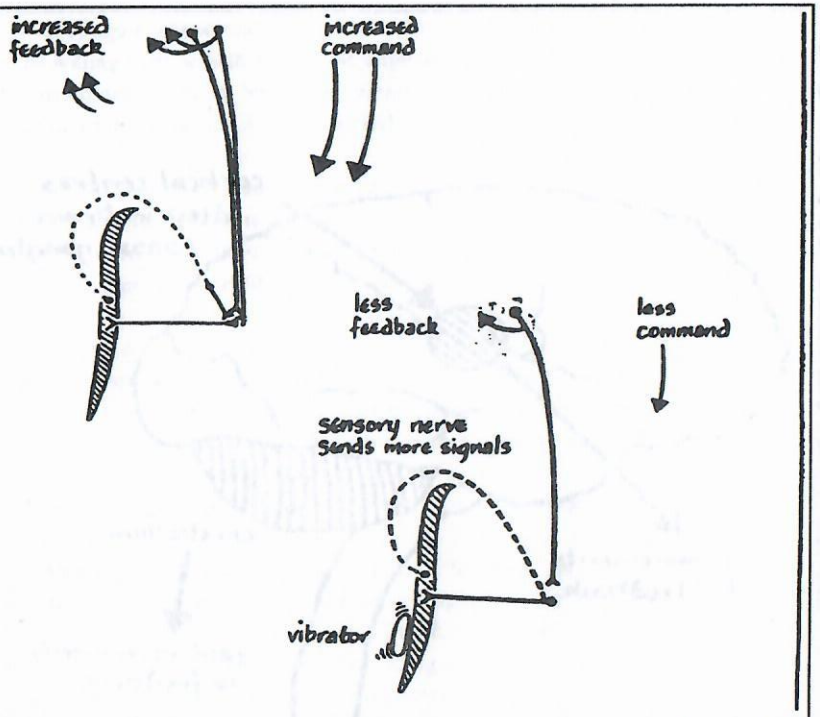

Figure 17. *On the left the diagram depicts events when a person carries a heavy load in the hand. The biceps muscle tires, the person feels the weight getting heavier and the motor brain has to send more signals (increased 'command') to get more motor nerve activity to the muscle to help it keep up its contraction. From the nerves from the motor brain are small branches that come back to another part of the brain giving a feedback of the increased cortical nerve firing and therefore giving a sense of more effort being required.*

On the right, is shown what happens when an active physiotherapy vibrator is applied to the biceps tendon. It activates the biceps muscle spindles as if the muscle were being lengthened. This causes greatly increased activity of the spindle nerves which now increase the activation of the motor nerve of the biceps muscle and greater contraction of the muscle. This means much less activation is required from the motor brain nerves and therefore less feedback occurs and hence there is less sense of effort. The person now feels the load has become lighter.

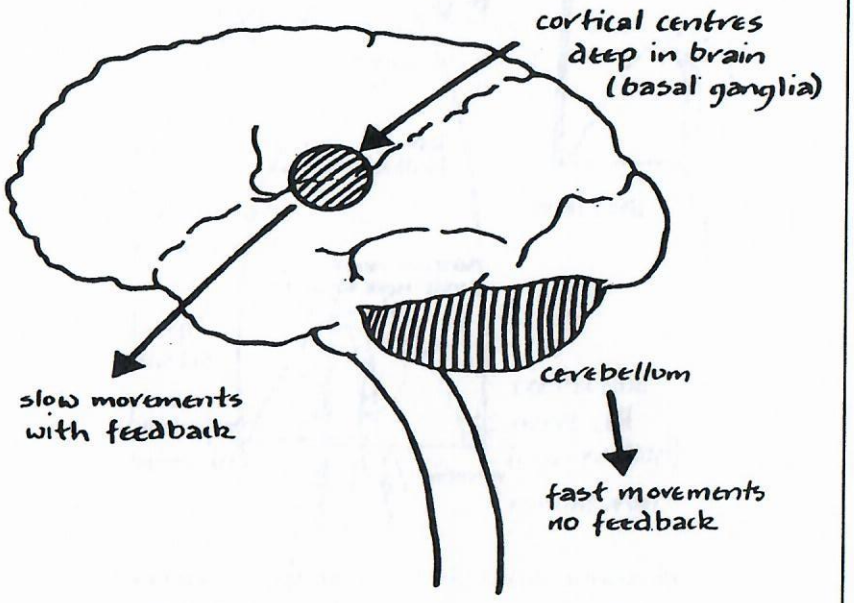

Figure 18. *Programs for fast movements seem to be stored in the cerebellum whereas those for slow movements are stored in centres deep in the brain. Slow movements allow time for feedback from muscle spindles, tendon receptors, joint and skin receptors. Slow movements are useful in the re-educational process of the Alexander Technique. Fast movements programmed in the cerebellum are necessary when required, such as leaping out of the way of danger or quickly grasping an object about to fall (adapted from A. Despopoulos and S Silbernagl "colour atlas of Physiology", 3rd ed. Stuttgart; Georg Thieme, 1986, p. 288).*

Once again it is pertinent to point out how limited we are in relation to wishing or willing to do something and the implementation of this as to how it is actually carried out. Once we 'will to do' something, then the organising and implementing of this is carried out sub-cortically and therefore sub-consciously.

