Tendon Structure and Healing

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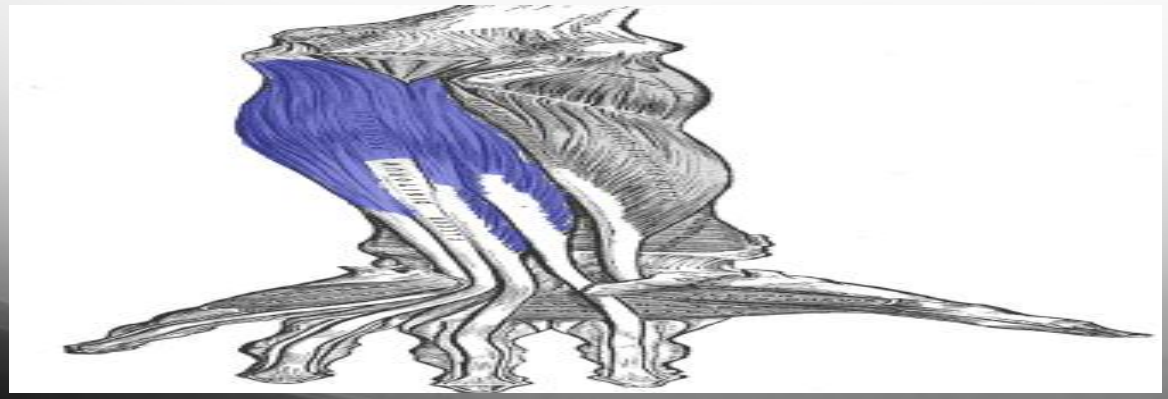
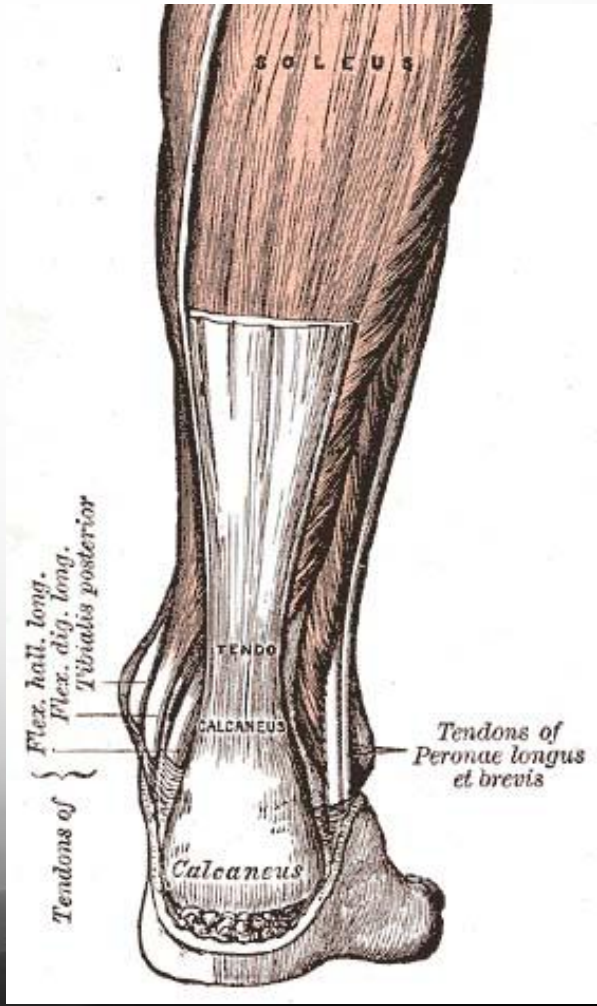
Tendons

- Attach muscle to bone
- Transmits tensile force
- Enable muscle to be optimally positioned
- Store energy

Macroscopic Structure

- Two types of tendon:
  - Lubricated tendons in synovial sheaths
  - Thick paratenon surrounded tendons

