

## Golgi Tendon Organs and Spindle Cells

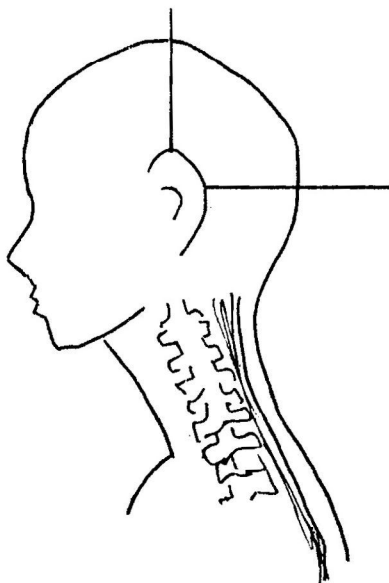
by Ann Holdway

For most of us the first time we hear the words "Golgi tendon organ" and "spindle cell" is in a Touch for Health class when we come to learn of them as part of a Touch for Health technique and possibly not much more than that. I would like to expand your knowledge by sharing with you some background information on these very important reflexes and the role they play in our bodies.

These two types of nerve cells, the Golgi tendon organs and spindle cells are part of the body's protective reflex system. Let's take a closer look at the role they play in our everyday lives.

### Spindle Cells

Our heads are held in an upright position by the tension maintained by the neck muscles, despite the natural tendency for the head to tilt forward. That's ten to twelve pounds being supported by these muscles. If you fall asleep in a sitting position the muscles in the neck relax and the head falls forward. This unexpected stretching of the neck muscles brings the spindle cells into action, they contract, which causes the person to jerk their head up. This protective reflex action has probably saved the lives of many a tired motorist and woken up many a bored listener.

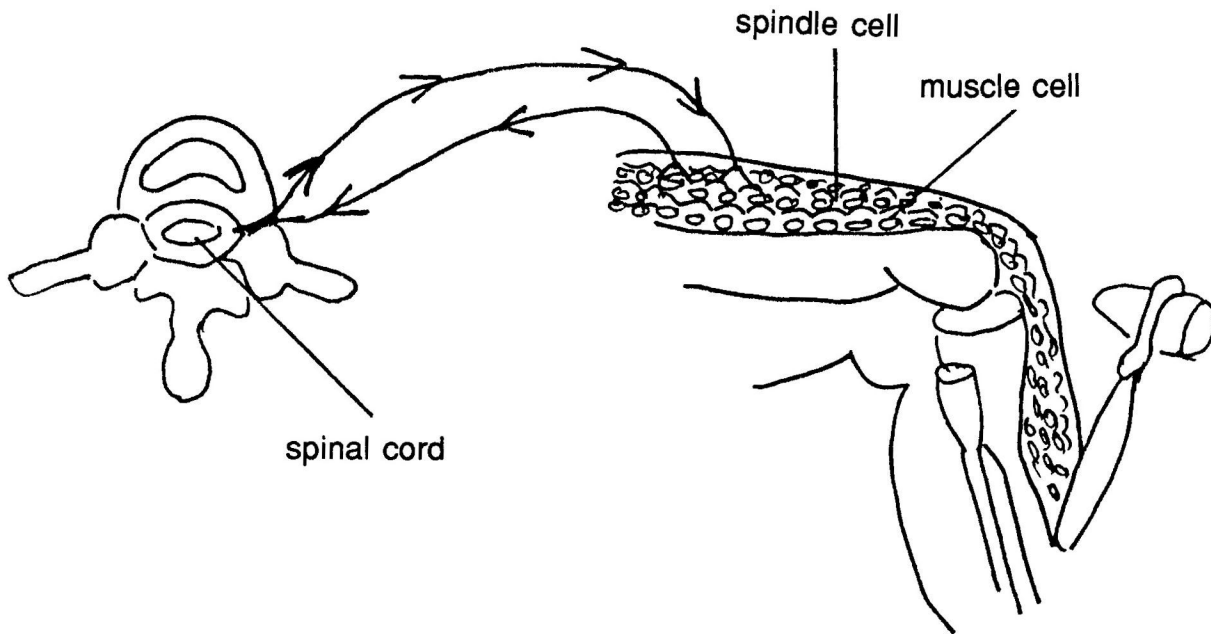


Spindle cells are long narrow cells that lie parallel to and are connected to the muscle cells throughout the muscle. They passively follow the movements of the adjacent muscle cells. When a muscle stretches, so do the spindle cells. If a muscle stretches too much so as to run the risk of injury, the spindle cells respond by sending a signal to the muscle to contract. This keeps the muscle from being injured. This protective mechanism is also known as the stretch reflex. The nerve impulses send messages to the spinal cord of the Central Nervous System. These messages travel to the brain and then back to the muscle which then contracts in response. The muscle spindle cell also responds when a muscle is stretched unexpectedly, but it will allow voluntary stretching when the movement is not too sudden.

