



Joint Inflammation: Do I have an autoimmune disease?

Learn about normal joint anatomy and how rheumatoid arthritis affects the joints. We'll go over all the signs and symptoms of joint inflammation and how rheumatoid arthritis can be diagnosed

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Disclosures

- No disclosures
- No conflicts of interests
- Not reimbursed for this talk
- All opinions are my own



The **ChristianaCare** Way

We serve our neighbors as respectful, expert, caring partners in their health. We do this by creating innovative, effective, affordable and equitable systems of care that our neighbors value.

Real Case

A 64 year old pleasant gentleman says that he has increasing pain in both knees. He asks if he has rheumatoid arthritis.



Defining Terms

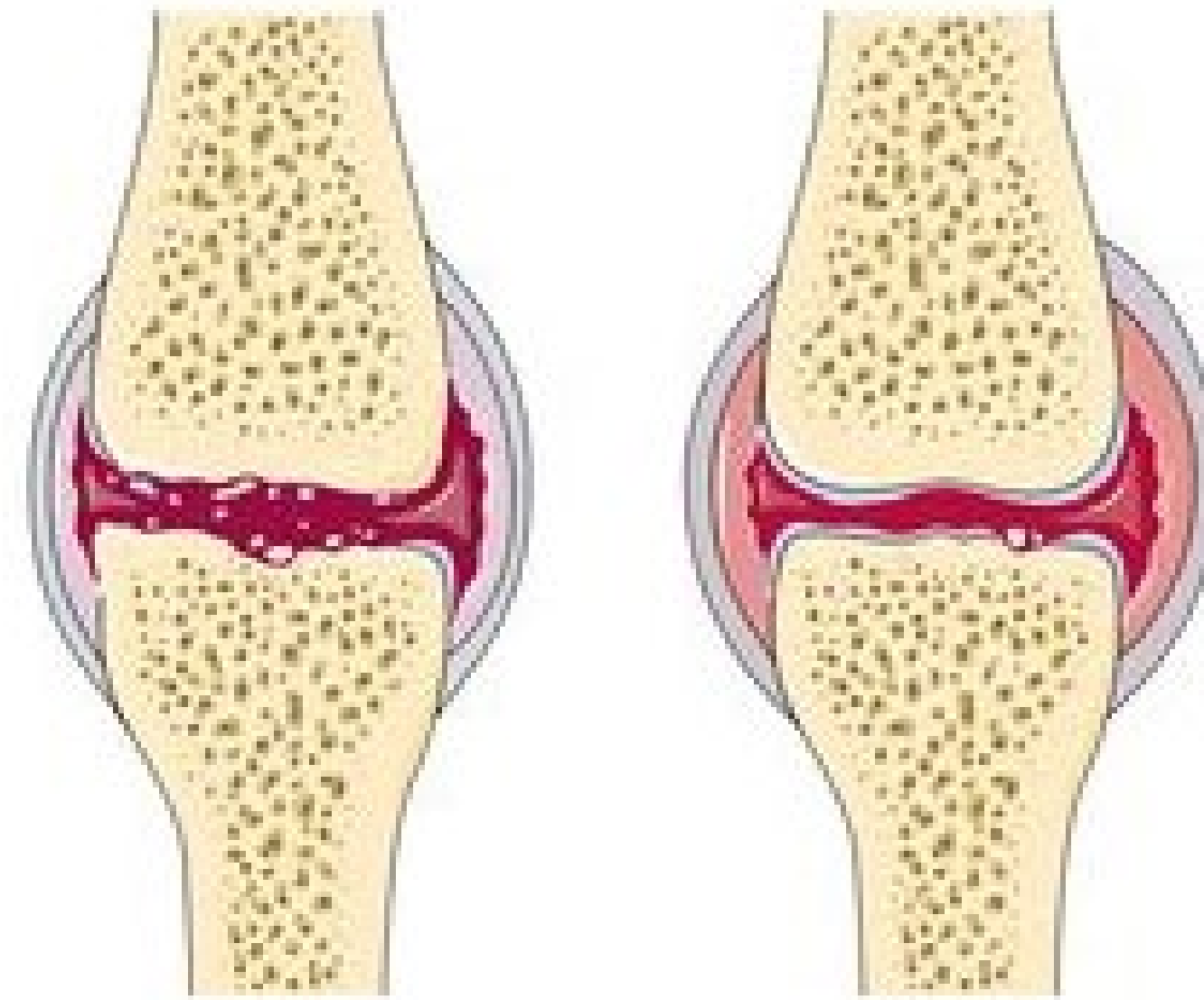
“Arth-”

Joint



“-itis”

Inflammation





Defining Terms

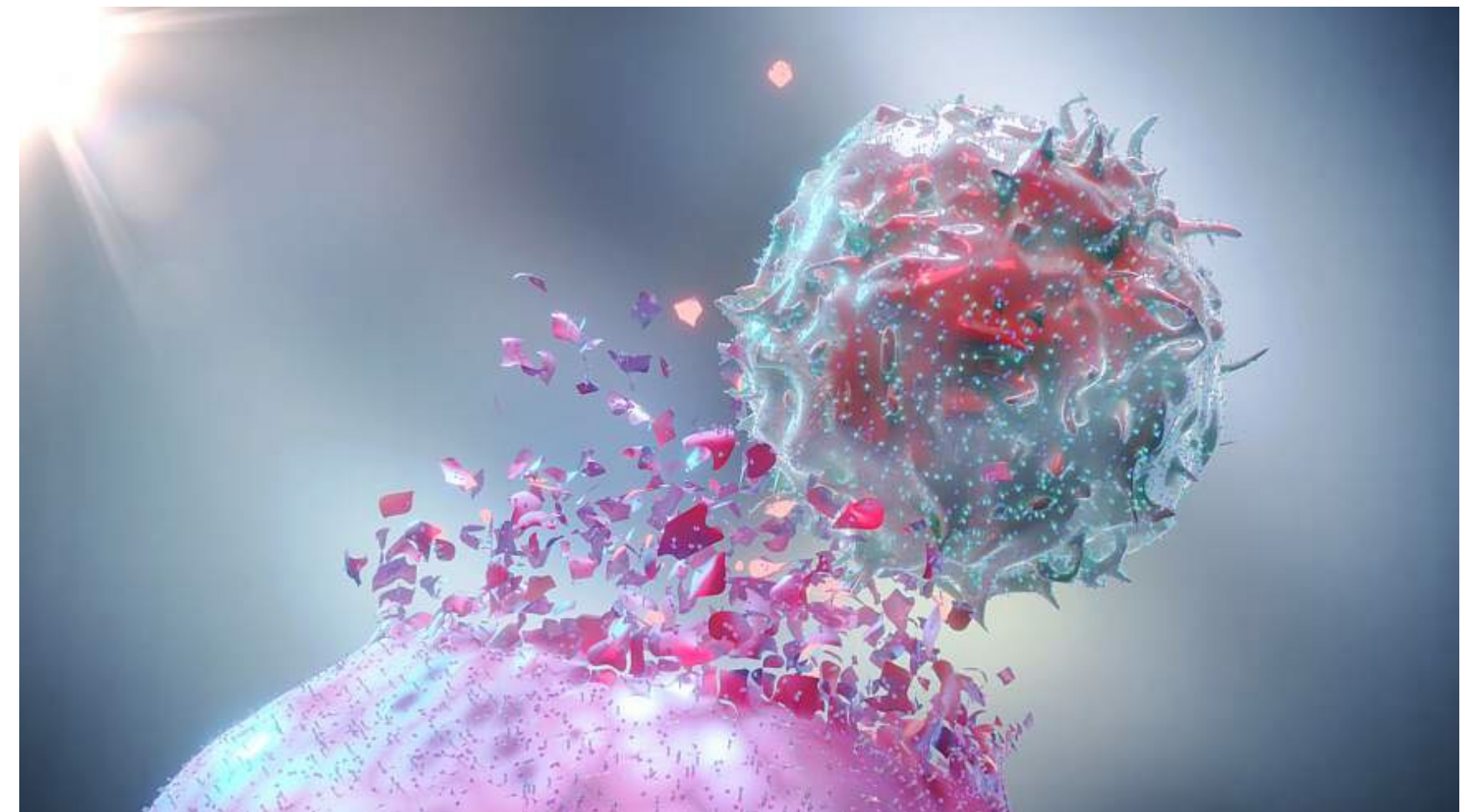
“Auto -”