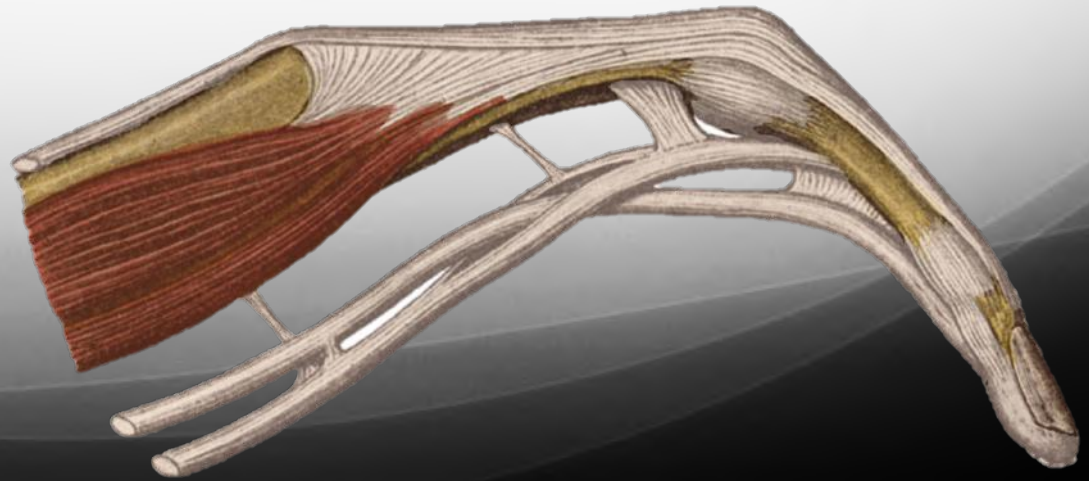




Blood supply

- Blood supply from muscle insertion

- Paratenon covered tendons
  - Paratenon blood supply
- Sheathed tendons - avascular
  - Venicuar blood supply
  - Nutrition by diffusion

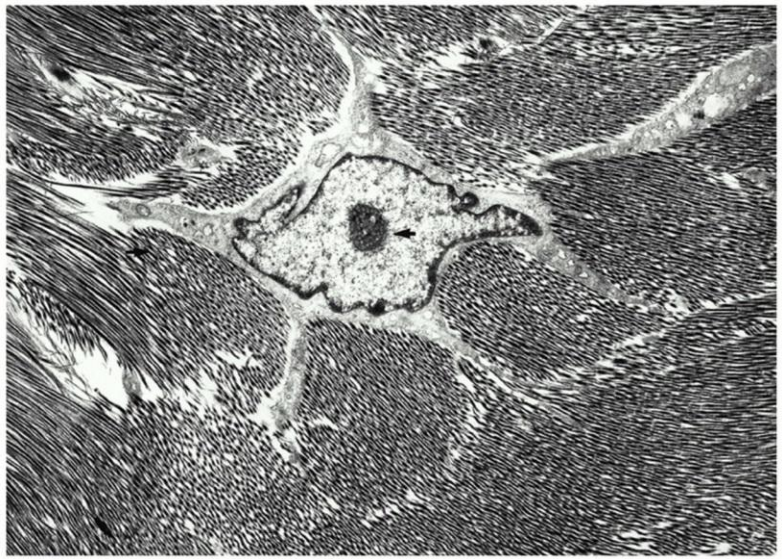


Tendon Healing

- Synovial fluid surrounded tendon
  - Direct intrinsic healing
- Paratenon surrounded tendons
  - Phase 1 inflammatory (hrs) haematoma, polymorphs and macrophages
  - Phase 2 proliferative (weeks) neovascularisation and fibroblasts (III collagen)

Microscopic Structure

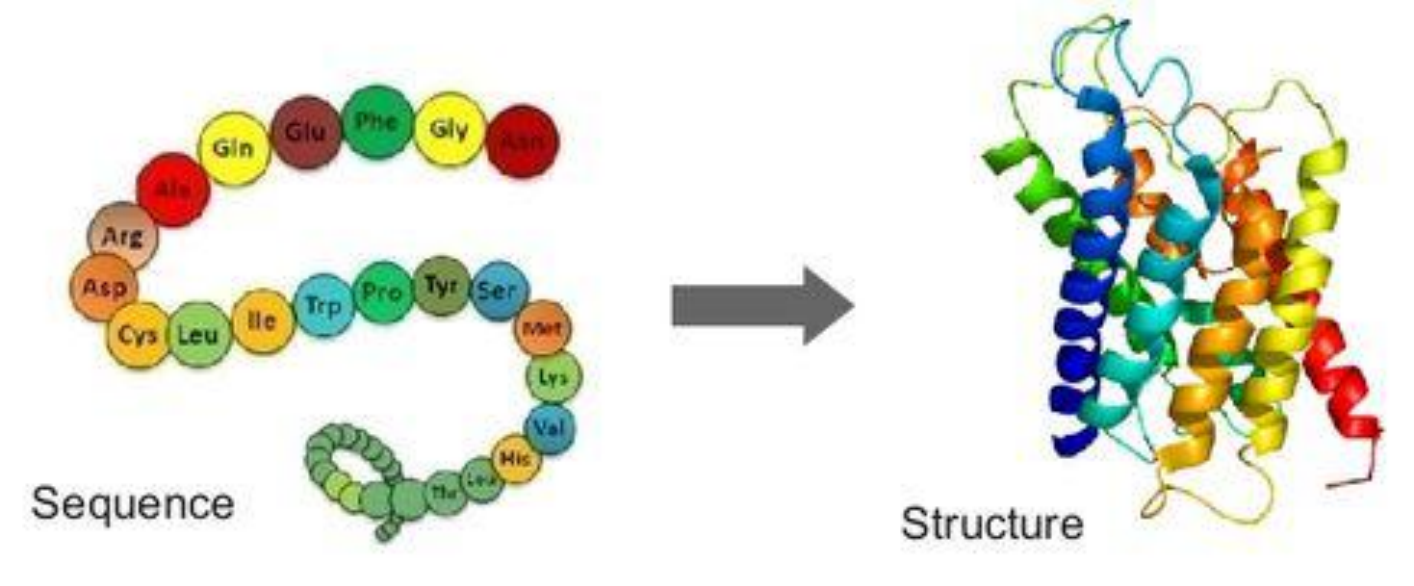
- Cells 20% volume
  - Mesenchymal stem cell
    - Tenocytes
    - Fibroblasts



- Extracellular matrix 80% volume
  - Elastin
  - Collagen
  - Ground substance

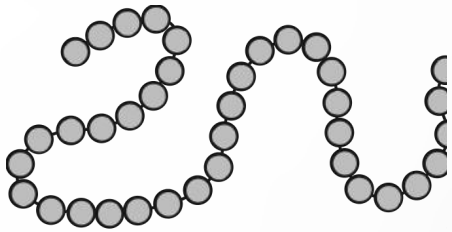
Collagen

- Type 1 collagen 90%
- Type 3 collagen <10%
- Protein structure

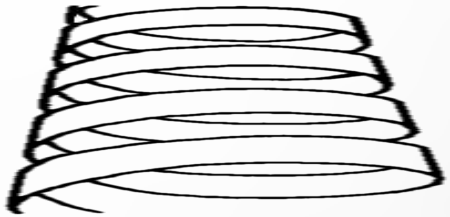


Collagen

- Primary structure - three amino acid chains

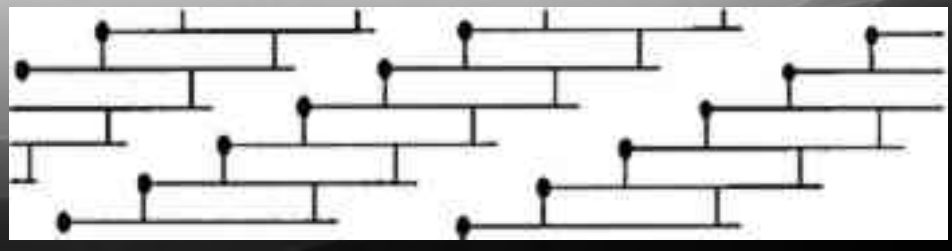


- Secondary structure - left handed helix



- Tertiary structure - right handed triple helix

