

# Sports Injuries

Kinesiology 11



**OUCH!!!**

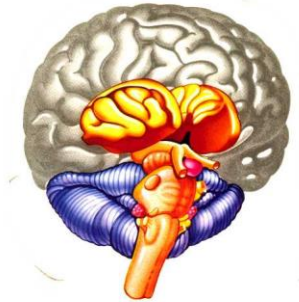
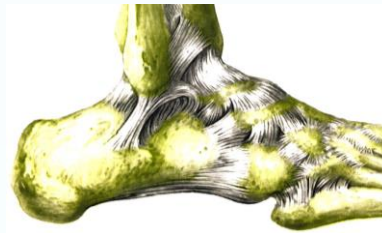
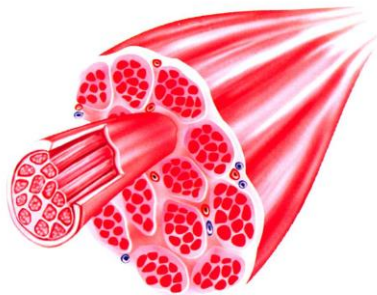


# What are they?

- **Sports injuries = any injury acquired through exercise or participation in sport**
- **Generally reserved term for an injury affecting the musculoskeletal system:**
  - **Muscles**
  - **Bones**
  - **Associated structures (cartilage and soft tissues)**
- **Can include traumatic brain and spinal cord injuries too.**
- **The cause of injury can vary:**
  - **Improper training**
  - **Insufficient warm up or cool down/stretching**
  - **Poor conditioning**
  - **Bad equipment**
  - **Accidents**

# Biomechanical Principals of Injury

Recall there are 4 types of tissue in the human body:



Epithelial

Muscle


Connective

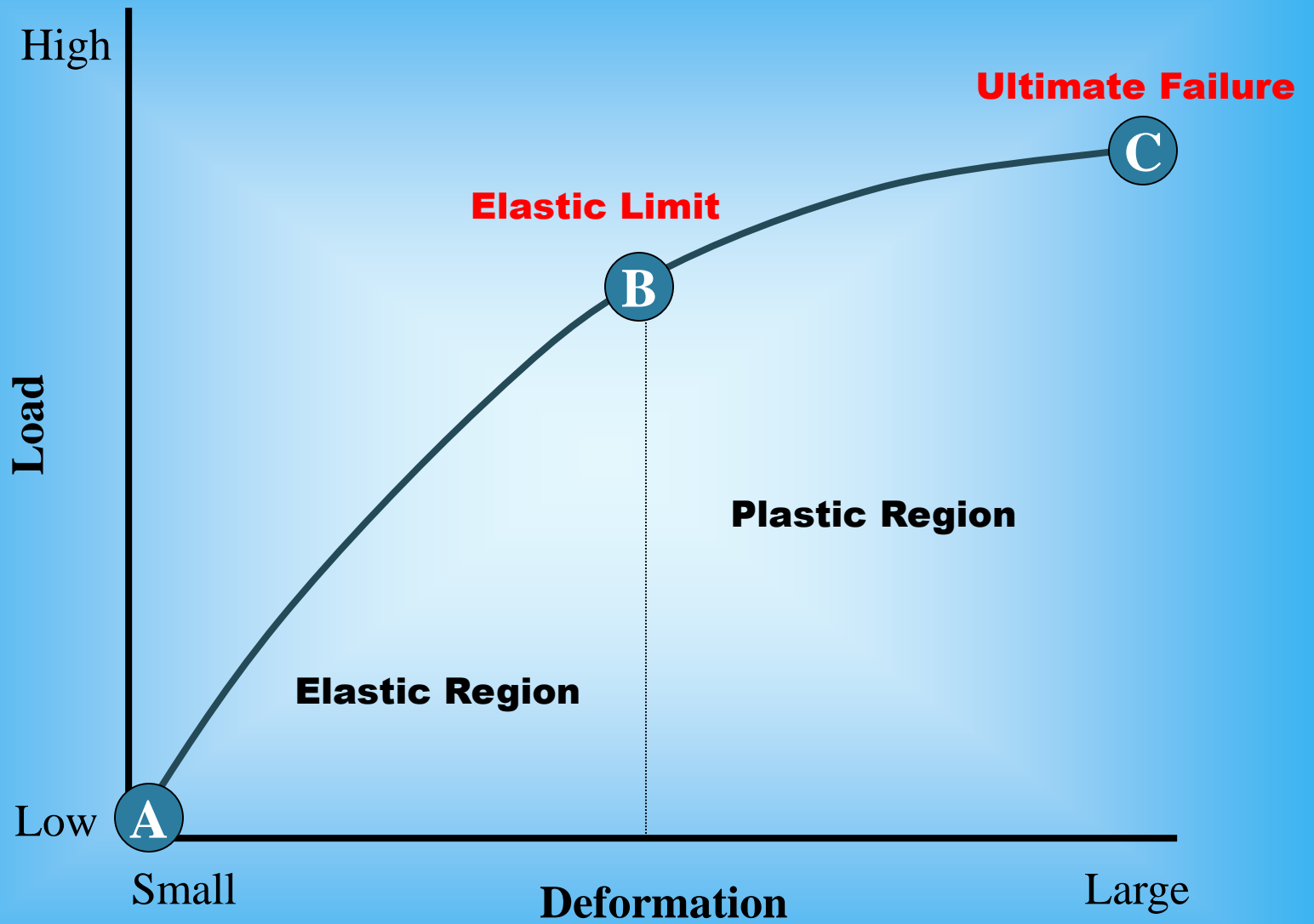
Nervous

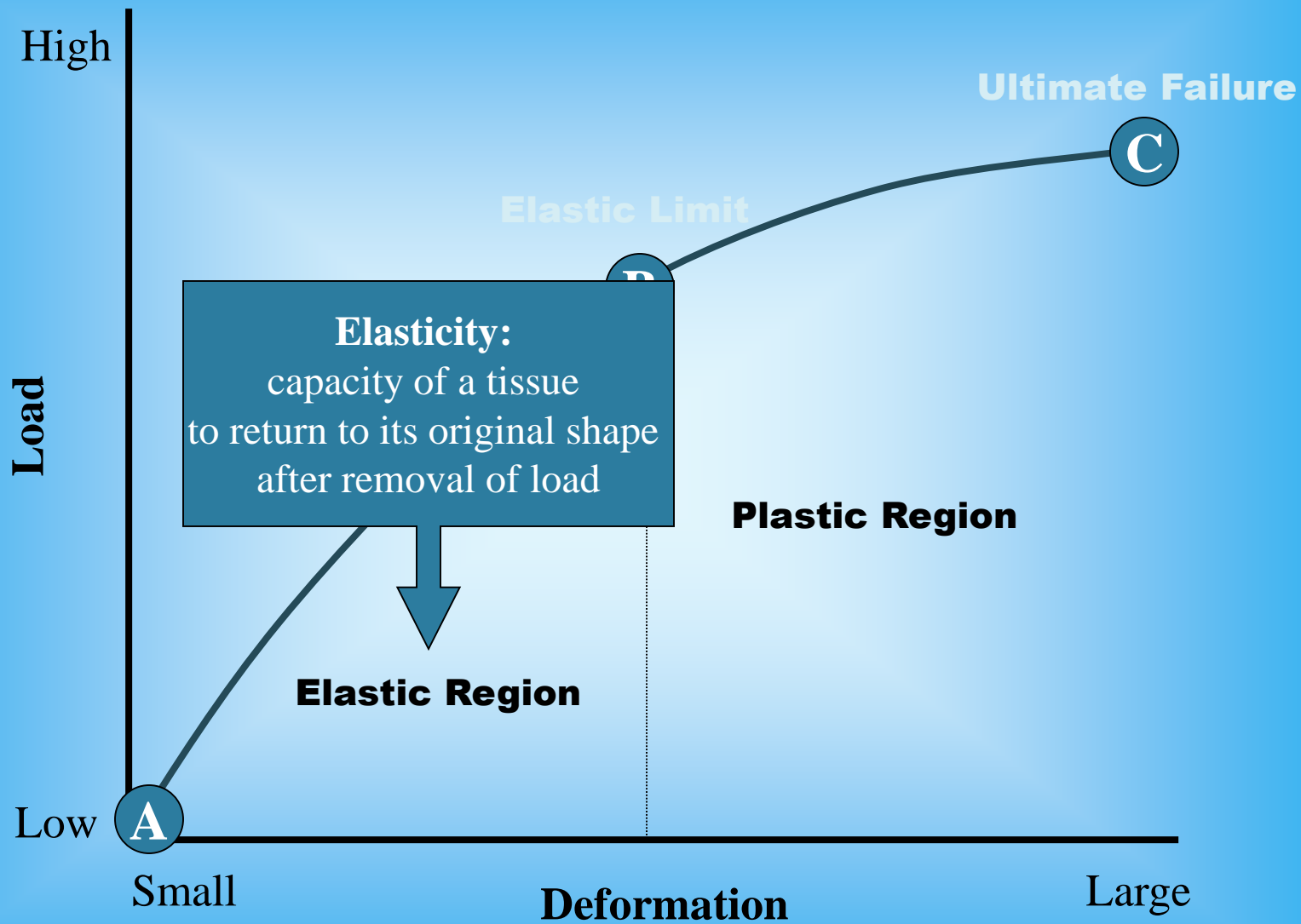
Each type of tissue possesses unique mechanical characteristics which determines their structure and function.