self



“-immune”

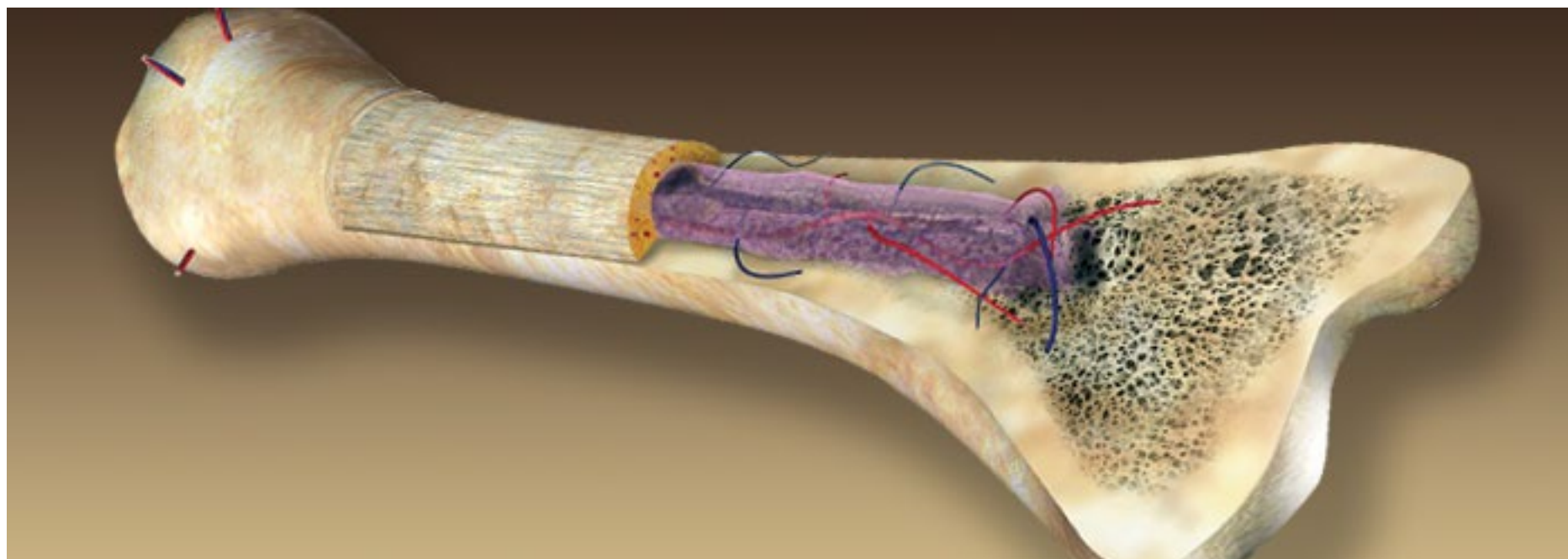
Immune system



Defining Terms

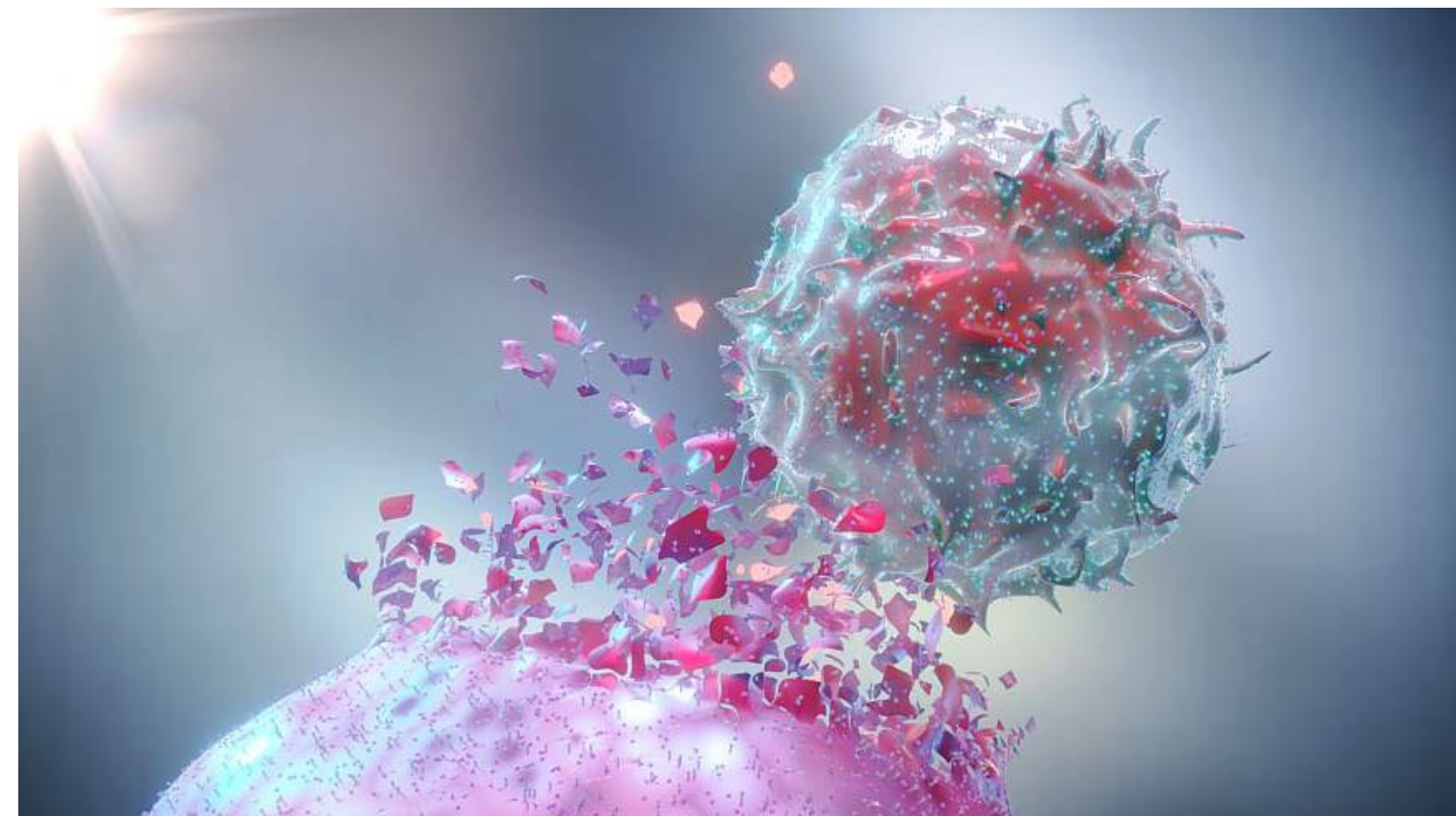
“osteo -”

bone



“rheumatoid”