When a doctor taps the ligament just below the knee cap, the muscle cells stretch. The spindle cell's reaction to this unexpected stretching is to protect the muscle by contracting, this is what makes the knee jerk. The delay between the tap and the kick is an indication of the time it takes for the nerve impulse to travel from the spindle cell to the spinal cord, to the brain and back to the muscle.

### Stretching

Suppleness and flexibility is a measure of the maximum range of movement we have in our joints and muscles. Suppleness declines with age; so maintaining flexibility is vital for an active old age. We can learn a lot by observing animals. Watch a cat and a dog stretch. They do it spontaneously, never over-stretching, not too quick, just naturally tuning up the muscles which they will be using. This is why, when you are carrying out stretching movements, you need to move into the position and just hold that position. Do not bounce or jerk. Fast or jerky movements can bring the spindle cells into action, but you can then bounce through or override this protective message, which has made the muscle contract, causing tiny tears



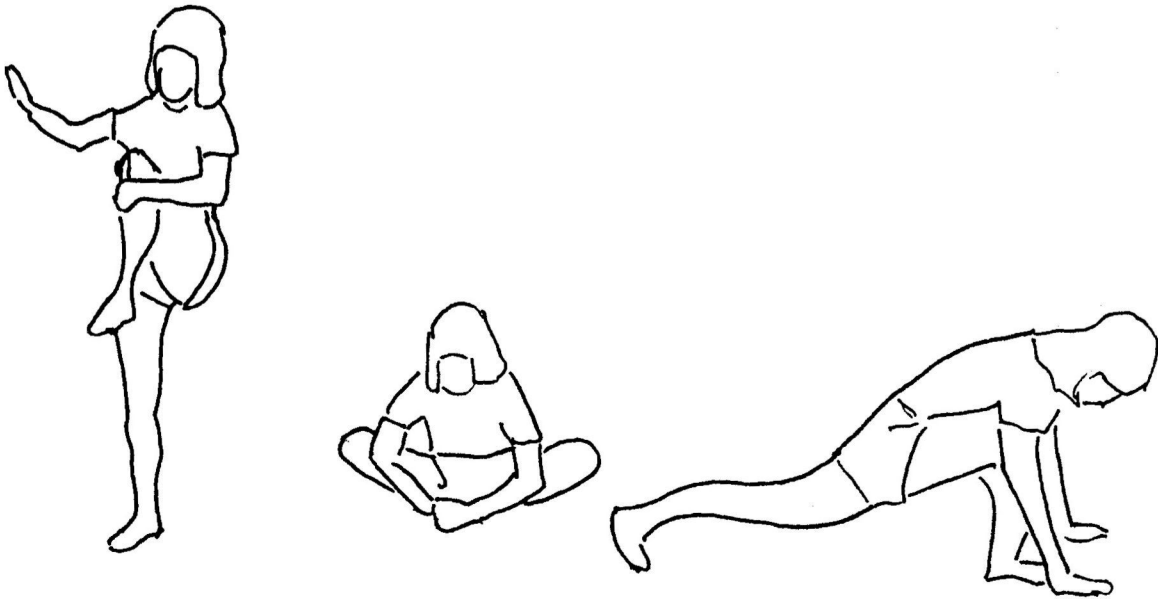
in the muscle fibres. This is the main reason why bouncing movements are not recommended. These tiny tears can lead to the formation of scar tissue in the muscle with a gradual loss of elasticity. It is a bit like putting the handbrake on in your car for added protection and then forgetting about it and driving off with the hand brake still on. I guess the drivers among us have all done this at some time.

