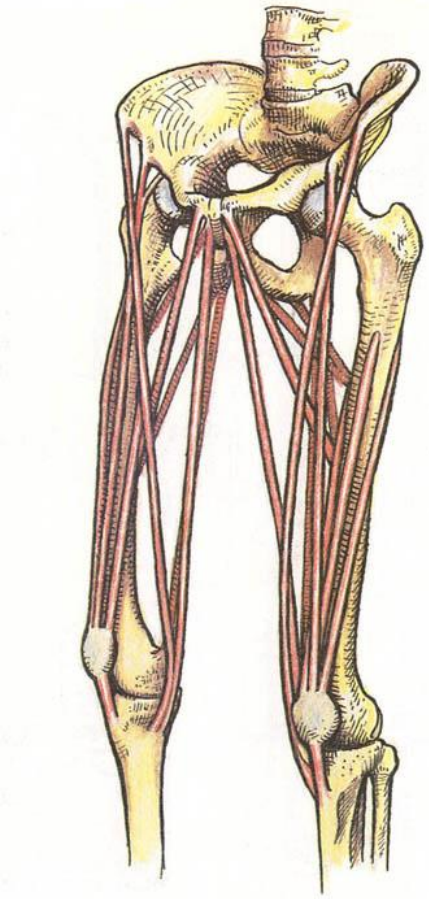
The Science of Contortion



Like a bridge, the body is held up by beams and ropes – the body uses bone, muscles and ligaments (made of collagen).

Reproduced from “Hyper-mobility of Joints”

A forward bend at the hips depends on having long muscles along the backs of the legs.

Backbending is more demanding, as it depends on extensible ligaments as well as muscles.

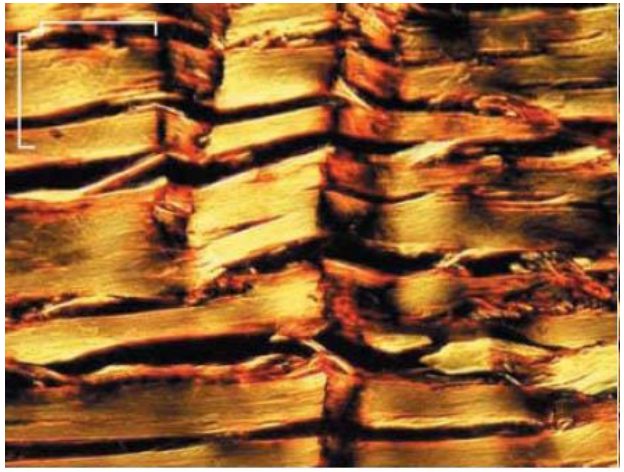
There are two views of the origin of contortionists' hypermobility:

1. The medical profession sees sick people who may have weak body tissues, who often have weak collagen (collagen disease). These patients are often hypermobile. Therefore they think that contortionists' hypermobility is due to weak collagen.

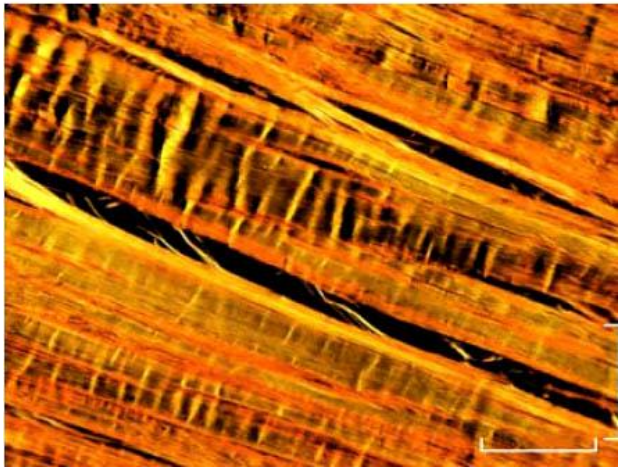
Inherited disorders of collagen include diseases such as Marfan syndrome and Ehler's-Danlos syndrome. These can lead to major disability and in some cases death. Contortionists are sometimes described as having Ehler's-Danlos syndrome. However, without an actual genetic test this is just supposition.

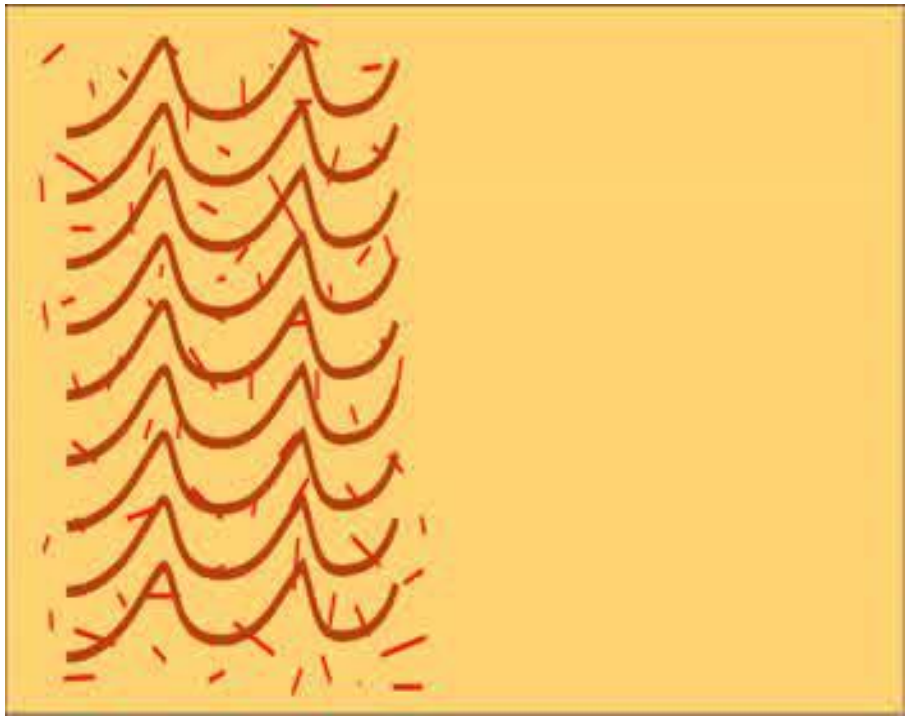
2. Contortionists are very strong. They have strong collagen, though it is very extensible. Therefore the medical view may be wrong for these individuals. The exercise community suggests that contortionists' hypermobility may come from other causes: e.g. a different molecular arrangement of the collagen and/or its associated molecules, which allows this greater extensibility.

Relaxed



Stretched





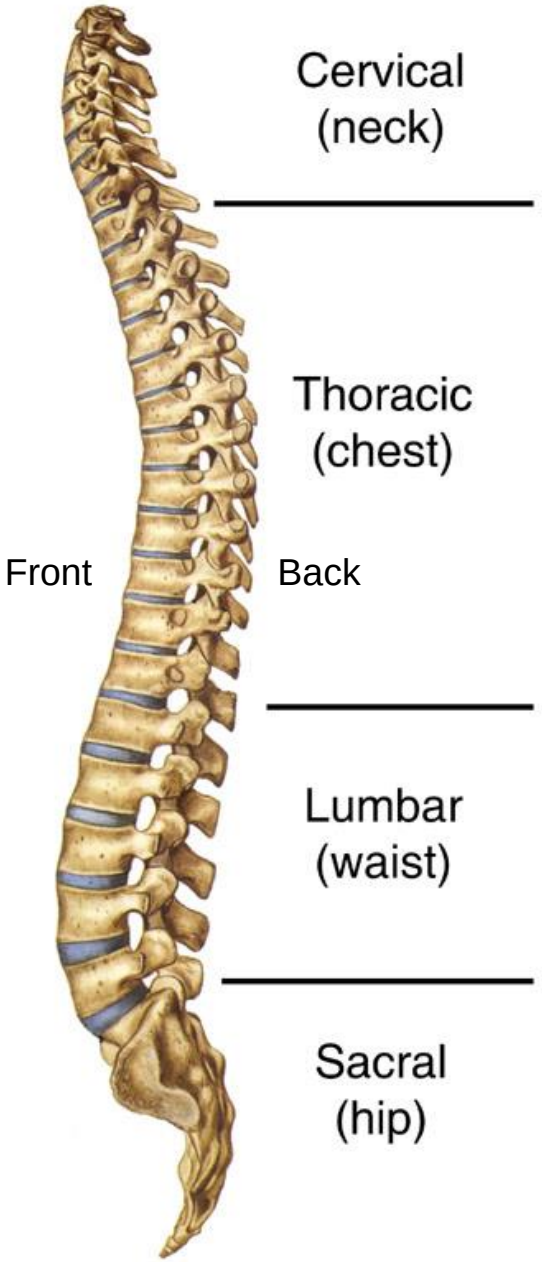
A microscopic closeup of collagen fibres show that they have a zig-zag structure – this is called **crimp.**
The crimp allows the collagen to extend.