An even more important difference exists between the two types of movement. The slow movement allows time for feedback. It allows time for information to be conveyed from the sixth sense of muscle activity and limb position. Slow movements are necessary if the sixth sense is to be made use of.

Tai chi, of course, is an obvious example of a procedure (of ancient origin) that is likely to improve a person's sixth sense with its emphasis on the quality of slow movements. The person's attention needs be directed to the movements as these are being carried out. The same applies to a pupil in an Alexander lesson. As her/his attention is directed to how muscles are being used in posture and in movement, so the sixth sense becomes re-awakened and so the basis for better muscle activity is laid.

With fast movements, there is no time for feedback. A program has been laid down which will be more or less effective depending on the skill the person used in establishing the program. A simple example of a fast movement is throwing a ball. The effectiveness of the throw will vary depending on practice, biomechanical efficiency, strength and so on. It is quite likely, even with good throwers, that some muscles will be used inappropriately, for instance with over-contracted muscles of the trunk and in the non-throwing arm as well as in the throwing arm.

Muscle states and mental states

The inter-relationship of muscle and mental states is probably one of the most important effects from the Alexander Technique. Other effects I have already alluded to - more effective use of anti-gravity muscles and decreased contraction of flexor muscles results in better biomechanical effects (reduction in headache, low-back pain, inappropriate posture), better breathing and a decreased sense of effort.

Everyone has observed on themselves and others the interrelation of mental and muscle states. If I am anxious, then my forehead and neck muscles contract more and so do trunk and back muscles and so on; breathing becomes shallower and perhaps irregular. In anger, chest and abdominal muscles become more contracted and breathing becomes

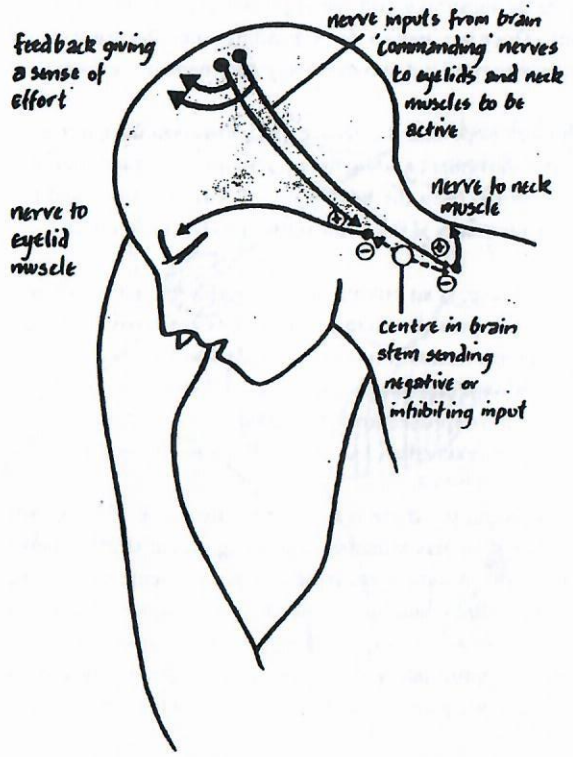

Figure 19. *This illustrates how the brain can create for itself the sense that muscles are difficult to use and hence the person feels tired. Cortical cells from the motor brain have a positive (+) effect on the motor nerves to the eyelid muscles and to the muscles of the back of the neck (extensor). From a centre in the brain stem there are activated periodically nerves with a negative (-) input to the motor nerves. It now requires more activation from the cortical cells to keep the motor nerves active and keep the eyelid muscle contracting to keep the eyelids open and to keep the neck muscles contracting to keep the head up. The increased feedback from the cortical cells gives a sense of increased effort. The person finds it hard to keep the eyes open and the head up and the person announces, "I'm tired".*

more difficult. One's face becomes red because blood is not able to return to the heart so easily from the head so blood is retained in the vessels of the face. In depression one slumps; trunk extensor muscles lose tone and the head, neck and trunk slump forward, and again respiration is impeded.