What is happening when you hold a stretch? Static stretching has an effect on the soft tissue elements of the muscle, fascia, collagen, ligament, and tendon. When a person eases into a static stretch and holds the position, a number of things start to happen. First, the spindle cells quickly get used to that position and their role. This is called "desensitization". The spindle cells are not shocked into producing a reflex contraction since there has been no sudden movement, such as happens with bouncing type movements. The muscle relaxes in that position, and the soft tissue (collagen) starts to give. After about six seconds the muscle fibers also give. These changes in muscle physiology are sufficient in themselves to result in increases in flexibility. Beginners especially should be encouraged to relax or stretch only to the point of mild discomfort.

Muscles can be stretched further by increasing the tension in the muscle, that is, tension caused by elongation or stretching. This brings into action the inverse stretch reflex or as we know it the Golgi tendon organ reflex. When enough tension is created in the muscle either through contraction or stretching, the Golgi tendon organs are "fired" because of the change in length of the muscle. Some people think this a new discovery. In fact it has been used in physiotherapy work since the 1940's and is known as PNF (proprioceptive neuro muscular facilitation). Physiotherapists use PNF when they are working to restore an injured muscle to it's natural length. This technique is also used in flexibility training and is sometimes called the contraction-relaxation-stretching method.

Stretching is easy to learn and feels good when done correctly:

1. Stretch only after the body has been warmed up.
2. Ease into the stretch to the point of mild discomfort, not pain.
3. You should feel a pull or tightness in the bulky part of the muscle.
4. Start with easy stretches, hold 8 to 10 seconds.



5. Developmental stretches can be held for 15, 30, 60 seconds. Only carry out these movements when the body is thoroughly warmed up. Choose positions in which you can relax and stay comfortable for the length of time needed. As the muscle relaxes take the stretch a little further.
6. Breathe normally.
7. Work within your range of movement.
8. Stretching before and after your workout will keep you flexible and help prevent common injuries.
9. You need to stretch daily if gains in flexibility are to be achieved.

#### **TFH Spindle Cell Technique**

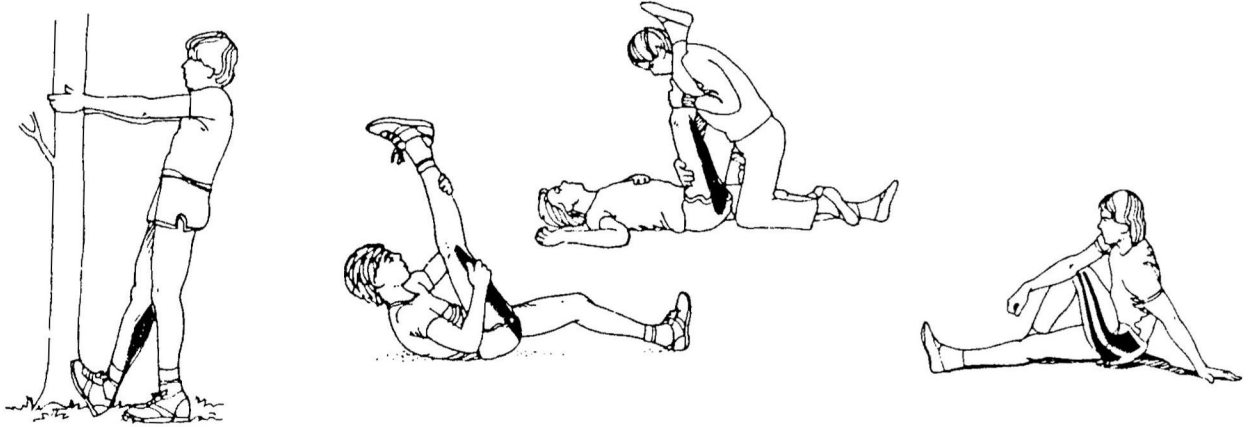
We work on spindle cells in TFH in reactive muscle repatterning. When we perform this technique, we go to the belly of the muscle and working in the direction of the muscle fibers we push the spindle cells together, working in the direction of the muscle fibers, to switch the muscle off. Pushing the spindle cells together crowds the cells and causes them to send the message to stretch and relax. If we were working on the spindle cells to switch on or strengthen that muscle we would pull apart at the belly of the muscle, again working in the direction of the muscle

fibers. Pulling apart causes the spindle cells to send the message to contract.

