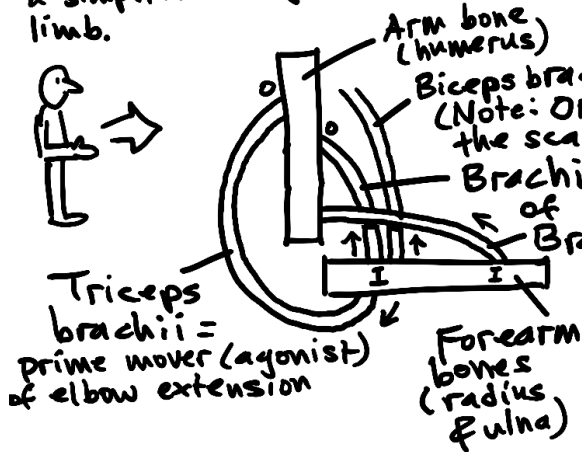


MUSCLE ACTIONS

To discuss the different roles that muscles can play, we'll use a simplified diagram of the upper limb.

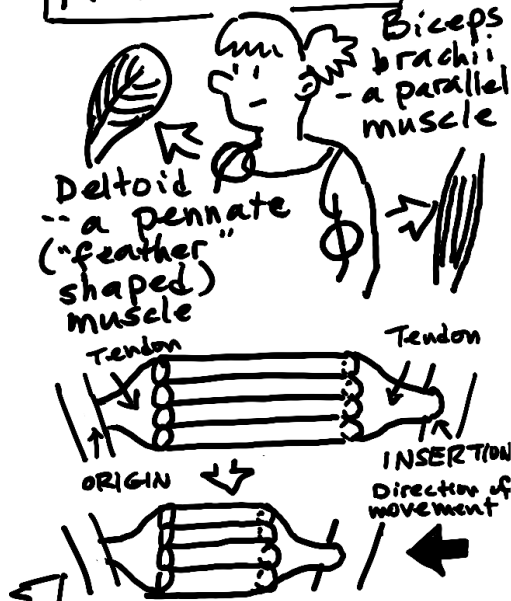


O = Origins (proximal, stationary attachments)

I = Insertions (distal, more movable attachments)

The terms "synergist" and "antagonist" are relative: Biceps brachii and brachioradialis are synergists (helpers) to brachialis in flexing the elbow, but they (like brachialis) are antagonists to triceps brachii.

MUSCLE TYPES



Parallel muscles are better at allowing a greater change in length, but pennate muscles are stronger because they have more muscle cells pulling on the tendon

(four times as many, in this example).

MUSCLE STRENGTH

Muscle strength is proportional to cross-sectional area. So if your opponent has arms twice as thick as yours, then you'll need 3 friends (if you don't want to get beat up).

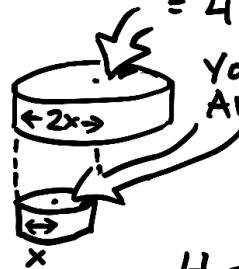


His arm:
 $Area = \pi (2x)^2$
 $= 4\pi x^2$

Ratio = $\frac{4\pi x^2}{\pi x^2} = 4$

Your arm: x
 $Area = \pi x^2$

4 times as strong!



∴ For equivalent strength, you need 4 times as many arms.

