***https://www.youtube.com/watch?v=Q\_\_bSi5rBlw***

***https://en.wikipedia.org/wiki/CimaVax-EGF PLEASE READ FOR FRIDAY***

**More About Cartilage's Medical Importance. *Nov. 16, 2016***

Medical importance for treatment of **slipped disks**,

Also **knee & hip replacement.** Also shaping of most bones in growing skeleton.

Please discuss what biological mechanism you would most like to be able to control.

***How could you cure herniated disks, knees, etc.? How to heal broken bones?***

Cartilage expansion pressure is a form of osmosis. (That doesn't use membranes)

Positive counter-ions (K+, Na+, H+, Ca++ etc. pulled toward ionized sulfates)

**How can cartilage swelling pressure be increased**: at certain places (and directions!).

#1) By chondrocyte (cells) growing larger and dividing.

(But cell volume depends on semi-permeable membrane osmotic pressure)

#2) By chondrocytes secreting more chondroitin sulfate, and other ionizing gels.

#3) By more sulfate or carboxylic acid groups becoming covalently bound.

#4) By cutting or weakening of protein fibers that hold back osmotic swelling.

Scientists trained in engineering concepts tend to assume #1 is most important,

and they tend to ignore #2, #3, & #4.

***Human building materials don't swell spontaneously to create their own shapes.***

Whereas I conclude that evidence points mostly toward importance of #2 and #4.

Self-shaping of cartilage controls the shapes of most bones (Also bone regeneration)

***Could bones develop the shapes they have except by differential swelling of cartilage?***

***Does geometry of cartilage inflation channel what shapes vertebrate bones can evolve?***

**Broken bones** dissolve bone matrix at the break; then cartilage forms between edges;

This cartilage then gets replaced by bone (the same as during embryonic development).

Consider the example of a growing **epiphysial plate**.

The "resting area", where cells are small and few; but where most matrix is secreted!

The area nearest where bone is forming is assumed to exert strongest pressure;

Cells enlarge 10-fold and line up parallel to direction of growth.

(Do you think matrix pressure is stronger here? Or maybe protein fibers cut?)

No form of osmosis can be stronger in any direction than any other direction.

Because a chemical concentration can't be larger in some directions than others.

**Please discuss whether you believe this: & why or why not.**

**How do cartilages elongate directionally?** Weakened resistance in some directions.

***Will learning cartilage physics enable you to improve orthopedic surgery?***