#### **Golgi Tendon Organs**

Golgi tendon organs are located at both ends of the muscle at the origin and the insertion. The Golgi tendon organs consist of fibrous capsules which are situated in the tendons near the origin and insertion points. These capsules are sensitive to both muscle strength and contraction, but cannot distinguish between the two. Golgi tendon organs also keep the Central Nervous System informed of the tension in the muscle. If the tension is too high, an impulse is sent from the Golgi tendon organ to the spinal cord to inhibit the muscle from contracting which would otherwise lead to increased tension; thus the muscle relaxes. This mechanism works like a safety valve to prevent damage to the muscle and the muscle attachments to the bones at the origin and insertion points due to over-contraction.

When sufficient tension is created in a muscle, the Golgi tendon organ will respond, causing the muscle to relax, and thus enabling the muscle to stretch further. This is what happens with PNF (proprioceptive neuromuscular facilitation). The method used in exercise training is for the person to take the muscle they are stretching as far as is



comfortable and then to tension that muscle group for about six seconds, usually by using an external resistive force, which could be a friend or wall. It is also possible to use your own body resistance. This produces an isometric or static contraction, and the belly of the muscle is somewhat shortened. When the contraction is released and the stretch position is resumed, it should be possible to reach further into the stretch than before.

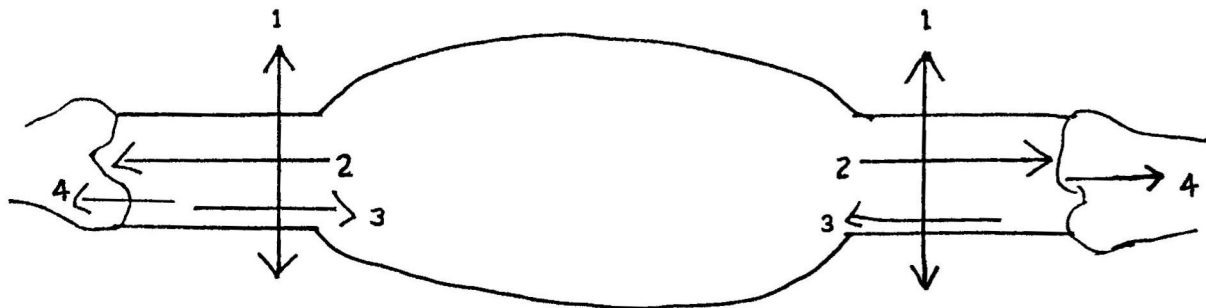
### TFH Golgi Tendon Organ Technique

We work on the Golgi tendon organs in TFH in origin and insert in massage. Golgi tendons can be manually stimulated, and we use this technique in a variety of ways in Touch for Health to help the body.

1. Origin-insertion massage to wake up or switch on a muscle: we work across both

ends of the muscle on the bone. This will switch on or strengthen the muscle. Use firm pressure.

2. To release an over tight muscle we place a hand on the origin and insertion of the muscle and pull or push apart. This sends a message to that muscle to relax and lengthen. This technique can be very useful when working with opposing muscles if one of the pair is overly tight. Muscle groups work in pairs. When one is contracting, the other is relaxing. Therefore, if the muscle group that should be relaxing and letting go, has started out with too much tension in it, there will be an imbalance in the movement and neither muscle group will be functioning properly.



3. A muscle can be too long or stretched. To correct this you place a hand at each end of the muscle and push towards the middle of the muscle. This will strengthen or switch the muscle back on. You are sending a message for the muscle to contract.
4. Another way of working with the origin and insertion of the muscle is when a muscle has been overworked, strained or injured so as to cause minute tearing of the muscle fibers. It has been found to be beneficial to apply firm pressure to the attachment, usually the origin, to re-establish contact, i.e. pushing the muscle fibres back on to the bone rather like pinning up wisps of hair that have gone astray.

### Summary

Therefore when we use the Golgi tendon organ and spindle cell techniques in Touch for Health, what we are doing is interrupting the signal being sent to the Central Nervous System and sending a new message so that the muscle responds appropriately.

In our everyday lives these protective nerve impulses play a significant part as defence mechanisms in the body. If they cease to function properly, the risk of injuries is greatly increased. Those of you who exercise or train regularly need to be aware that, when you are tired or cold, the protective reflex signals travel at a much slower rate.