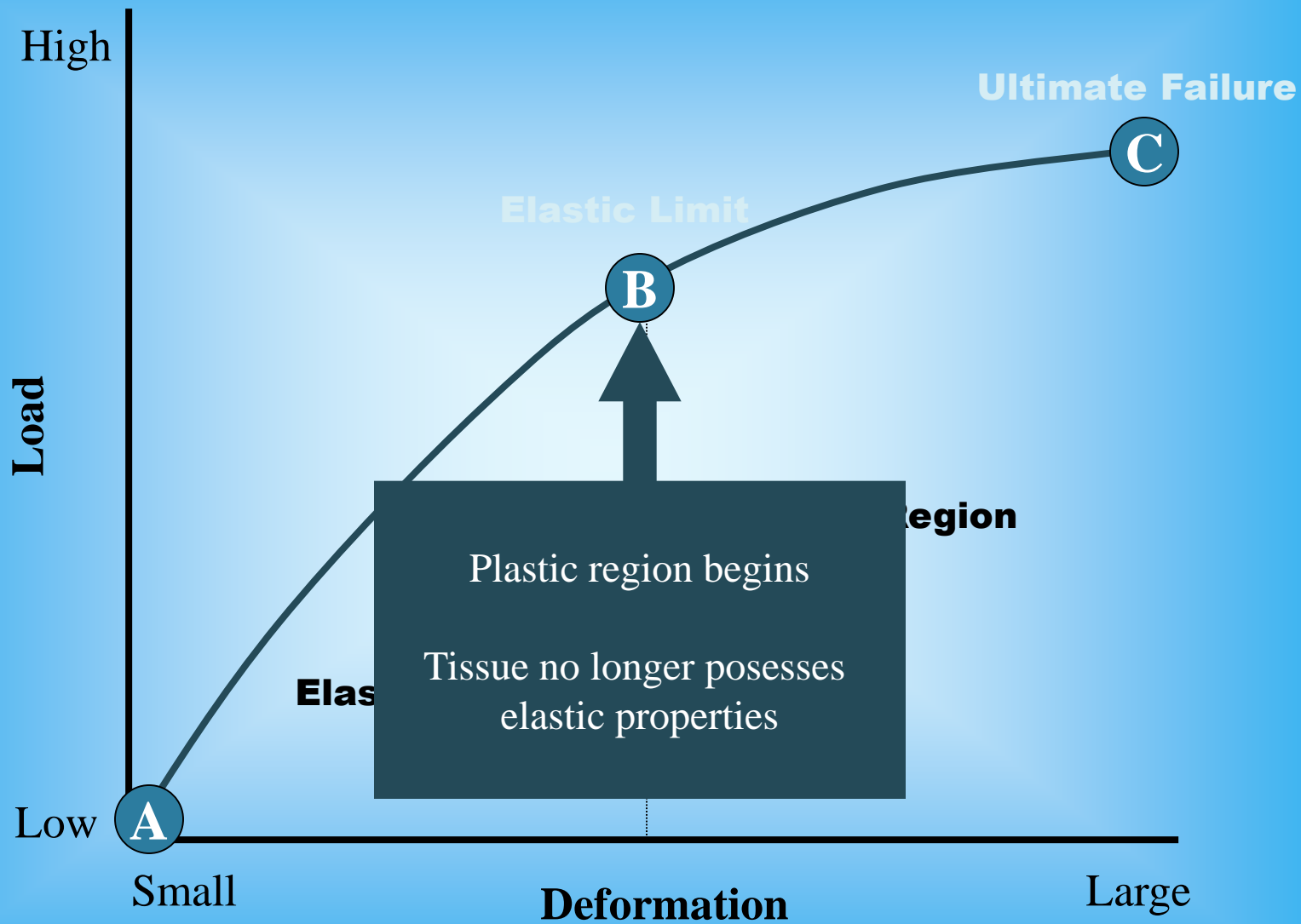
# Loading



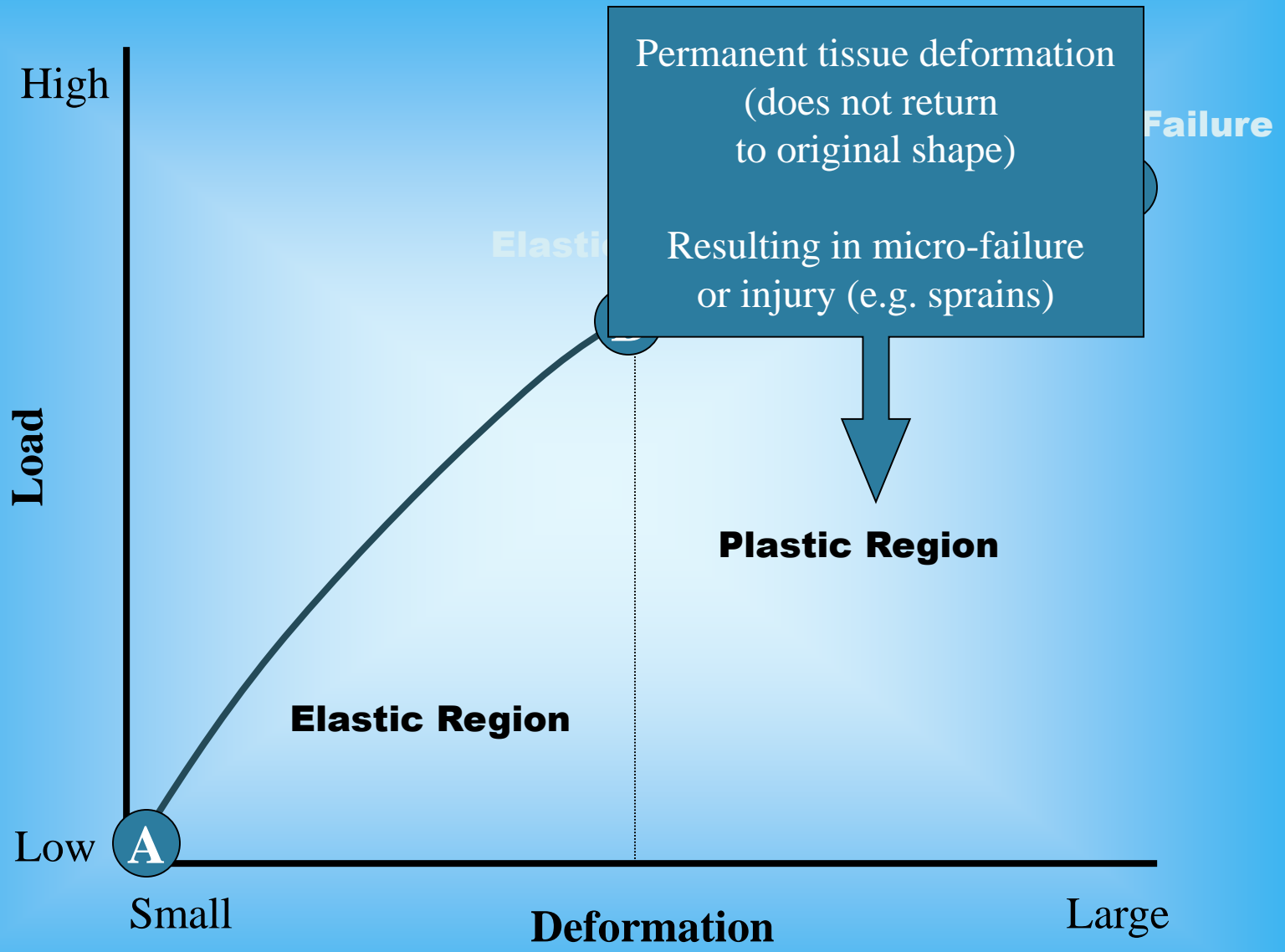
- To best understand the biomechanical characteristics of tissue we examine its behaviour under physical load
  - Under load a tissue experiences deformation
  - Deformation can be visualized through deformation curve
- 











High

Load

Low

Small

Deformation

Large

A

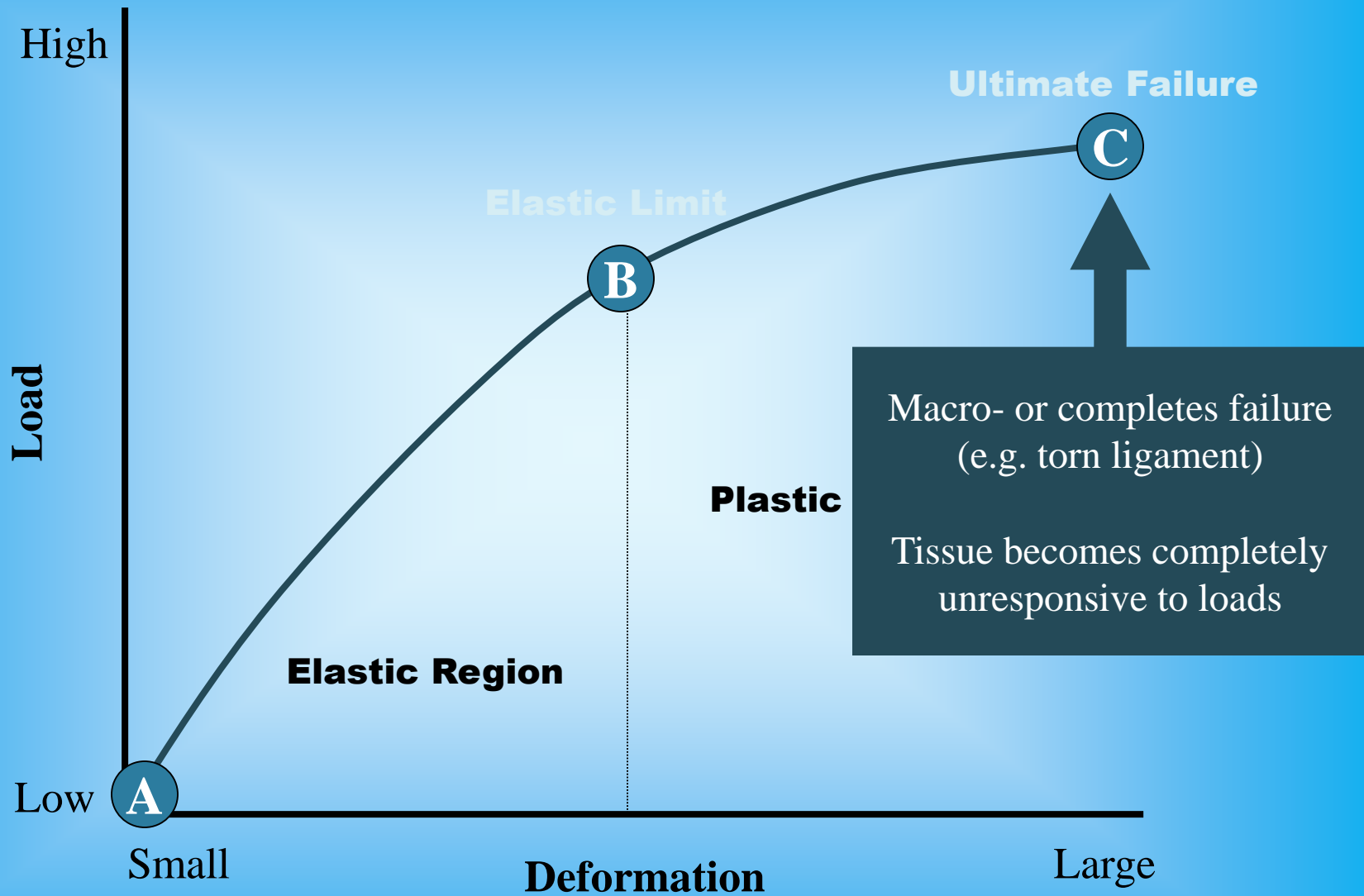
Elastic Region

Elastic

Plastic Region

Permanent tissue deformation  
(does not return  
to original shape)  
Resulting in micro-failure  
or injury (e.g. sprains)

Failure



# Deformation Curve Explained

- Elasticity is the capacity of a tissue to return to its original shape once the load has been removed
- The yield point (or elastic limit) is where the plastic region begins. This is where tissue no longer has elastic properties
- The plastic region is where we see permanent tissue deformation, meaning that the tissue will no longer return to its original shape.
  - This results in micro-fracture or injury (like sprains).
- At the failure point we see complete failure of the tissue. This is when the tissue is completely unresponsive to loads.
  - Ex. Torn ligament

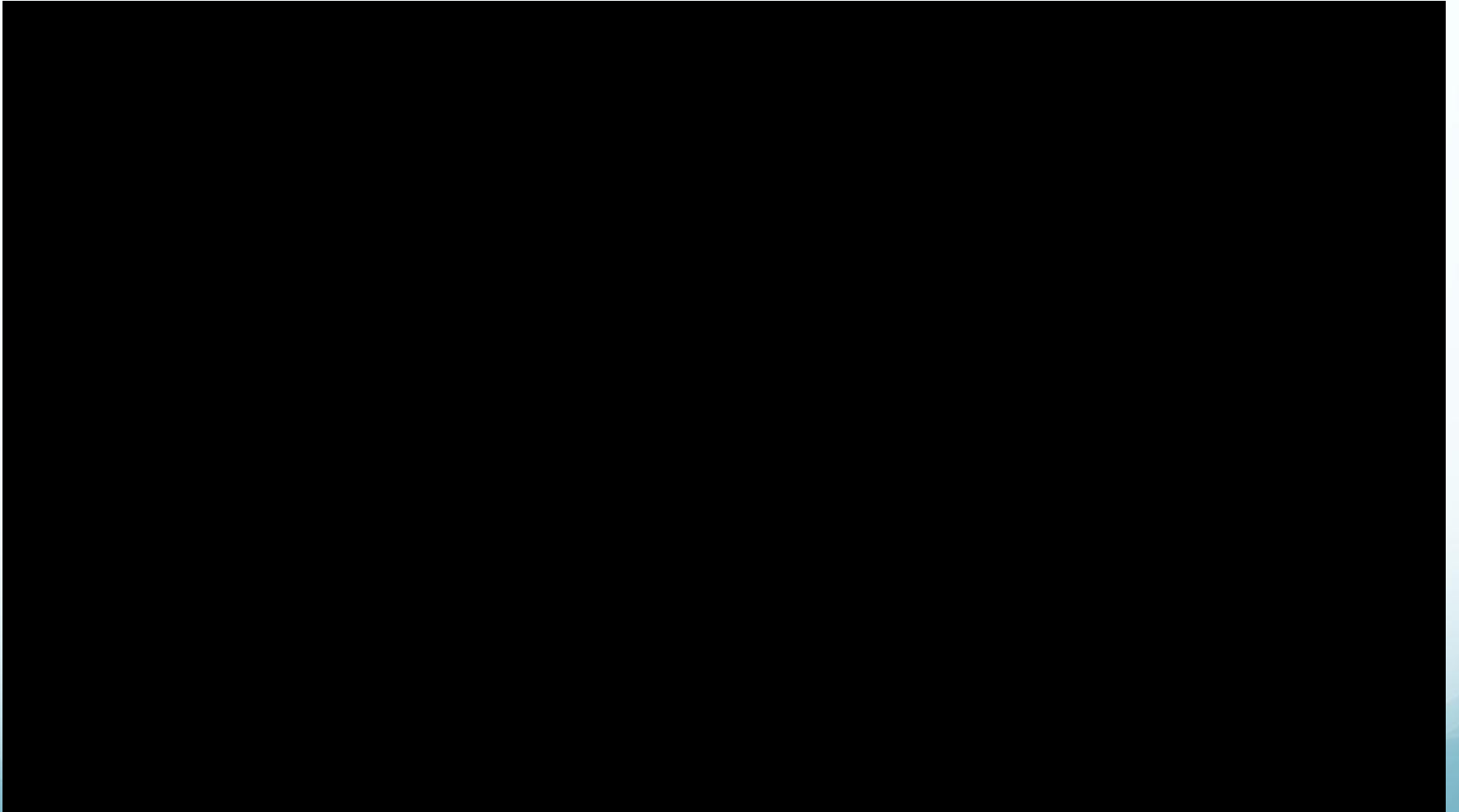
# Tissues Response to Training Loads



A couple different situations may arise when one considers the deformation curve in their training program:

1. Training at a load that is equal or less than the elastic limit.
  - Results in micro-failure at the tissue level.
  - This causes new tissue to be created to replace old tissue.
  - Over time will have a positive training effect.