Related to the
immune system





Two Main Types of Arthritis

Inflammatory

Non-inflammatory

Overactive immune system

“Wear and tear”, mechanical



Symptoms of Arthritis

Inflammatory

Non-inflammatory

AM Stiffness

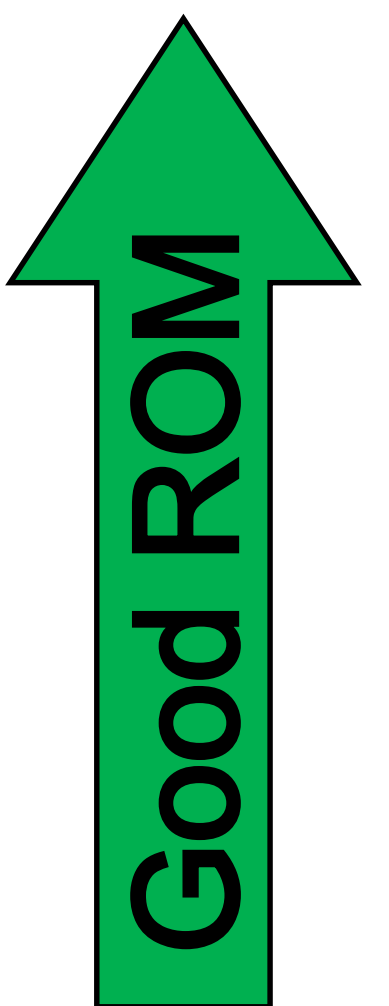
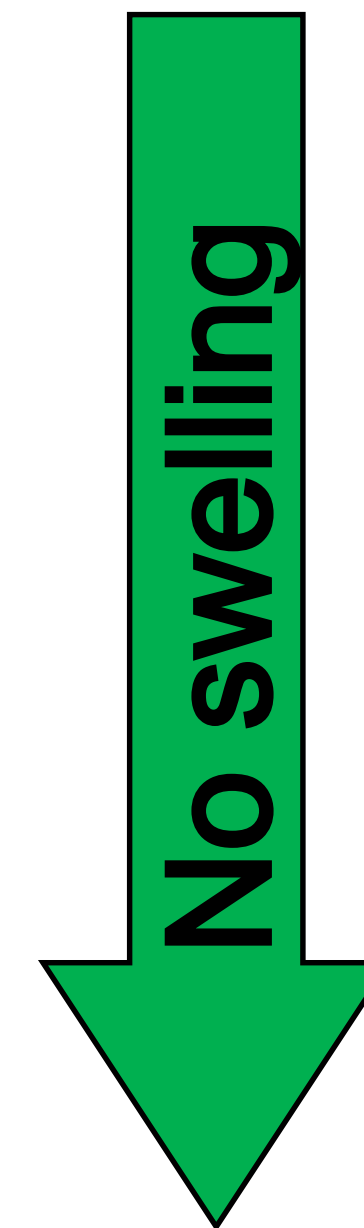
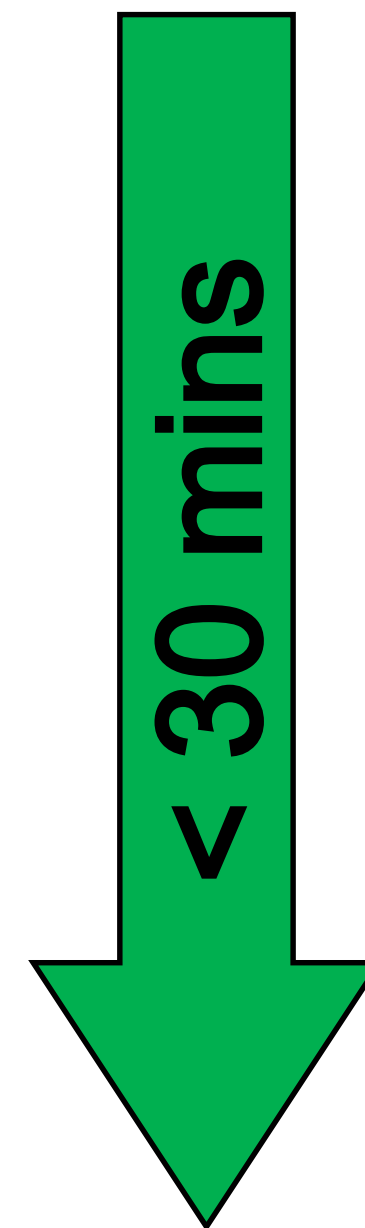
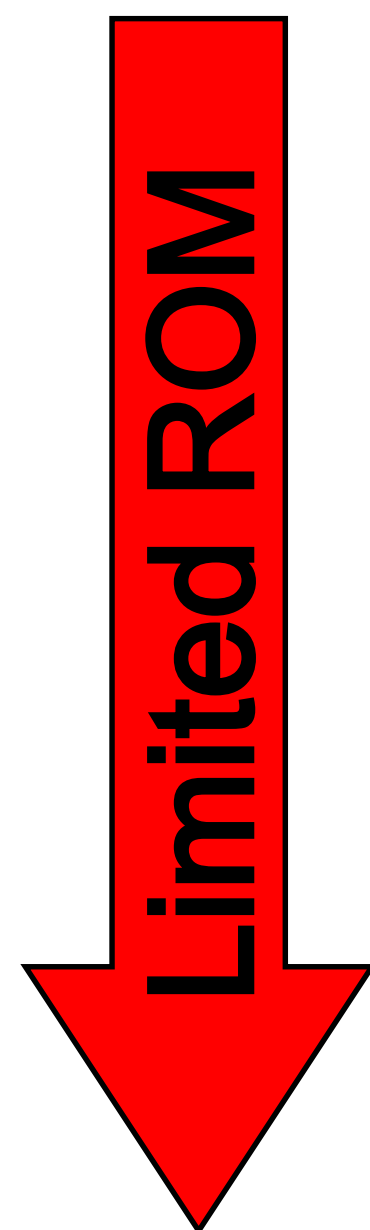
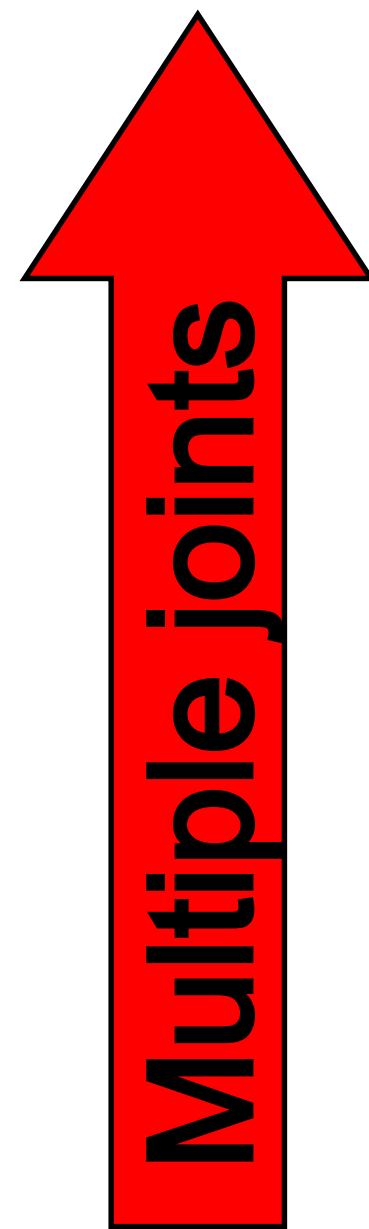
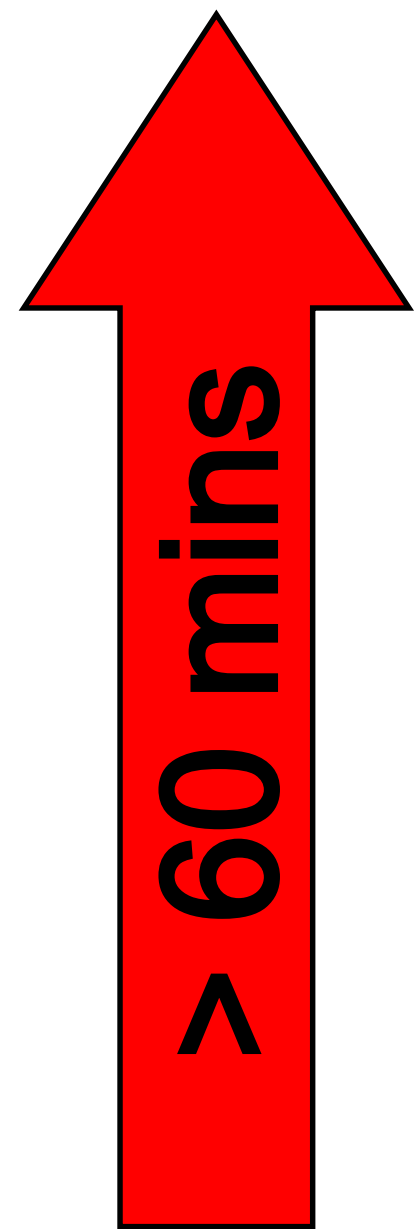
Swelling