- Quarternary structure - quarter staggered array

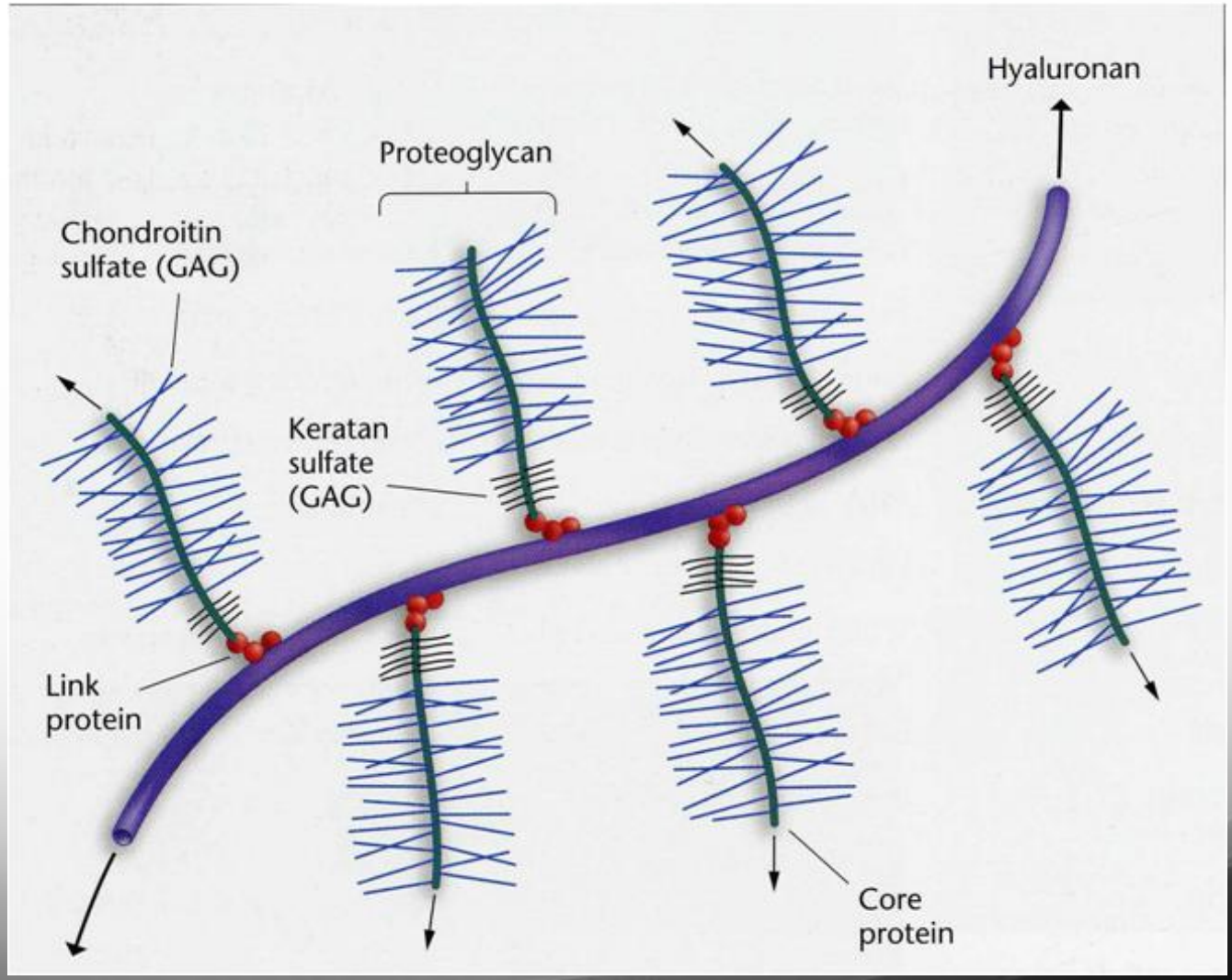


Ground Substance

- Hydrophilic spacers
- Proteoglycans
- Glycoproteins

Ground Substance

- Proteoglycan



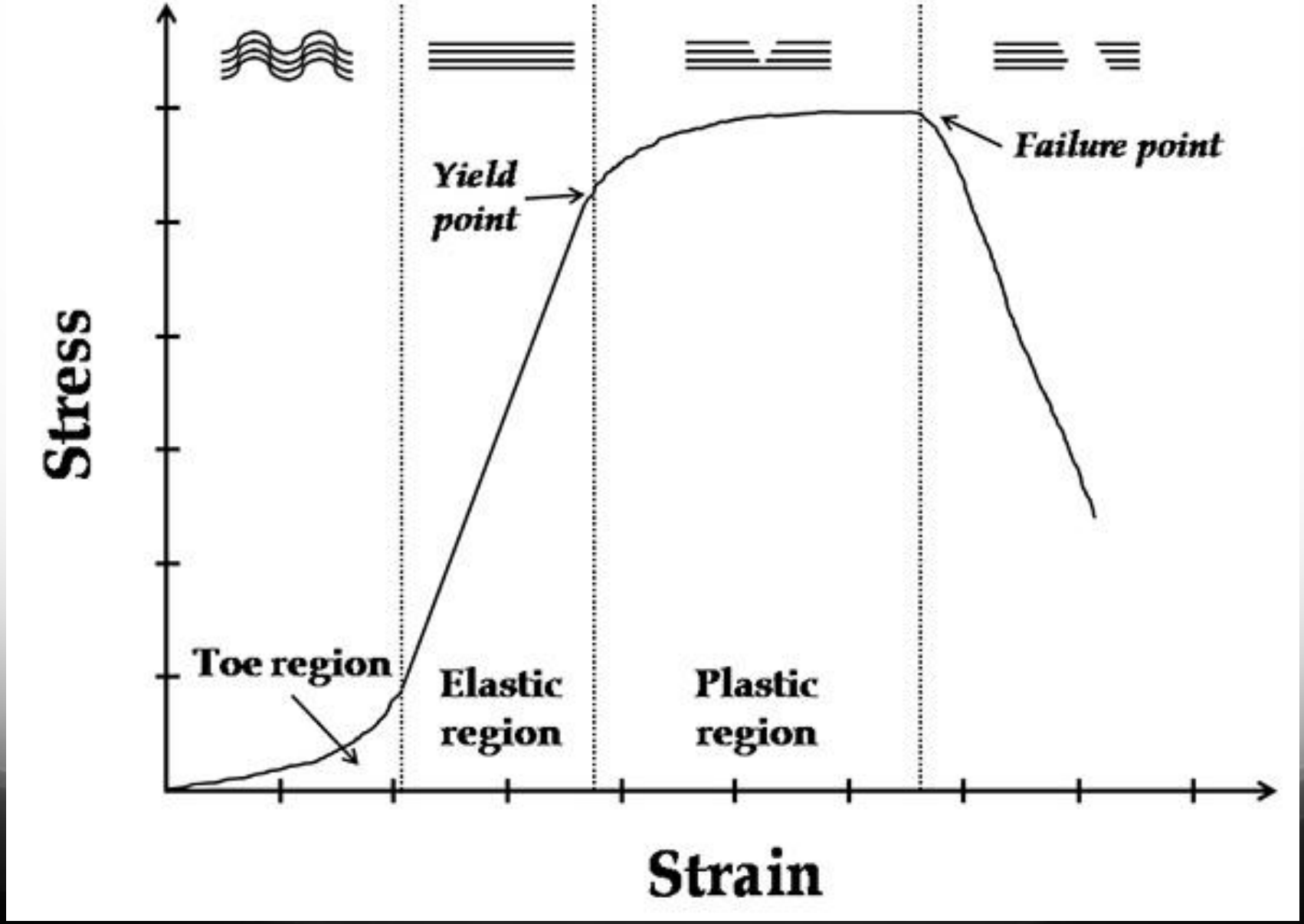
Tendon Properties

- Stress
- Strain
- Viscoelastic

Tendon Properties

- Stress = force / area
- Strain = change in length / original length
- Viscoelastic = time dependent properties

Stress Strain Curve

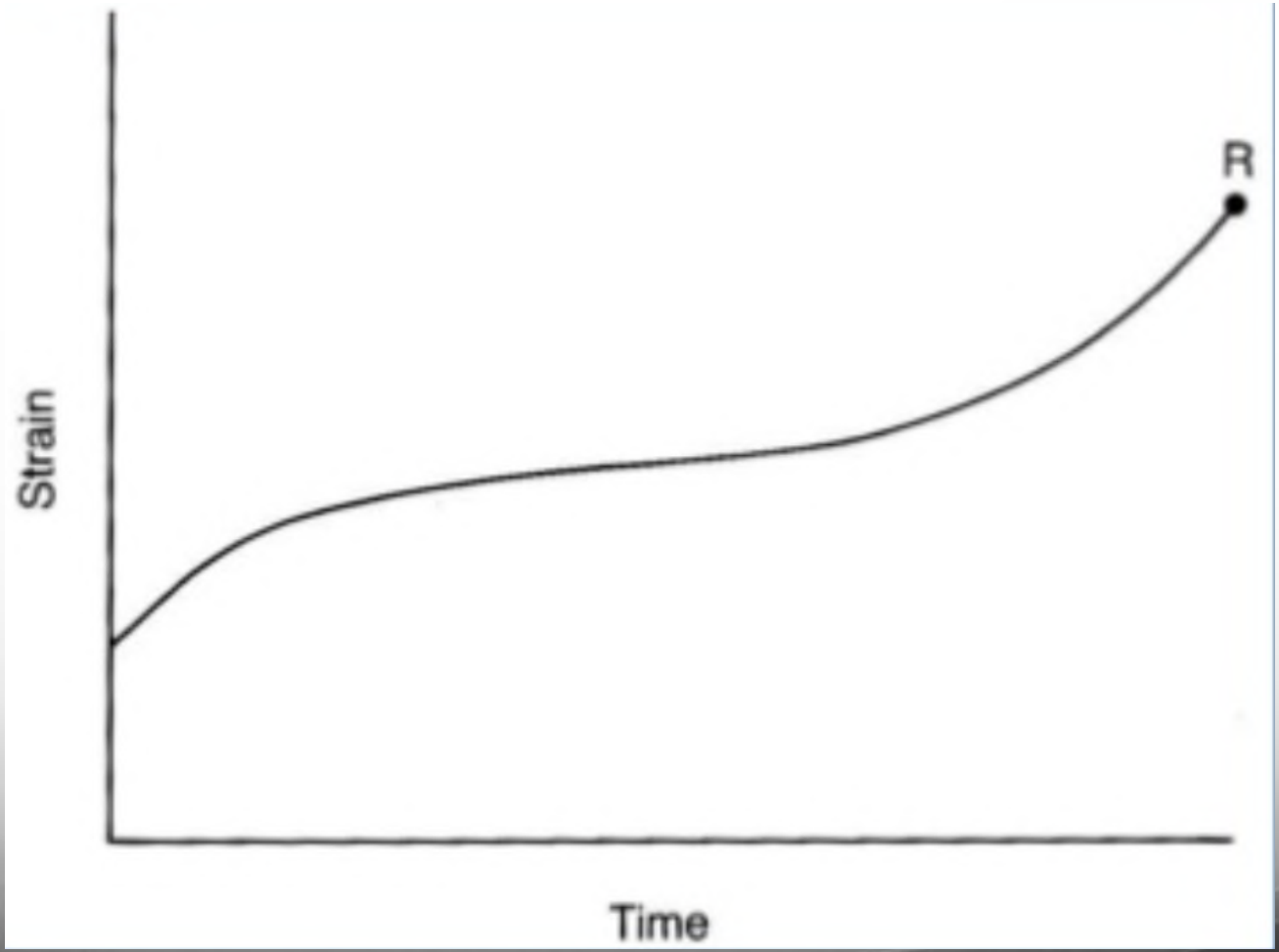


Tendon Properties Viscoelasticity

- Creep
- Stress Relaxation
- Hysteresis

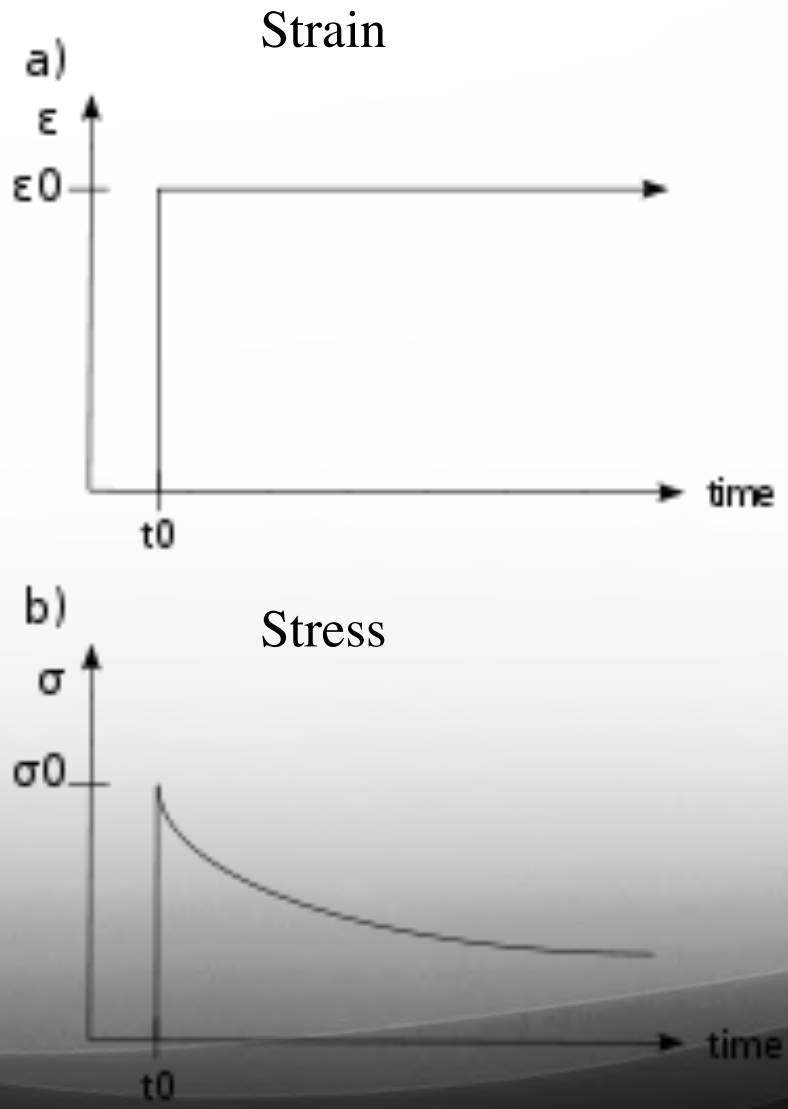
Tendon Properties Viscoelasticity

- Creep



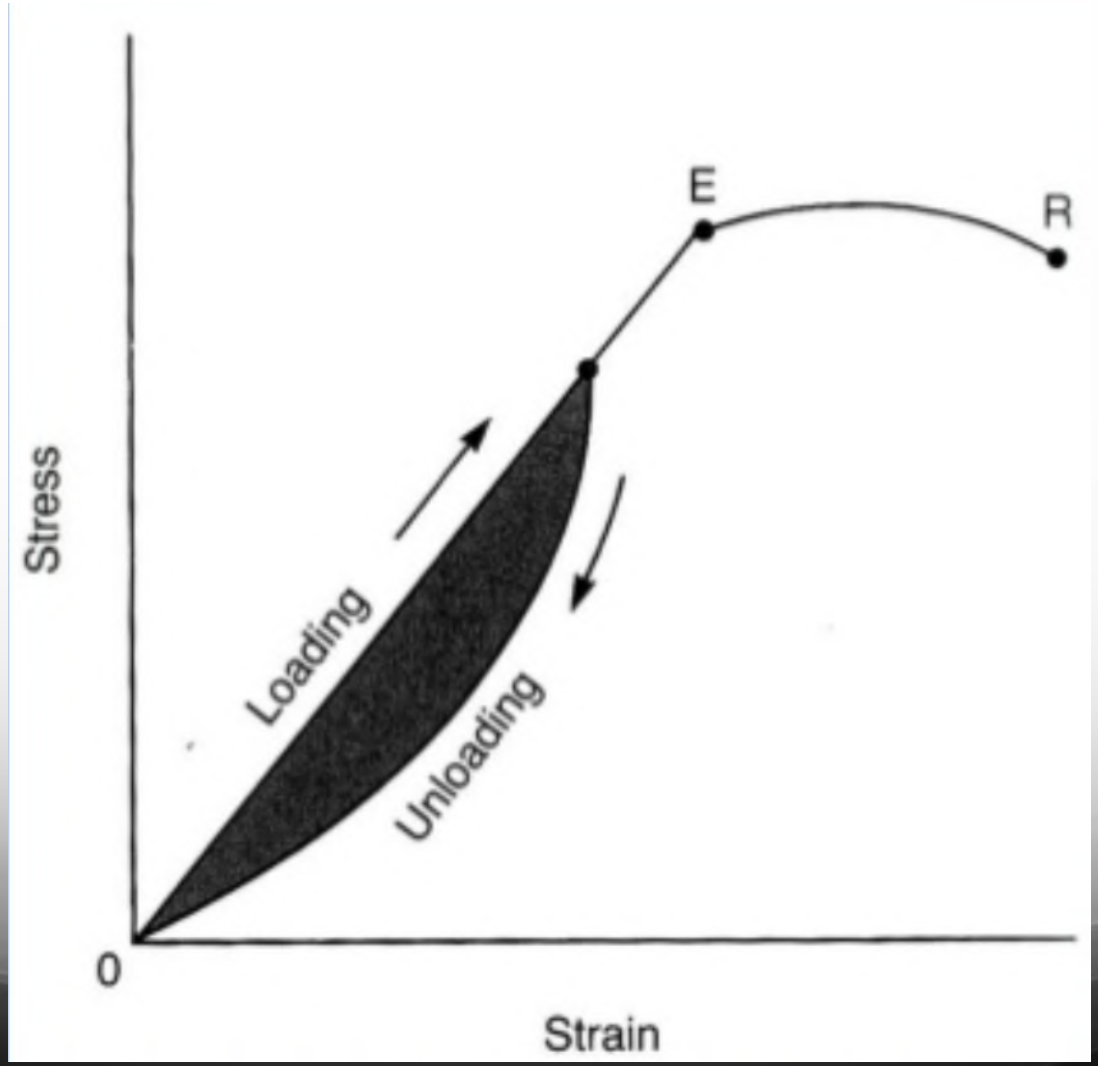
Tendon Properties
Viscoelasticity

- Stress Relaxation



Tendon Properties Viscoelasticity

- Hysteresis

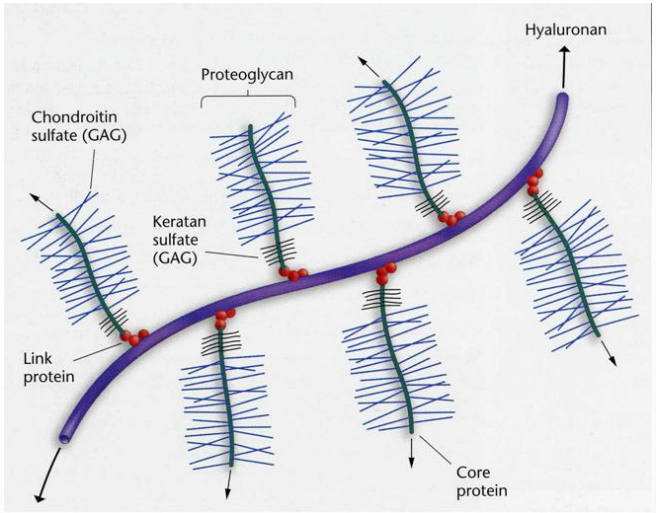


Conclusion