# What makes muscles grow?



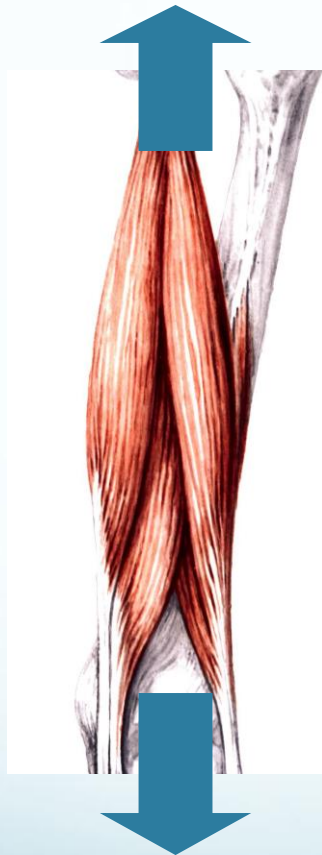
# Tissues Response to Training Loads

2. Training at a load greater than the elastic limit
  - Results in permanent failure and injury to the affected area

Studies have shown that:

- Resistance training can increase the size and strength of tendons and ligaments. It is suggested that this may be due to an increase of collagen within the connective tissue sheaths.
- The elastic limit of a tendon or ligament can be enhanced by exercise and training, and can be reduced by aging and inactivity.
  - The elastic limits of ligament are estimated to be 12-50%, and the elastic limits of tendon is 9-30%

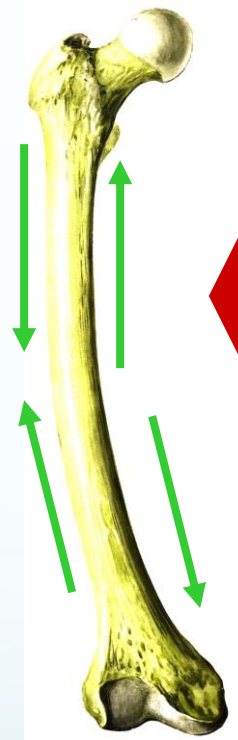
# Forces Acting on Tissue



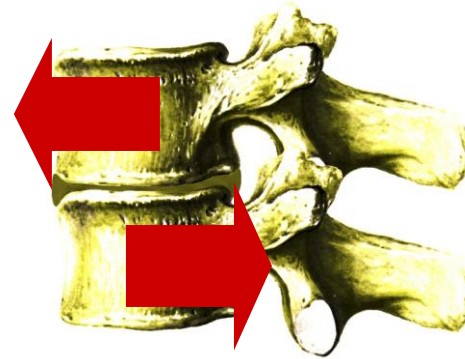
**TENSION**



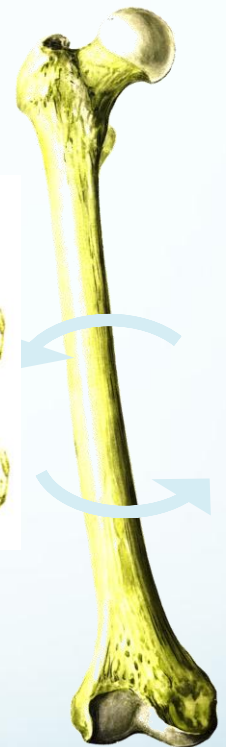
**COMPRESSION**



**BENDING**



**SHEAR**



**TORSION**

# Injury Treatment and Rehabilitation



- Treatment

- Received by patient from a health care professional
- Promotes healing
- Improves quality of injured tissue
- Allows quicker return to activity

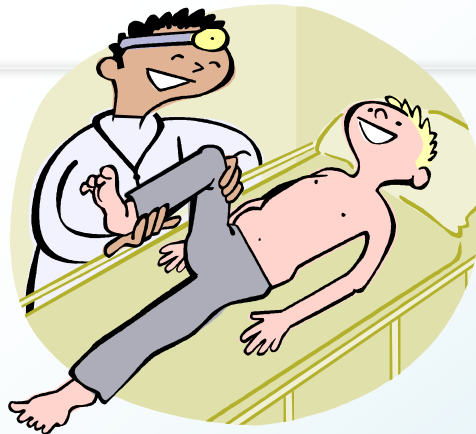


- Rehabilitation

- Therapist's restoration of injured tissue and patient's participation
- Individualized for each athlete



# Healing Phases



Inflammatory  
Response  
Phase

**2 – 4 days**

Fibroplastic  
Repair  
Phase

**hours – 6 wks**

Maturation-  
Remodeling  
Phase

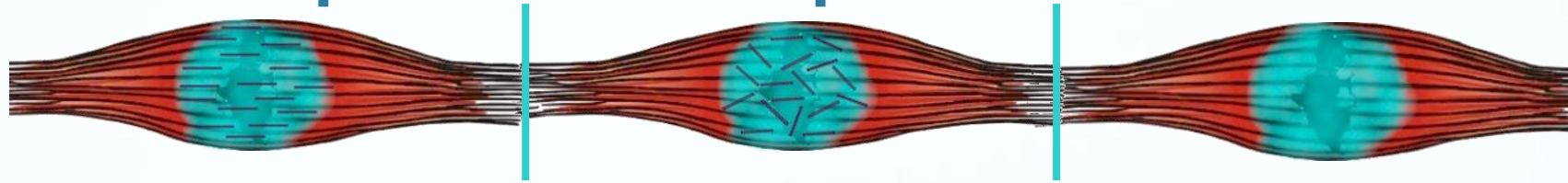
**3 wks - yrs**

# Inflammatory Response Phase



- Inflammation begins at the time of injury
- Signs
  - Redness
  - Swelling
  - Pain
  - Increased temperature
  - Loss of function
- **Protect**
- **Rest**
- **Cryotherapy (ice/cold water immersion)**
  - Decreases swelling, bleeding, pain and spasms
- **Compression**
  - Decreases swelling
- **Elevation**
  - Decreases swelling

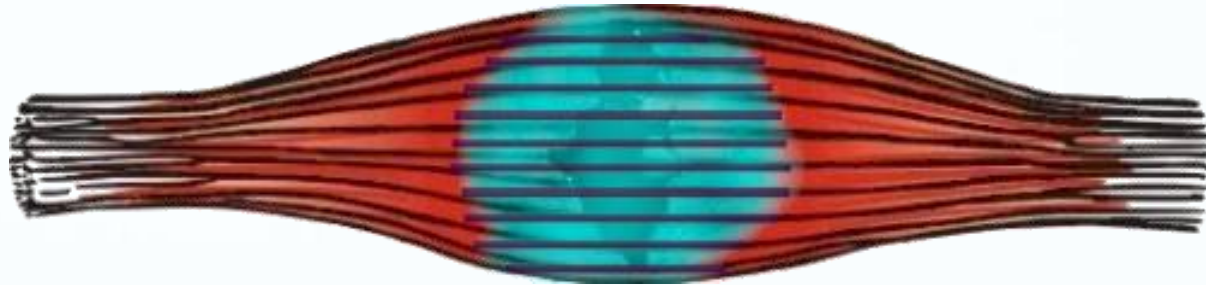
# Fibroplastic Repair Phase



- Repair and scar formation
- Granulation tissue fills the gap
- Collagen fibres are deposited by fibroblasts
- Signs seen in the inflammatory phase subside

- Rehab-specific exercises
  - Restore range of motion and strength
- Manual massage therapy and ultrasound
  - Help break down scar tissue
- Protective taping and bracing