ROM

AM Stiffness

Swelling

ROM





Symptoms of Arthritis

Inflammatory

Non-inflammatory

Activity

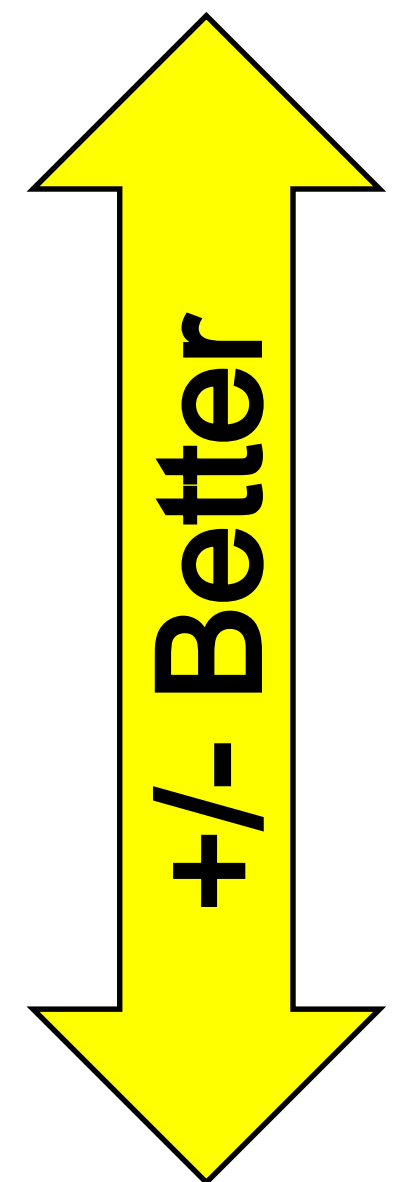
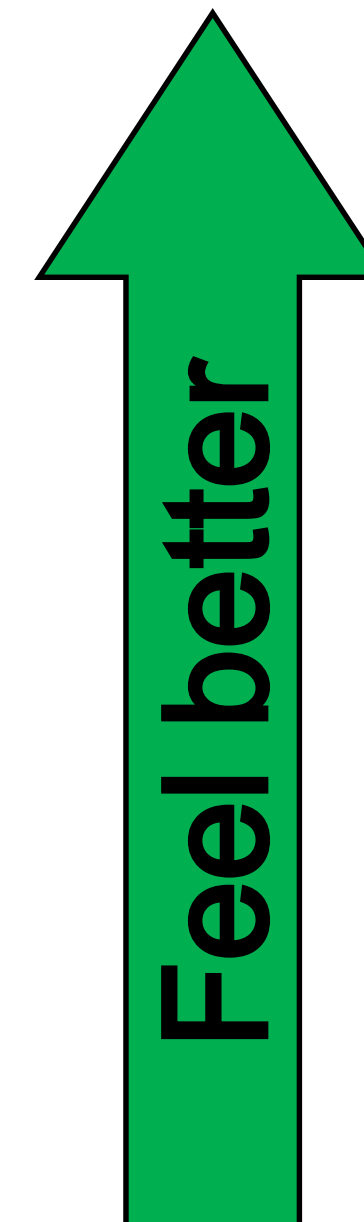
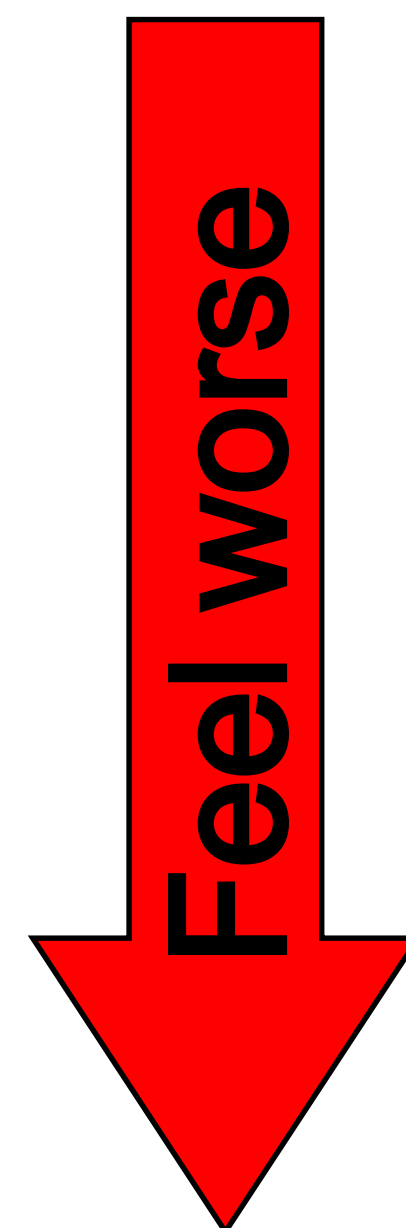
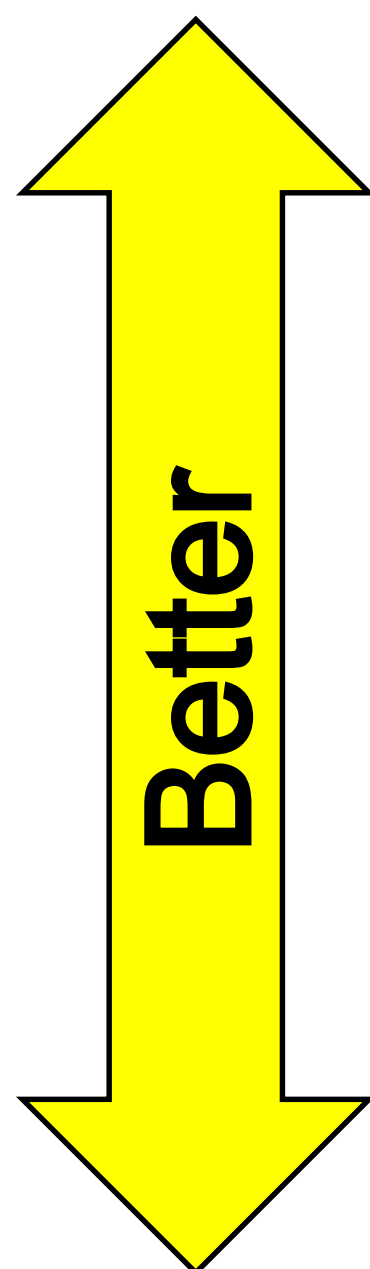
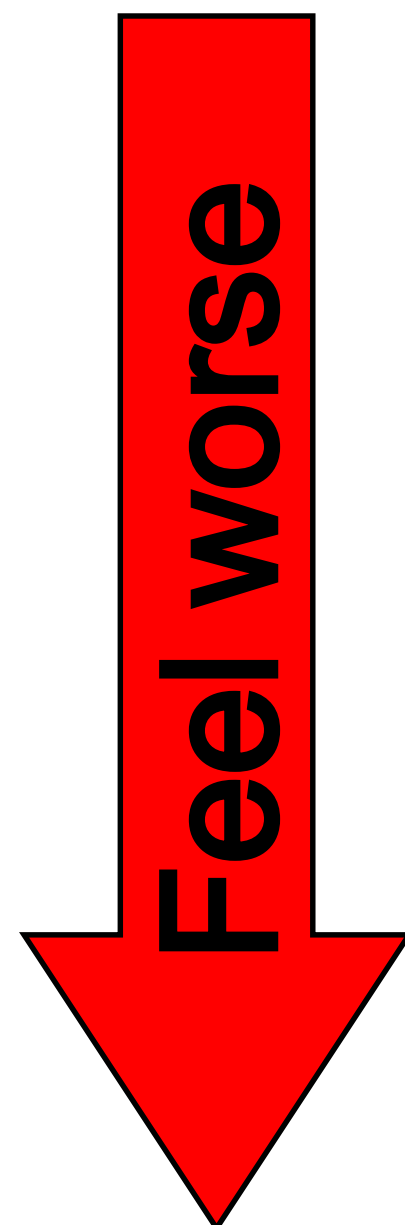
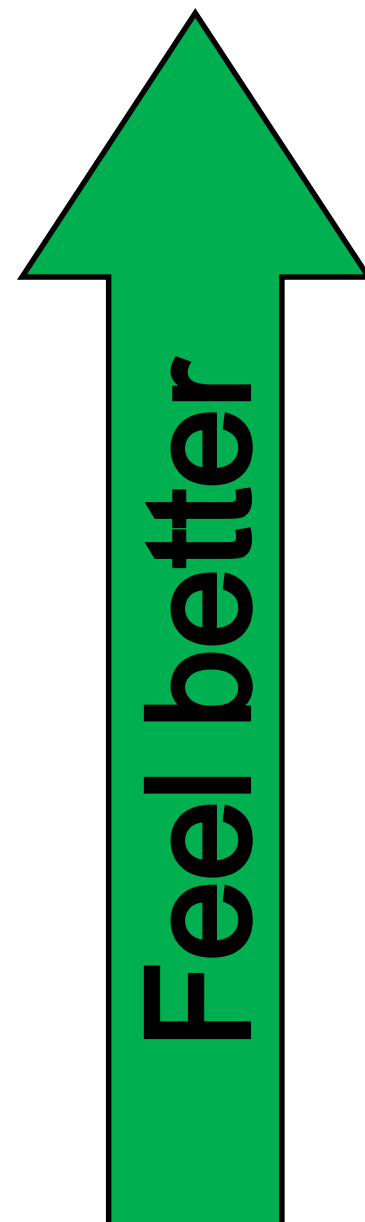
Rest

Steroids

Activity