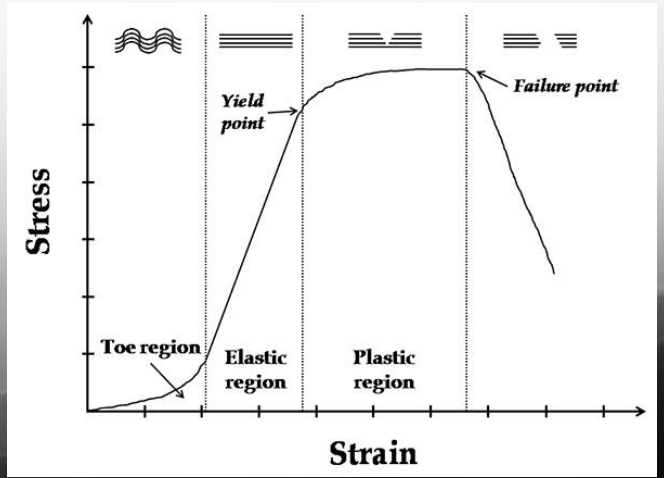
- Tendons
  - 80% extracellular matrix
  - 20% cells
- Blood supply
  - Paratenon
  - Veniculi and diffusion

Conclusion

- Draw a proteoglycan



- Draw stress strain curve



Questions