# Maturation-Remodeling Phase



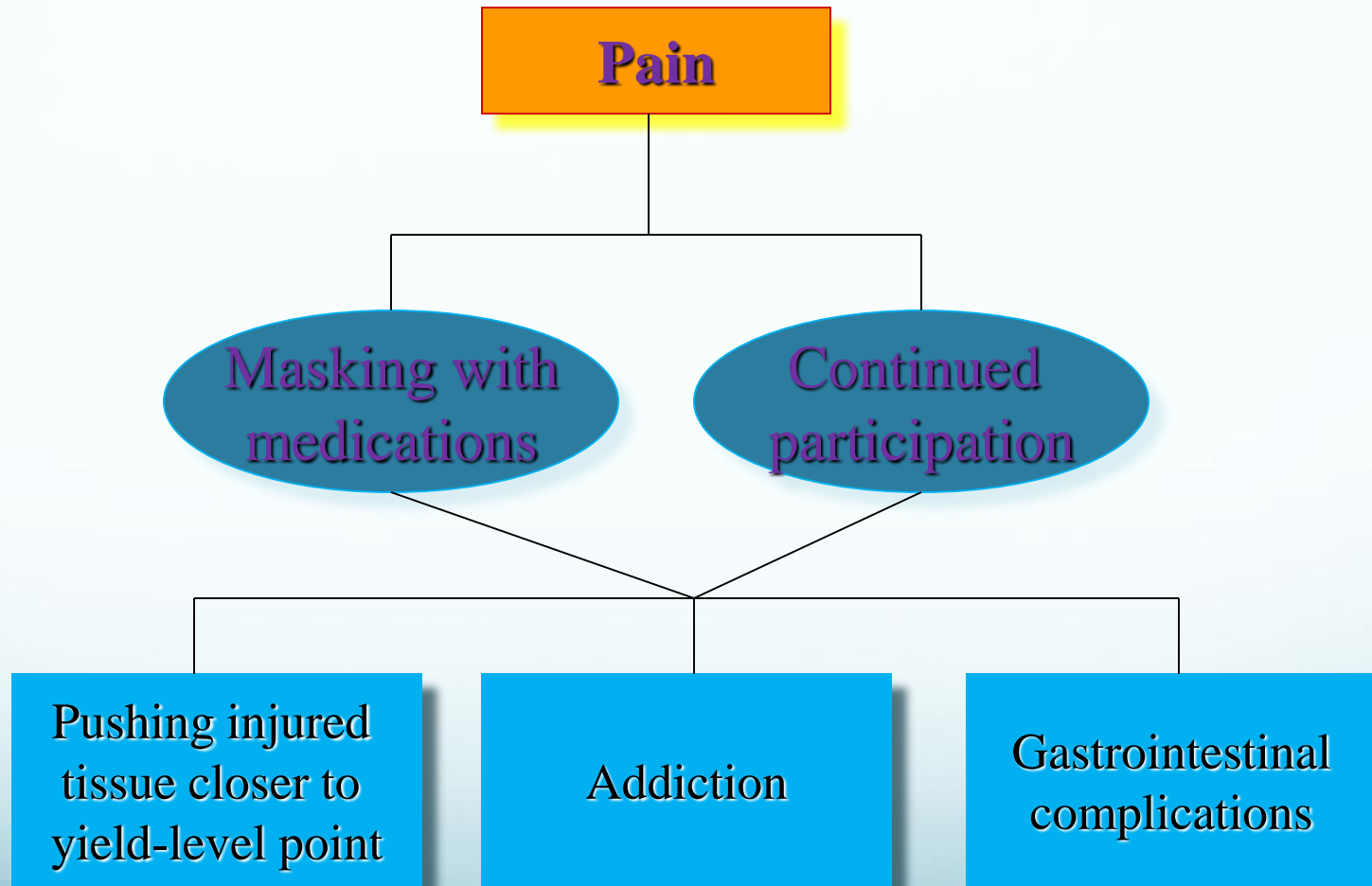
- Remodeling or realigning of the scar tissue
- More aggressive stretching and strengthening
  - To organize the scar tissue along the lines of tensile stress
- Include sport-specific skills and activities

# Pain

- Nature's way of telling us something is wrong
- One of the best indicators of when it is best to resume play



# Problem with Ignoring Pain

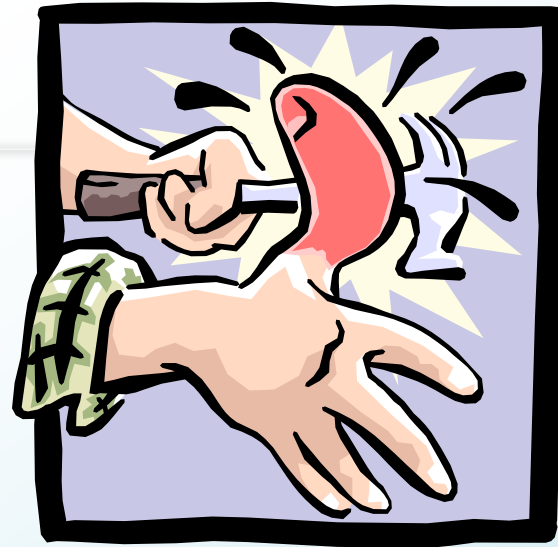


# Return to Exercise

- Once pain has subsided, one can begin their gradual return to exercise
- The load placed on an injured area should increase gradually.
- If one overloads an injured area they risk their acute injury becoming a chronic problem.



# Contusions (a soft tissue injury)



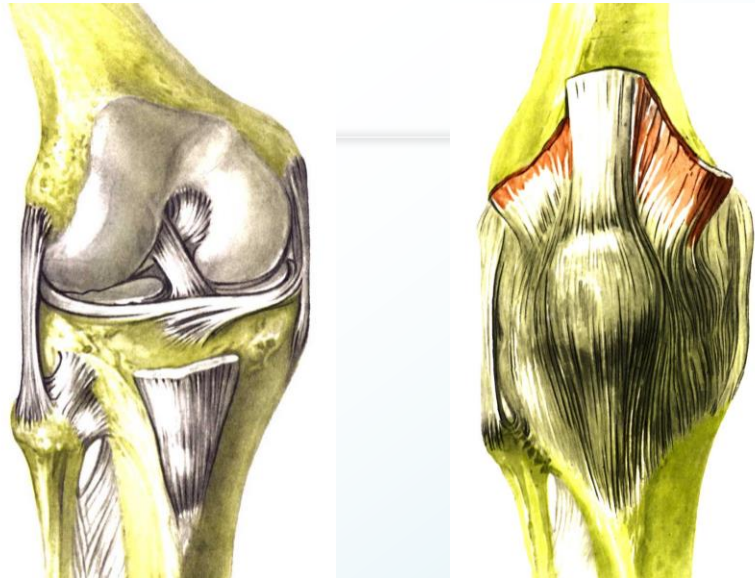
- Aka a bruise
  - Occurs when a compressing force crushes tissue
  - E.g. “charleyhorse” – quadriceps

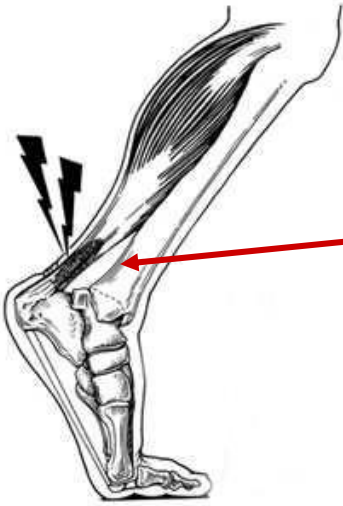
### Symptoms:

- Discoloration and swelling
- **Myositis ossification** – abnormal bone formation in a severe contusion
- Life-threatening if the tissue involved is a vital organ
- P-R-I-C-E is typically a good treatment plan



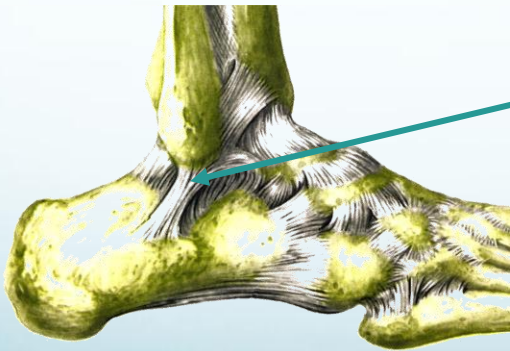
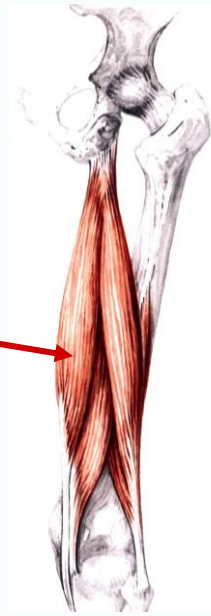
# Strains and Sprains





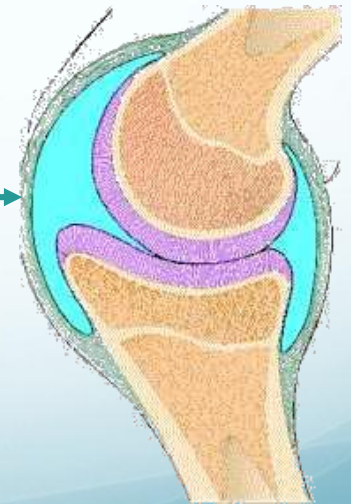
## STRAIN

Tendon or muscle  
tissue is stretched  
or torn



## SPRAIN

Ligament or the joint  
capsule is stretched or  
torn



# Grades of sprains and strains

- GRADE 1
  - Slightly stretched or torn; few muscle fibres
- GRADE 2
  - Moderately stretched or torn, more muscle fibres
- GRADE 3
  - Complete rupture
  - Surgery required
  - E.g. ACL tear



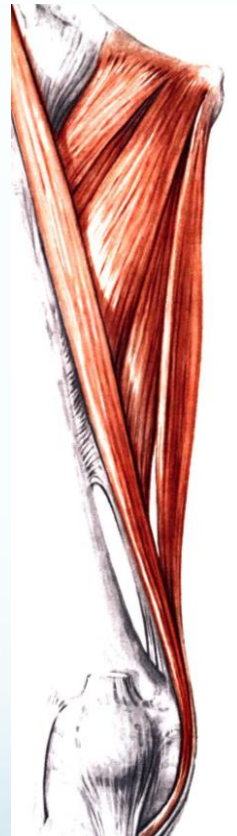
# Grades and Treatments

Severity	Physical Examination Findings	Impairment	Pathophysiology	Typical Treatment*
Grade 1	Minimal tenderness and swelling	Minimal	Microscopic tearing of collagen fibers	Weight bearing as tolerated No splinting/casting Isometric exercises Full range-of-motion and stretching/ strengthening exercises as tolerated
Grade 2	Moderated tenderness and swelling Decreased range of motion Possible instability	Moderated	Complete tears of some but not all collagen fibers in the ligament	Immobilization with air splint Physical therapy with range-of-motion and stretching/ strengthening exercises
Grade 3	Significant swelling and tenderness Instability	Severe	Complete tear/ rupture of ligament	Immobilization Physical therapy similar to that for grade 2 sprains but over a longer period Possible surgical reconstruction

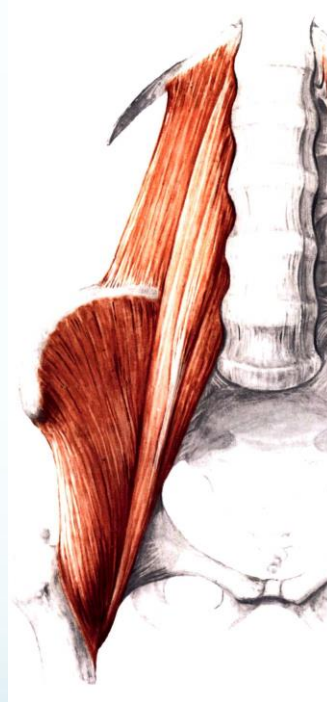
# Common Strains



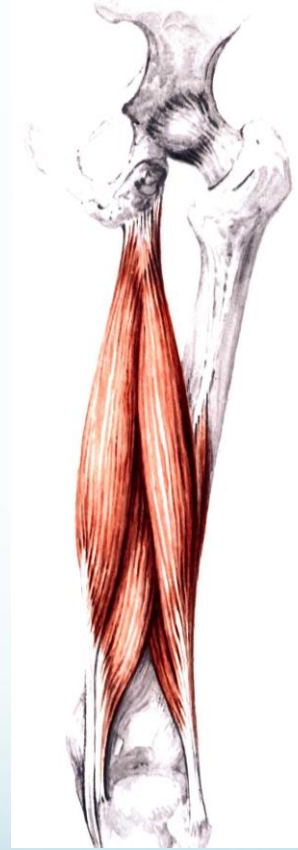
**Quadriceps**



**Adductors**



**Hip flexors**



**Hamstrings**



**Rotator cuffs**

# Hamstring Strains

- Most frequently strained muscles
- Mechanism:
  - Rapid contraction in a lengthened position
  - E.g. sprinting and running
- Due to strength imbalance
  - Hamstring strength <<< quadriceps strength

FIX? **Emphasize hamstrings and quadriceps equally**





# Ankle Sprains

- During running, walking, dancing or stepping off a curb
- Most common = lateral ankle sprain
  - Inversion
- Common reoccurrence
  - Decreased proprioception
- Symptoms
  - Rapid swelling
  - Point tenderness
- Rehabilitation
  - Decreases reoccurrence
  - Incorporation of balance exercises