Rest

Steroids

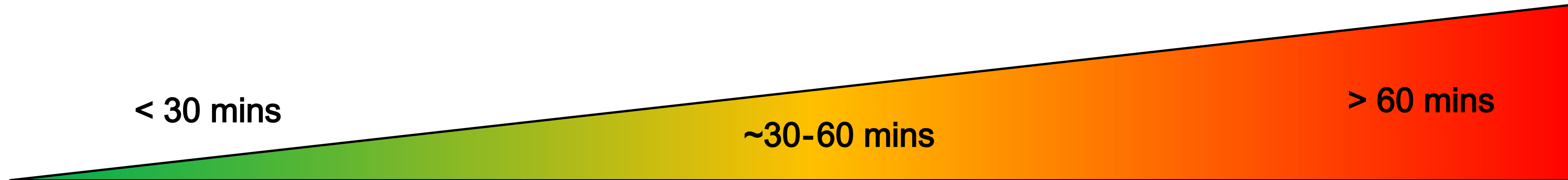




Three Questions to Ask

How long does it take to loosen your joints in the morning?

Non-inflammatory



Inflammatory

Do you have swelling of any joints?

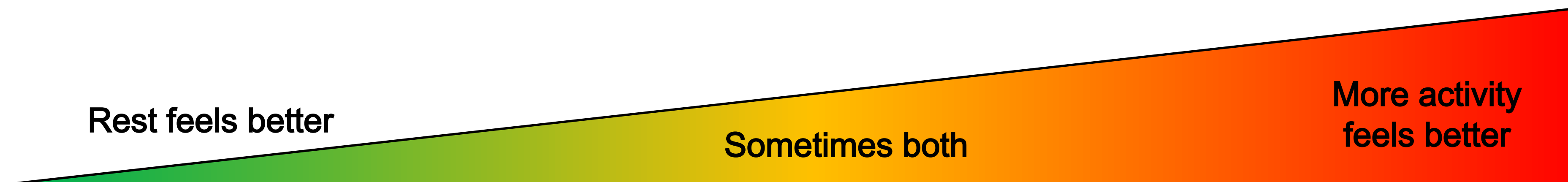
Non-inflammatory



Inflammatory

Do the joints usually feel better with activity, or worse with activity?

Non-inflammatory



Inflammatory



Classic Disease in Each Category

Inflammatory

Non-inflammatory

Rheumatoid Arthritis (RA)

Osteoarthritis (OA)

Diagnosing Rheumatoid Arthritis (RA)

| 2010 ACR/EULAR Criteria for RA Diagnosis | | |
|---|--|---|
| A. | Joint involvement | |
| | 1 large joint | 0 |
| | 2-10 large joints | 1 |
| | 1-3 small joints | 2 |
| | 4-10 small joints | 3 |
| | >10 joints (≥1 small joint) | 5 |
| B. | Serology (≥1 test result needed) | |
| | Negative RF and negative ACPA | 0 |
| | Low-positive RF or low-positive ACPA | 2 |
| | High-positive RF or high-positive ACPA | 3 |
| C. | Acute-phase reactants (≥1 test result needed) | |
| | Normal CRP and normal ESR | 0 |
| | Abnormal CRP or abnormal ESR | 1 |
| D. | Duration of symptoms | |
| | <6 wk | 0 |
| | ≥6 wk | 1 |
| Definite diagnosis requires total score ≥6/10. | | |



Defining Terms

Sero

-logy

Serum, blood

Study of

Serology is same as saying blood tests



Defining Terms

“Anti”

“body”

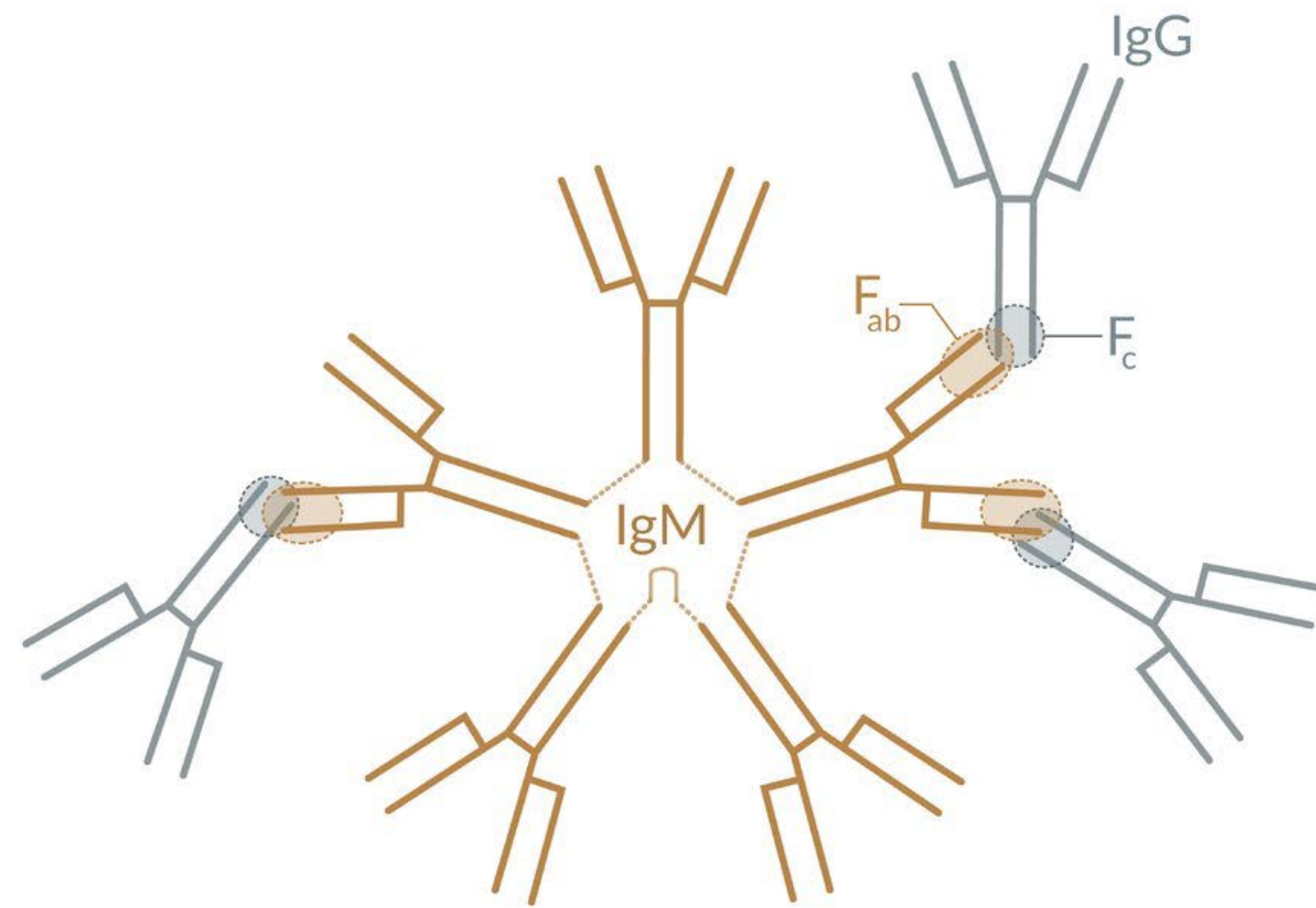
Against

Protein

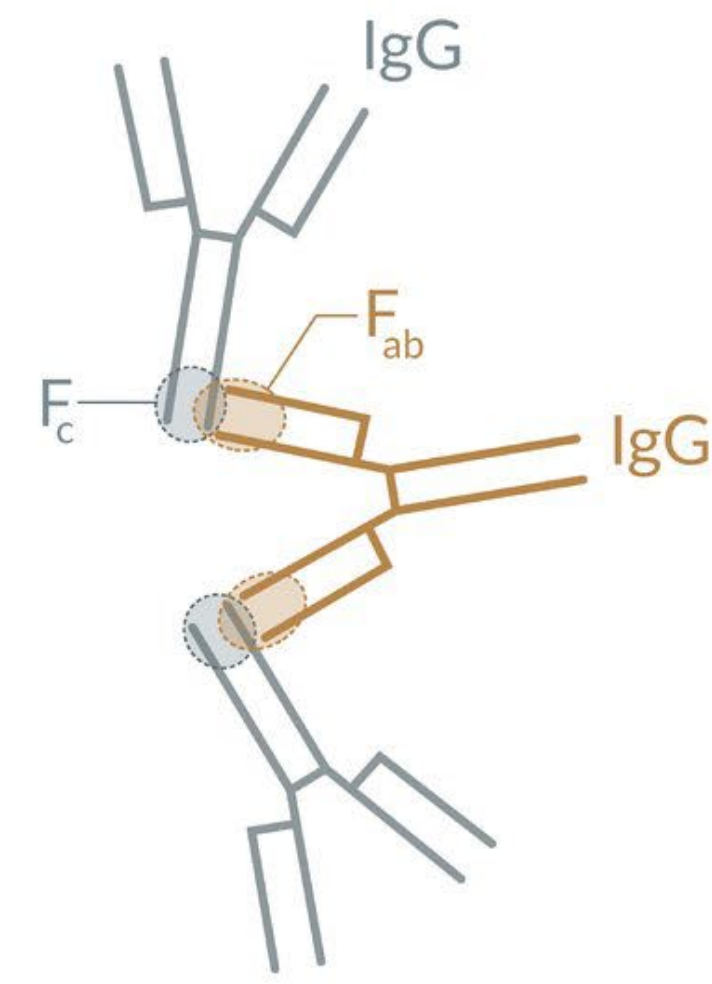
Proteins made by immune cells molded as mirror images of what it “sees”

Two Common Serologies in RA

1) Rheumatoid factor (RF) antibody



IgM rheumatoid factor



IgG rheumatoid factor

2) Anti-cyclic citrullinated peptide (anti-CCP) antibody

Am I Born With These Antibodies?

