

Littlejohn's pivots and the joints in the extremities are located more or less exactly on the crossings of lemniscates or in the center of loops. Here we can see that Littlejohn's model is not only structural but also functional.

The arrangement of the muscles in lemniscates facilitates a very energy-efficient execution of smooth movements in all planes. It becomes possible to convert potential energy into kinetic energy. Thereby, the effect of a spiral or spring is obtained (see the gait study in Chapter 3, p. 39). An additional advantage is the fact that pressure on the vessels, thorax, and abdomen is reduced.

*Note:* The greater the load that we must transport, the greater our muscular exertion becomes because we can no longer utilize the momentum of the movement. At the same time, this increases the strain on the joints, respiration, and circulation. Muscle contractions and joint blockages have the same effect.

**Fig 8.1** Motor units.

## 8.1 Muscle Chains

In the preceding chapters, we have introduced a number of muscle chain models. While some have certain similarities (Busquet and Chauffour, both from the French school), others are very specialized (Myers, Struyf-Denis). Each of the authors described their model from a particular perspective. For Rolfers, for example, certain aspects dominate more than for osteopaths or physiotherapists.

In addition, we described the mechanical aspect of cranial osteopathy, the Zink patterns, and Littlejohn's model of the spinal column. Furthermore, we determined that one of the main functions of the locomotor

system, namely the gait, reproduces the behavior of the spinal column and the pelvis, as described by Sutherland, Zink, and Littlejohn in their models.

For us, it is obvious that it is the muscles that form these patterns. This is by no means in contradiction to Sutherland's cranosacral theory. No matter whether a pattern is triggered by the skull, the trunk, or the extremities, the rest of the body adopts the same pattern (for economical reasons; to avoid burdening the brain). This is important from a cranosacral perspective because it allows the primary respiratory mechanism (PRM) to function free of stress.

This also explains why the segment or the skull is adjusted in the lesion pattern during treatments with the Sutherland techniques. This allows for a flexion and extension of the PRM that is as free as possible.

The muscle chain model that we propose differs from the other models in two essential respects:

1. We are convinced that flexion and extension alternate in the spinal column and upper extremity as they do in the lower extremity. The definition of flexion is the bringing together of both ends of an arch; extension is the distancing of the ends of an arch. The spinal column consists of three arches, of which two are dorsally concave, and one is ventrally concave. Accordingly, flexion of the cervical spinal column (CSC) is a posterior flexion, that of the thoracic spinal column (TSC) is an anterior flexion, and that of the lumbar spinal column (LSC) is again a posterior flexion.

This perspective on flexion and extension of the spinal column is interesting in that it accords with Sutherland's model. Cranial flexion corresponds to an extension of the spinal column, that is, an extension of the three arches. Cranial extension is the opposite.

On the upper extremity, we also find an alternation between flexion and extension (upper arm in extension, elbow flexed, fist extended, and fingers flexed, see the position of the arm during writing). We believe that a slight flexion in the elbow and a medium position between pro- and supination constitutes the neutral position of the lower arm.

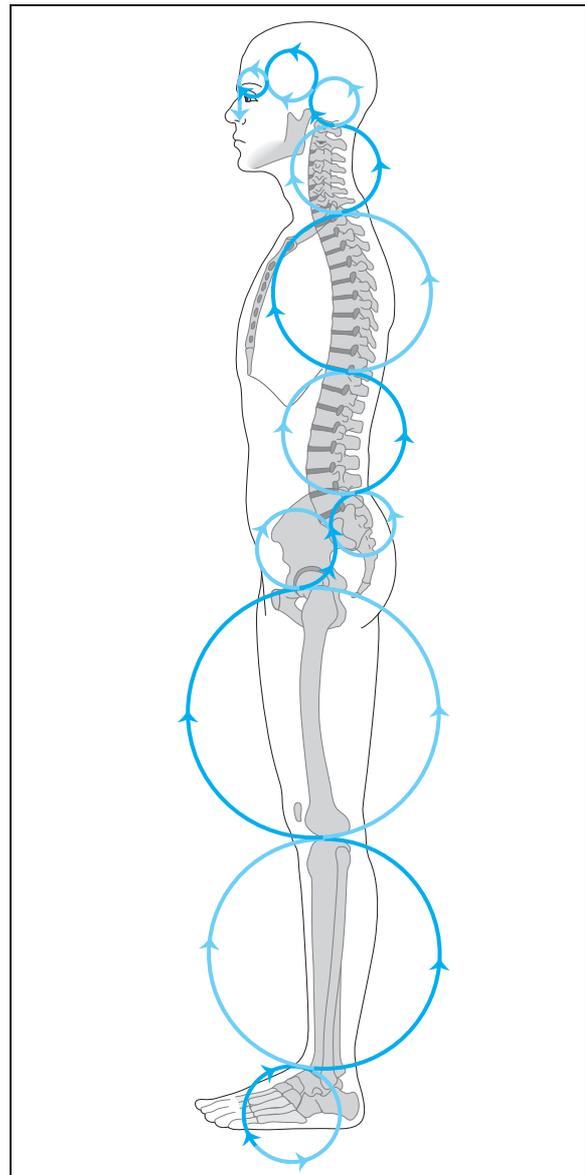
2. In our opinion, there are only two muscle chains in each half of the body:
  - a flexion chain; and
  - an extension chain.

As described by Sutherland, external rotation and abduction are associated with flexion, and internal rotation and adduction with extension (see **Figs. 8.2** and **8.3**). This results in the following combinations:

- Flexion + abduction + external rotation
- Extension + adduction + internal rotation

*Note:* We point out again that cranial flexion corresponds to extension in the parietal plane.

The arrangement of muscles in the shape of lemniscates permits a continuity of myofascial chains between individual spinal column segments and thereby creates connections between right and left. The same is true for the extremities.



**Fig. 8.2** Behavior of individual motor units in case of dominance of a flexion pattern (*bright blue*) or extension pattern (*dark blue*).

The inhibition of the antagonist and the crossed stretch reflex are the neurophysiological foundations for the formation of torsion patterns.

Before describing the muscle chains, we first want to describe the functional motor units of the skeleton: