TENSEGRI-TEACH

Tensegrity is a balance of forces that reach a stable but dynamic equilibrium. It manifests when a continuous web of attractive forces (pulling in) is counter-balanced by several non-continuous, repulsive forces (pushing out). This balance results in a system with maximum efficiency of spatial organization and energy expenditure. These forces can be non-visible such as gravity or visible such as wooden sticks and rubber bands. Tensegrity can manifest in anything from the smallest atoms attracting and repelling each other, to planets, stars, and solar systems. Many systems in nature will naturally organize this way due to its high efficiency, minimal resource requirements, and resilience to external forces.

Force distribution: Since tensegrity is a continuous tensional network, any changes in one part are immediately distributed through the whole network as evenly and widely as the composition of the network allows. A network composed of rubber bands will distribute tension differently than one composed of metal wires – both do so as efficiently as they can through the whole network. This means that an impact in one part will immediately be distributed globally at the speed of kinetic force (the speed of kinetic force is the speed that one molecule pushes on the next which pushes on the next. It is equal to the speed of sound through that material – 670 MPH through rubber and 7400 MPH through wood.) Since force is being distributed so fast through the system it prevents force from accumulate at one spot and ensures the sustainability of the system.

Spatial adaptation: Such a continuous network also means that if one spatial relationship within it changes, all spatial relationships change as the network adapts. The system responds as a whole – always.

Global expansion and contraction: As tension is added to a tensegrity and it distributes that tension globally and adapts spatially, all the tensional members will be a little tighter and the system will contract three dimensionally. The tighter the tensegrity, the more stable and less adaptive it becomes, until eventually it turns into a solid or breaks. As tension is removed from the tensegrity, it will release globally, all members will adapt spatially, and the system will expand three dimensionally as all the tensional members loosen a little. The looser it gets the more dynamic and adaptive it becomes, until it becomes floppy and collapses.

The field of **Biotensegity** is a natural evolution from the study of tensegrity and explores how tensegrity manifests in biological systems; from viruses and cells, to tissues and even whole living systems. In the human body, the fascial web, composed of collagen and elastin fibers, organizes and holds every cell in place, defining its mechanical environment and spatial relationship to its neighbors. Thus, the fascial web is an intricate, three dimensional web of tension organizing around strong bones that resist compression. The skeletal system is organized, balanced, and suspended within the fascial web. Where the body needs to be able to control the length and tension in the tensional members of our Biotensegrity, it will grow muscle cells in the fascia (myofascia) with the nerves to control them.

Biomechanic implications: The shift from a compression based, mechanistic model of the body to a tension based, relativistic model is quite radical. It moves us away from the parts based perspective of ‘the whole is equal to the sum of the parts’ towards a systems based perspective of ‘the whole is greater than the sum of the parts’. Biotensegrity unifies our system into a seamless, fascially organized whole managing forces with maximum efficiency - a dynamic system where everything is involved in all function, at all times, no matter what.

Functional implications: Tensegrity suggests a built-in sustainability. If a high load is added at one point, it is distributed globally and managed by the whole system, making it much easier and less dangerous. That load could be absorbed into the soft tissue and dispersed via its visco-elasticity as in when landing a jump, or it could be focused into the fascia and concentrated for reuse through elastic recoil (Fukunaga 2002). Also, the system could organize the force distribution into a reverse flow creating force concentration (think of Bruce Lee’s one inch punch that could knock down an opponent).

Therapeutic Implications: Our bodies grow based on how we use them. If there is chronic tension being added due to posture, work, or somato-emotional embodiment it is distributed globally and, over time, grows into our myofascial Biotensegrity. Any adhesions or imbalances grown into the myofascia reduce its ability to lengthen, shorten, or glide and thus reduce local adaptability and strain distribution. The potential for our Biotensegrity to manage forces with maximum efficiency becomes limited and the risk of injury increases.

Local limitations impact distal tissues along myofascial continuities (Myers, Anatomy Trains 1997) and potentially compromise their function, increasing their susceptibility to acute and slow growth injuries. Treatment of specific symptoms or injuries that don't address these distal influences are less effective and those distal influences can quickly bring back the problems. Therapeutic strategies that include a global perspective and address the system as a Biotensegrity have the greatest potential for resolving localized problems and guiding the system back towards resilience and maximized potential.

Talking points for therapists and educators: Our bodies are organized by one continuous fascial web (rubber bands) with pockets of concentrated muscle cells (pull on the rubber bands), all organized around bones (sticks) that are suspended and balanced within the web of tension.

Whatever happens in one part of the body is adapted to by the whole body, distributing its strain globally. As soon as one thing is out of balance, everything is out of balance (bring two stick ends closer together and show how everything changes). If that happens for a short time it won't be a problem. We can adapt. If it stays in the body for a long time, the fascial system will grow around the pattern, locking it in locally and globally. The body is now fascially designed for that pattern.

Releasing a chronic imbalance locally will be resisted by the globally grown-in pattern. In order to effectively bring balance locally, one must work to release the imbalance globally (point to other areas of the model that are now imbalanced as well). Whatever is not released will remain as an anchor to the old pattern.

References

Dr. Steven Levin, a orthopedic spine surgeon, is credited with coining the term Biotensegrity and is the grandfather of the field. Since 197???, Dr. Steven has published many articles arguing for the further exploration of how biotensegrity manifests in biological systems, from the micro to the macro. (www.Biotensegrity.com)

Dr. Donald Ingber of Harvard University Childrens Hospital began to explore how Biotensegrity manifests on a smaller scale. He has published numerous papers describing how cells organize themselves internally, how they relate to their mechanical environment, and how they move using Biotensegrity. (www.*wyss.harvard.edu/viewpage/121/**donald**-e-**ingber)***

Tom Myers pioneered a new vision of musculo-skeletal anatomy by mapping how muscles fascially link to each other to form long myofascial continuities in the body. He named this theory the Anatomy Trains and has argued that the trains are a simple mapping of the body's macro Biotensegrity and its ability to distributes strain distally. His book is now in its third edition and has been translated into 13 languages, and he has lead five human cadaver dissections to prove his theory. (www.AnatomyTrains.com)

Tom Flemmons, an artist and designer, has been exploring tensegrity for over 30 years. He has been collaborating with Dr. Levin to designed many models that attempt to mimic how human joints and structures function using Biotensegrity. He has created a pelvis, foot, hand, spine, and more. (www.IntensionDesigns.com)

In 2014, **Graham Scarr** published the first book focusing on Biotensegrity. It explores the theoretical origins of tensegrity and many examples of how Biotensegrity manifests in biological systems. (www.TensegrityinBiology.co.uk)

Eli Thompson is the creator of Tensegri-Teach teaching products (Tensegri-Teach.com).

There are too many others contributing to the growth of BioTensegrity to name here.
To one and all - Thank you!