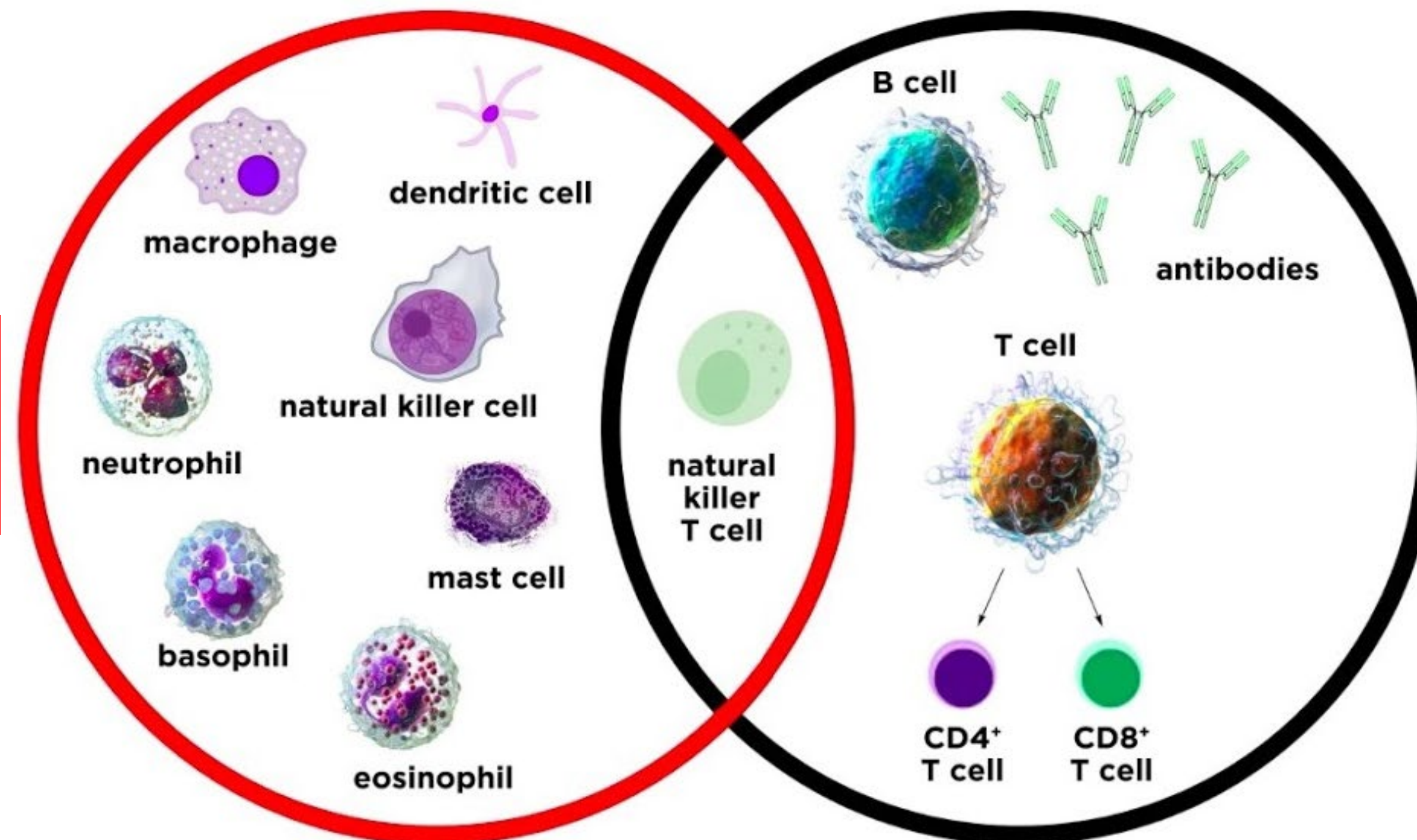
Two main types of immunity: Innate and Adaptive

Innate

Adaptive/
Humoral

What you're born with
(Ex. skin & secretions)

What you learn with each exposure
(Ex. B & T cells)