Sense of fatigue

An interesting example of how muscles determine a state of feeling is that of fatigue. This is an area I am doing some research on.

The sense of fatigue can be roughly classified as due to peripheral or due to central mechanisms. Peripheral fatigue is what one experiences after active exercise: One feels fatigued or tired because the muscles have been actively used. In sprinting and in sports requiring rapid movements, fatigue is due to a loss of the energy-containing compounds in muscle or due to a build-up of lactic acid in muscle. Running long distances results in loss of muscle glucose (stored as glycogen) which results in muscle fatigue.

An example of central fatigue is interesting as it relates to day-time drowsiness and night-time sleepiness. Amongst the various rhythms in brain function there is one that may have a three-hourly rhythm. Everyone experiences it at night and during the day, particularly if things are boring or it is hot. Eyelids tend to close, the head tends to drop forward. It can become overpowering and one says, 'I'm tired' or 'I'm sleepy, I better do something' - like move, walk, get a cup of coffee and so on.

In this case, one's muscles are not fatigued or tired. The muscles would have been used very little and are capable of doing quite a lot of contracting. The difficulty one has is in getting the muscles to contract, such as getting the eyelid muscles to contract to keep the eyes open and getting neck muscles to contract to keep the head up. The difficulty exists because it has become harder to activate the nerves to these muscles and hence one senses an increased effort in trying to get the muscles to contract. The reason why it is hard to activate these nerves it that the brain (actually the brain stem, just below the brain itself) has been sending inhibitory or negative nerve impulses (note - it may be somewhat more complicated than this but the effect is the same) to the nerves to the muscles making it harder to activate these nerves. And so one says "I'm tired. I can't keep my eyes open; I can't keep my head up".

The mechanism is more pronounced when surroundings are quiet (or proceedings are dull). Stimulating and exciting situations mask such a mechanism. With such a sense of drowsiness, one can take a number of options - get a cup of coffee, move and get some fresh air and so on. One of the most effective responses is to lie down on one's back with eyes closed but not asleep for a limited period like 10 minutes, or so. In fact, this is an area I am developing some research in, termed the alert-drowsy cycle. Like other body functions, there does seem to be a cycle of briefly feeling drowsy which wears off after a struggle if one does not take any other action. This cycle may be about every three hours but generally it is most noticeable in the middle of the day or in mid-afternoon. You might sometimes notice it after breakfast or at dinner-time. Of course, in mid-evening, drowsiness serves as a signal for sleep.

The point is, the brain uses muscles to create a feeling state of tiredness which then prompts the person to take some action. The muscles are not fatigued but they become harder to use and we sense tiredness or drowsiness.

Emotions then are expressed by muscles. This is most obvious with facial muscles. We look at a person's face to understand her or his mood as well as to interpret what has been said; was it said with humour or anger and so on.

Body Language

Body language is only slightly less obvious but still important. For instance, body language expresses a person's assessment of her or his social standing. When two people meet, the one sensing a lower social position will tend to stoop or bend, the other sensing a higher position will be more upright.

To be more aware of one's muscles, as occurs with the Alexander Technique, means not only easier movement but also being more aware of one's emotional state, particularly when this becomes a frequent state or one that persists. For instance, a tense or anxious person is like that over a period of time. Often the person is unaware of tenseness but the muscles are tense. It is likely that the muscles, programmed to be tense, will maintain a state of mental tension even when there is no external cause. Thus the muscle state (in anxiety, depression, anger etc) perpetuates the emotional state. To become aware of one's muscle state is thus to become aware of emotional or mental states. This awareness then provides the opportunity for breaking the cycle of, for instance, emotional tension --> muscle tension --> emotional tension and so on.

Access, as provided by the Technique, to one's muscle state provides one with the opportunity of a choice; for instance, "I do not wish to continue being tense; I will discontinue or inhibit muscle contractions or tensions". So one can break the habit of a non-productive mood.

The Alexander Technique, then, has relevance for the musculoskeletal system and for ease of posture and movement, preventing problems arising in the body. The Technique also has important implications for one's emotional state, for one's moods.

In fact, I surmise so many of us are interested in the Technique from the time we come in contact with it because of its integrating effect. The mind comes back in touch with the body and it gives a rewarding sense of re-integration, of being back in touch with oneself.