The spine has 24 segments in all, plus the sacrum.

Most of the movement occurs at the neck (cervical spine) and the waist (lumbar spine).

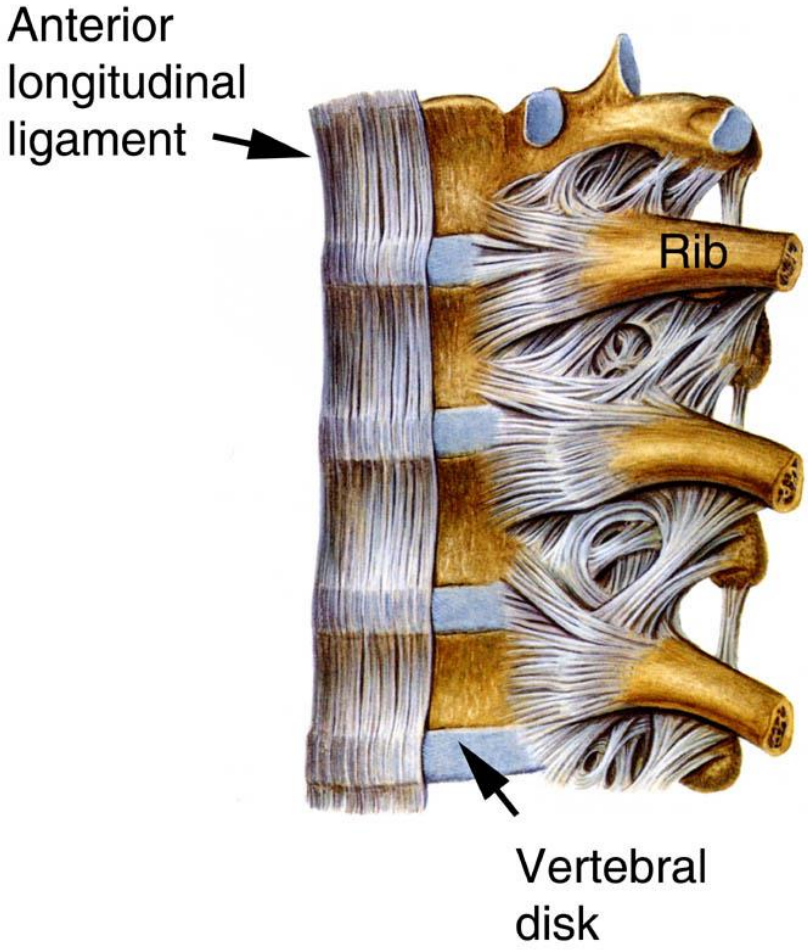
There is very little movement in the thoracic spine, because the ribs and the shape of the vertebrae stop movement.

Understanding how the segments (vertebrae) fit together is very important for understanding bending.