# Dislocations



- Great enough forces push the joint beyond its normal anatomical limits
- Joint surfaces come apart (full separation)
- Subluxation
  - When supporting structures (e.g. ligaments) are stretched or torn enough
  - Bony surfaces partially separate
- Most common = fingers
- Can become chronic



# Shoulder Dislocation



- Most mobile joint, therefore it is the most unstable joint
- Categories of dislocation:
  - Partial (subluxation)
  - Complete
- Most common
  - Head of humerus slips anteriorly
  - Falling backwards on extended arm
- Symptoms
  - Swelling, numbness, pain, weakness, bruising
  - Capsule and/or rotator cuff tears
  - Brachial plexus injury
- Require medical treatment to relocate head of humerus back to glenoid fossa



# Fractures

- Simple fracture
  - Stays within the surrounding soft tissue
- Compound fracture
  - Protrudes from the skin
- Stress fracture
  - Results from repeated low magnitude loads
- Avulsion fracture
  - Involves tendon or ligament pulling small chip of bone



# Concussions

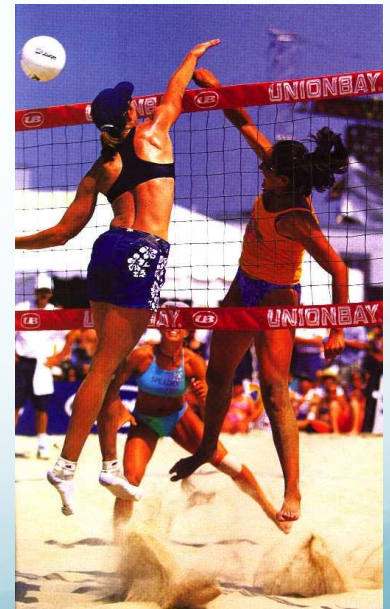


- Injury to the brain
- Mechanism:
  - Violent shaking or jarring action of the head
  - Brain bounces against the inside of the skull
- Symptoms
  - Confusion
  - Temporary loss of normal brain function
- Best treatment is REST

No such thing as “minor concussion and “shaking it off”

# Overuse Injuries

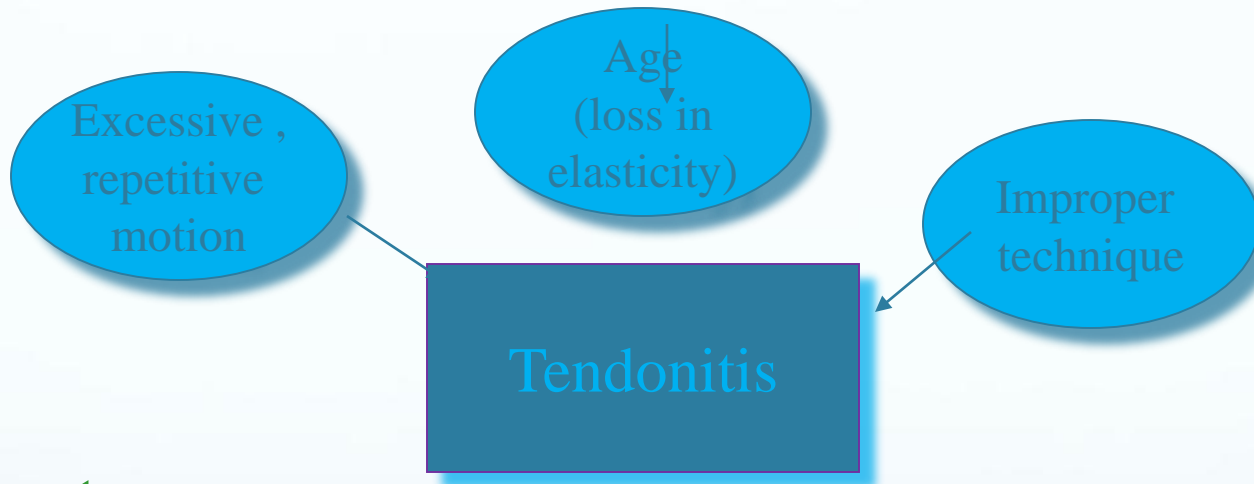
- Due to
  - Repeated and accumulated microtrauma
  - Non-sufficient recovery
  
- Results from
  - Poor technique
  - Poor equipment
  - Too much training
  - Type of training





# Tendonitis

- Inflammation of tendon as a result of a small tear in the tendon



- Symptoms
  - Pain (aggravated by movement)
  - Tenderness
  - Stiffness near joint



# Tennis Elbow

- Lateral epicondylitis
- Affect forearm extensors
  - Attach to lateral epicondyle
  - Extend wrist and fingers
- Contributing factors
  - Excessive forearm pronation and wrist flexion
  - Gripping racquet too tightly
  - Improper grip
  - Excessive string tension
  - Excessive racquet weight
  - Topspins
  - Hitting ball off-centre

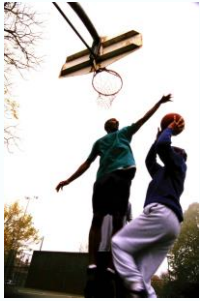


# Golfer's and Little League Elbow



- Medial epicondylitis
- Affects tendons of forearm flexors
  - Attach to medial epicondyle
  - Flex wrist and fingers
- May result in collateral ligament and ulnar nerve injury
- May affect medial humeral growth plate in young children (little league elbow)





# Jumper's Knee

- Patellar tendonitis
- Affects infrapatellar ligament
- Caused by:
  - Repetitive eccentric knee actions
  - Eccentric load during jump preparation  
>>> body weight



# Bursitis

- Inflammation of the **bursae**
  - Tiny fluid-filled sacs
  - Lubricate and cushion pressure points between bone and tendons
- Results from overuse and stress
  - Age is also a factor
- Most common
  - Shoulder, elbow and hip
- Inflammation and pain



aggravated by movement and direct pressure

# Shoulder Impingement

- Excess movement of the humeral head + **lack of space**
- **Inflammation of bursae or rotator cuff tendon**
- **Result of muscle imbalances in shoulder muscles**
  - Weak shoulder depressors
  - Strong shoulder elevators
- **Balanced strength training**





## Stress fracture

- Results from repeated low-magnitude forces
1. Small disruption of the outer bone layer
  2. Weakened bone
  3. Cortical bone fracture
- NOT a shin splint

## Shin splints

- Pain along inside tibial surface
- Involve pain and inflammation
- NO disruption of cortical bone

# Injury Prevention

- Wear the proper protective equipment





- Warm Up and Cool Down



# Keeping Fit and Flexible

- “Use it or lose it”
- Especially important during the off-season
- Preparing the muscle for placing demands

# Eating and Resting

- In order to function effectively body must receive
  - Proper nutrient
  - Adequate rest
  
- Avoid over-training and lack of sleeping