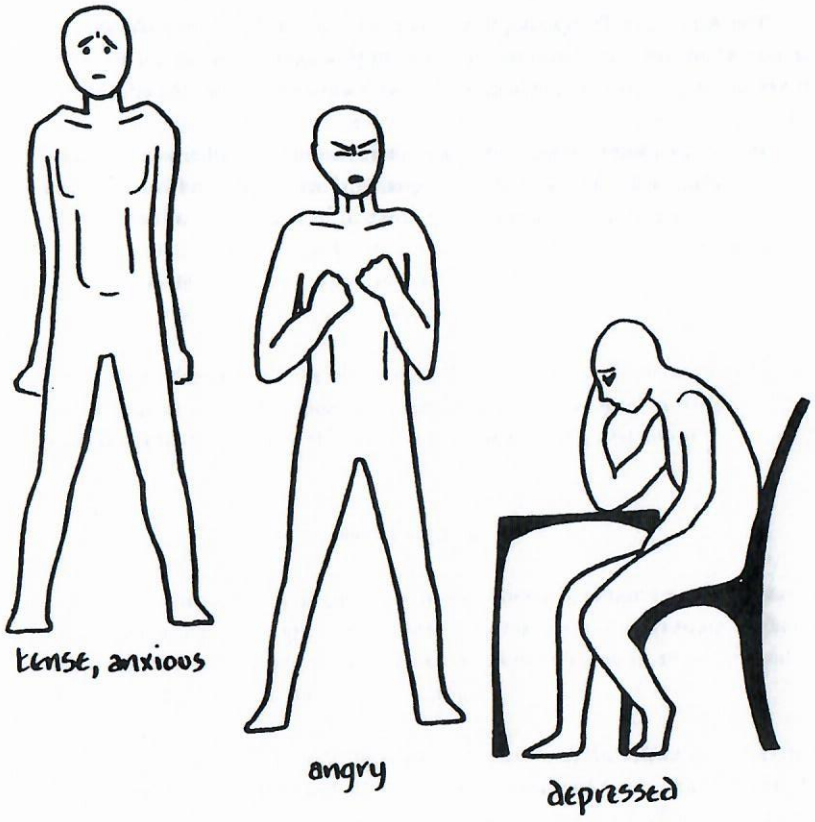

Figure 20. *The tense person has tense muscles such as hunched shoulders with rapid, shallow breathing. The angry person often takes a deep breath and contracts the muscles of the chest and abdomen. The depressed person has little extensor tone and the head, shoulders and back lump.*

Section VII

PRACTICAL ASPECTS

Can one learn about the Technique, and apply it, without a teacher? Certainly reading about it and talking about it can help. Information about it will help one's understanding and give one a general idea of what might happen and what effects one might expect. The problem is that the usual suppression of sensory inputs from the body's muscles and joints means one cannot know what one should be sensing; there needs to be input from a person with experience. Or if one does get some idea that one might have asymmetrical postures and over-contracted muscles (or under-contracted ones) then one's attempts to counteract the situation is almost certain to lead to overcompensation; for instance, overcontraction of one muscle group may be compensated for by overcontracting an opposing muscle group; leaning one way may be compensated for by leaning the other way.

One needs delicate sensory input and one needs to be prevented from trying too hard (or end-gaining). The skilled hands of a teacher provide for both these aspects. The teacher's sensitive touch makes one aware of one's state of muscle and thus of helping to make up for one's sensory deficit. At the same time the teacher prevents one from 'end-gaining' - trying to compensate for one's deficiencies by contracting muscles even more. With the manual and verbal help of a teacher one becomes aware of one's state of muscles and of the body so that one can stop (by 'inhibiting') stiffening or pulling down or over-contracting while at the same time allowing the anti-gravity muscles to contract appropriately against a background of 'giving directions' - of releasing neck muscles and allowing back muscles to lengthen. It sounds complex but it is simple in a step-by-step process; simple but subtle.

How many lessons?

One lesson is at least a beginning and eight lessons are a start in sensing where there might be problems; with twenty lessons one is getting an idea of how problems are being resolved; with forty lessons one is gaining confidence in inhibiting pre-existing habits of under- and over- used muscles and of establishing habits or programs of appropriate muscle use.

In fact, it is not easy to state what is the desirable number of lessons. It partly depends on age and condition. A younger person is less likely to be set in poor habits or programs of muscle use. An older person may have developed musculoskeletal problems as well having more established patterns of poor muscle programs.

It is really a matter of having as many lessons as you can as it develops into a voyage of self-discovery and re-integration. It does become an expense and hopefully in the future, the Technique will be included in some form of health insurance. In the mean time, my attitude is that it is surely reasonable to spend as much on your body as your car; although that may be overdoing it in practice although it is reasonable in principle - the cost of a car must be at least $50 per week without driving it.

In Australia there is the Australian Society of Teachers of the Alexander Technique, the professional association for trained teachers.

Listings in a telephone directory can be found under Alexander Technique.