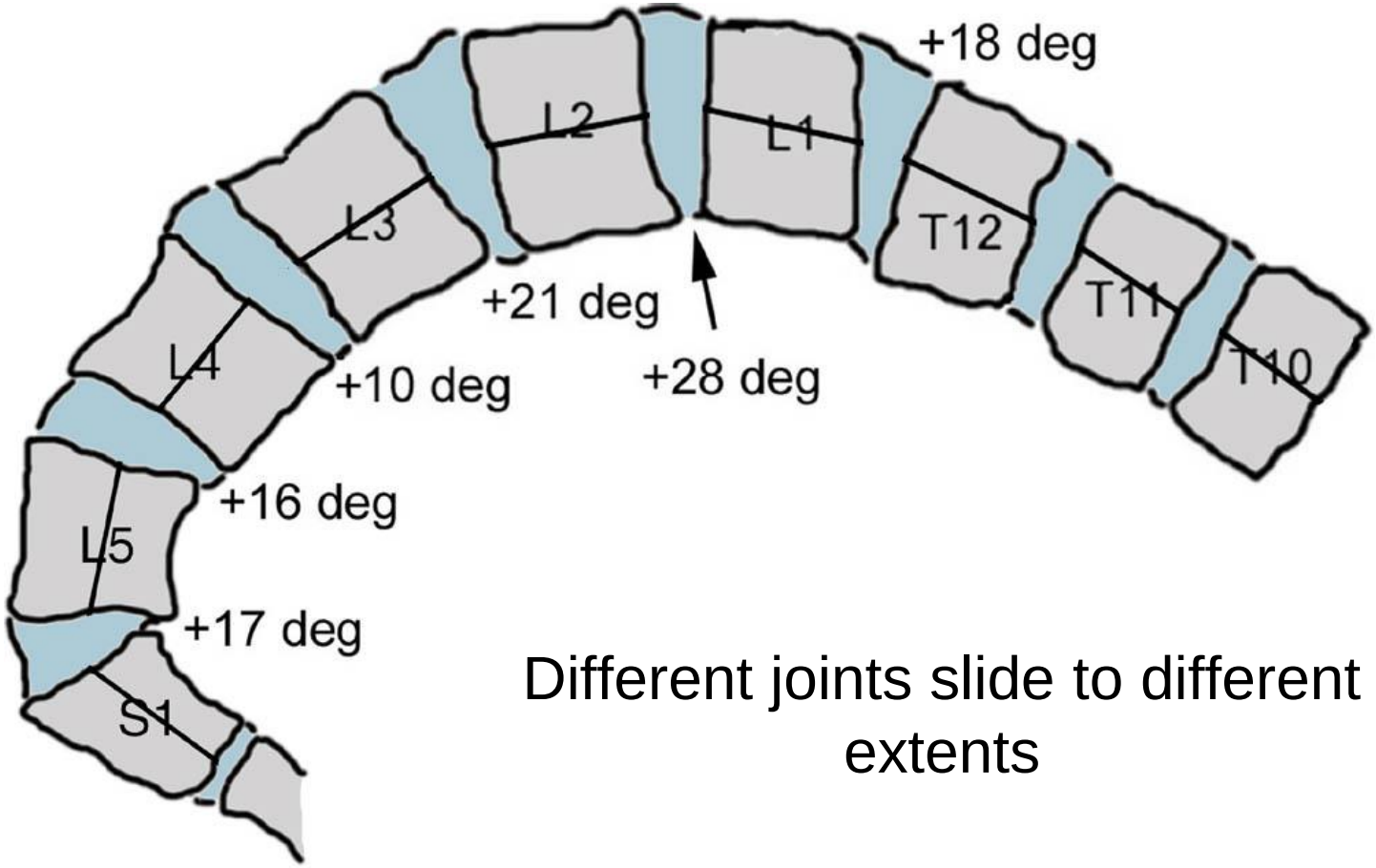


The exact shape, curvatures, and angles of the facet joints affect the amount of bending and rotation possible at each segment.

The amount of backbending possible is determined by how much structures at the front of the spine can stretch, and by how much space there is between the structures at the back of the spine.



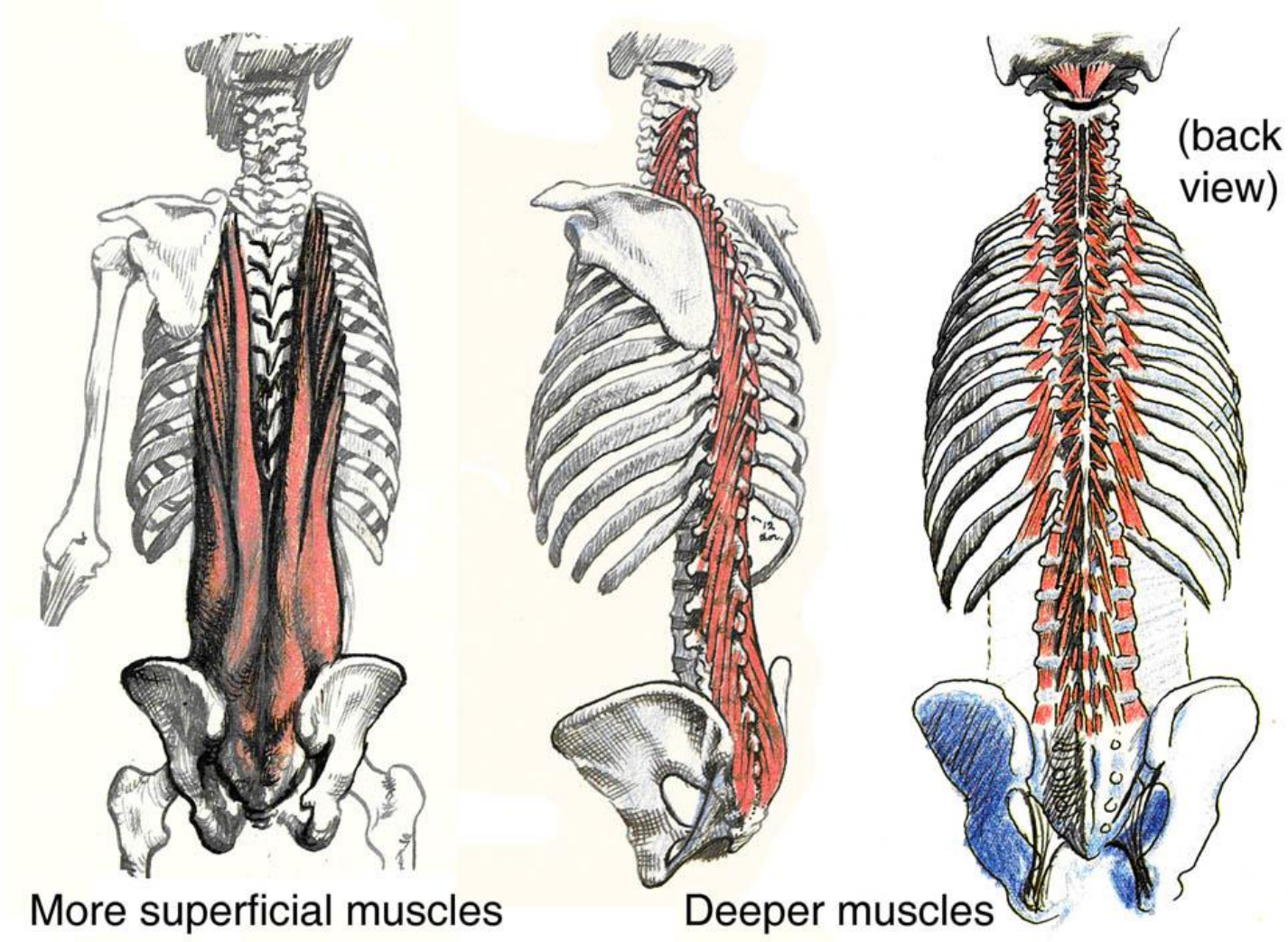
The upper vertebrae may slide back a little during backbending.



Different joints slide to different extents

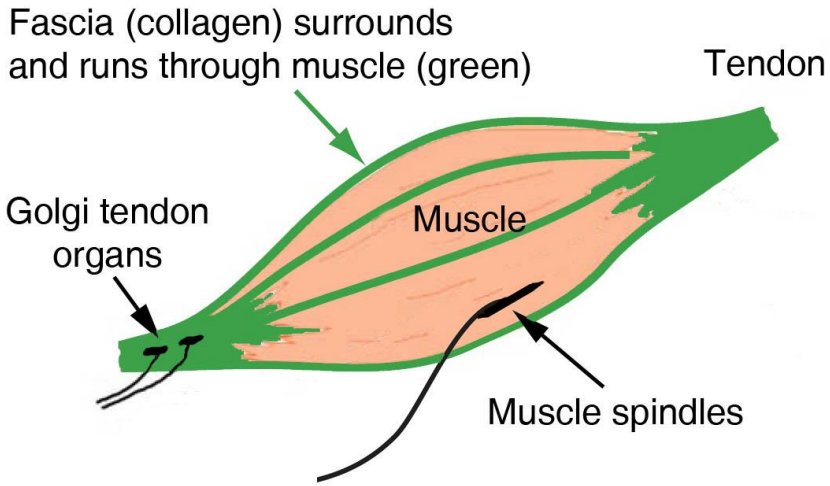
Tracing of x-ray from Zlata (Julia Gunthel). The total bend at these 6 joints is110 degrees. The rest of the total she can achieve comes from the other thoracic vertebrae (probably 50 degrees), the hips (90 degrees), the neck vertebrae (40 degrees), and the tilting of the skull.

MRI of spine of contortionist backbending



The back has many sets of muscles. The more superficial long ones are the “prime movers” used for heavy lifting. The shorter deep ones control the movement of the individual vertebrae. It is very important that contortionists have good control of these muscles.

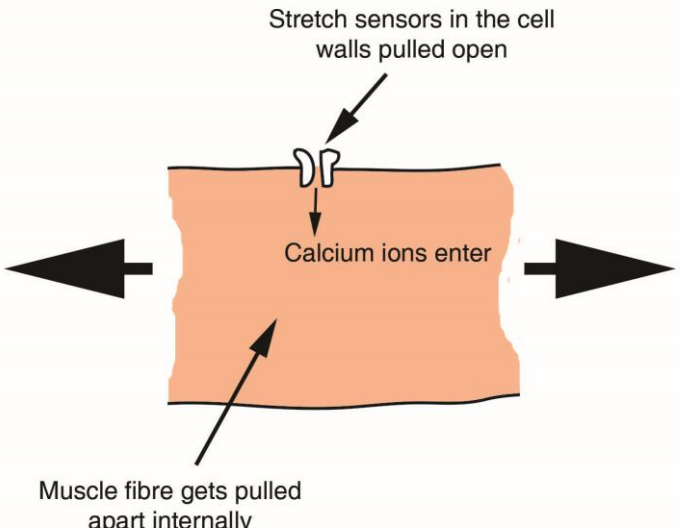
How do we stretch muscles?



Muscle spindles detect stretch in the muscle – by a reflex, they make the muscle contract. When learning to stretch, we have to learn to stop this happening (by relaxation).

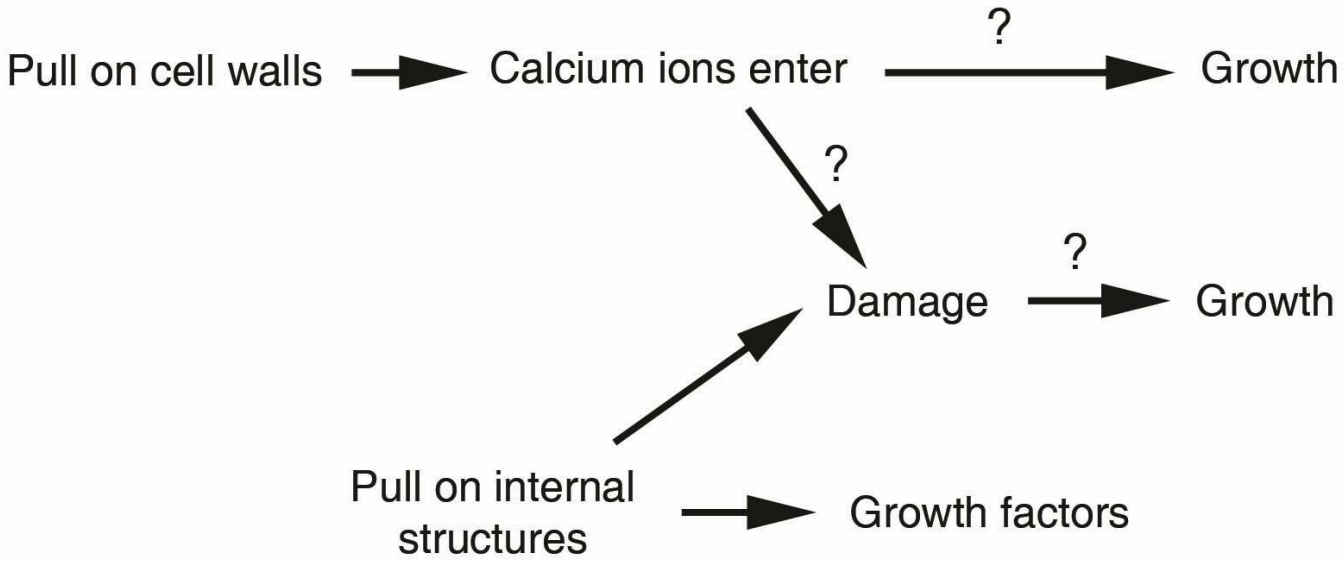
Golgi tendon organs detect tension in the muscle – they switch muscle contraction off, to stop it tearing itself apart. We can use this reflex in stretching.

Muscles contain a lot of collagen in the fascia surrounding the muscles. This collagen has to be stretched too.



We want the muscle fibres to grow longer as a result of stretching them. It is not exactly known how this happens. Stretches which make the muscle grow longer also seem to cause some degree of damage.

We do not know if it is possible to stretch muscles fast and effectively without causing any damage – which would be nice.




The End
and happy contorting!