Auto-inflammatory diseases

Auto-immune diseases



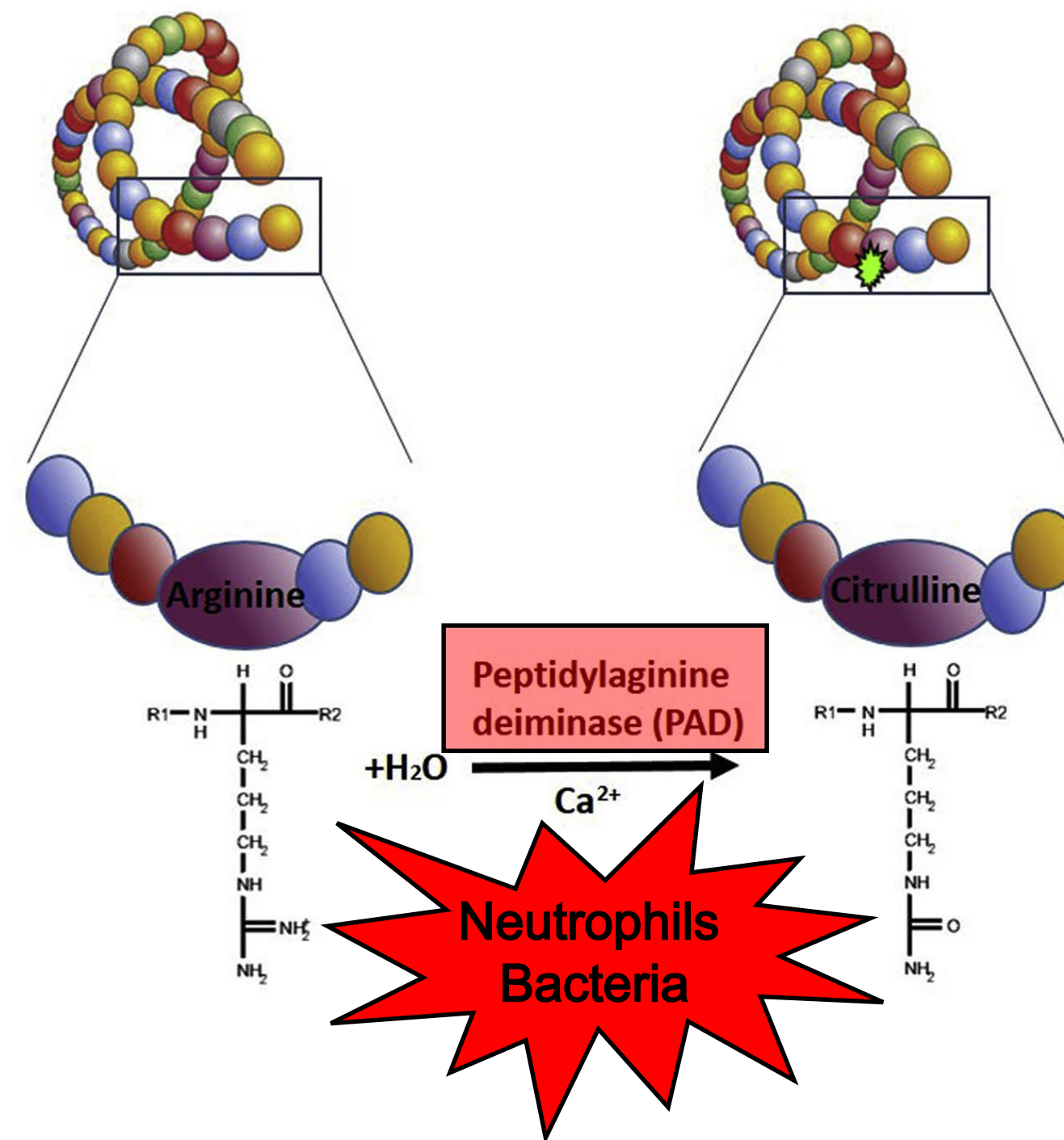
Analogy of an auto-immune disease

Your roommate got into a car accident requiring plastic surgery because of facial burns, and you call the police when they enter the house mistaking them for an intruder

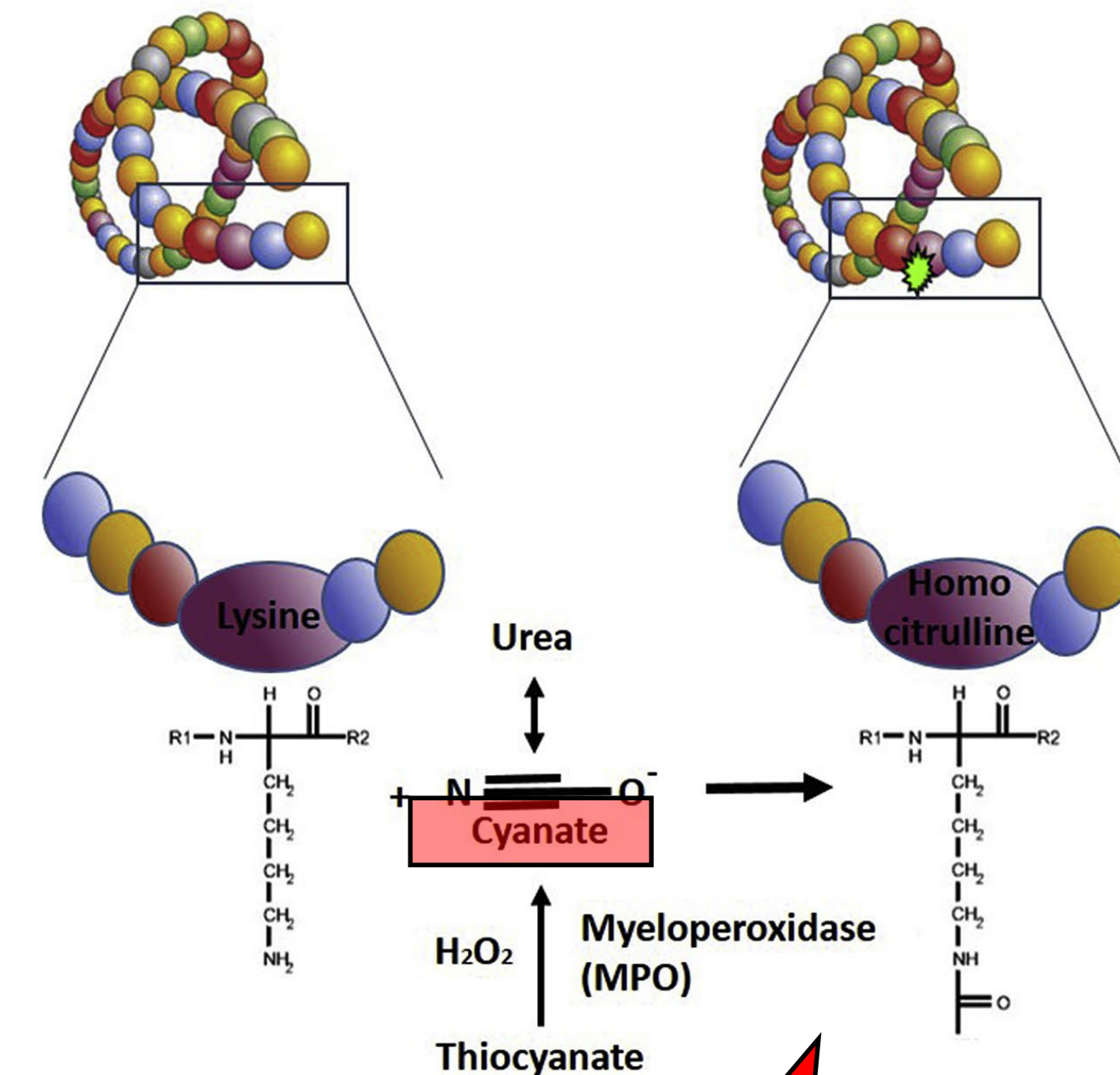
Am I Born With These Antibodies?

Due to post-translational modifications triggering auto-antibody production

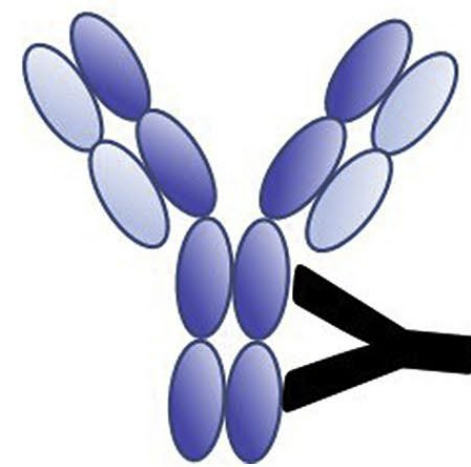
A. Citrullination



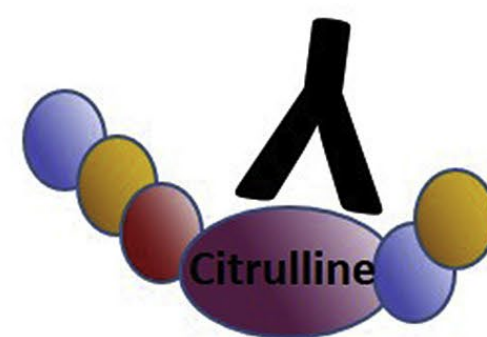
B. Carbamylation



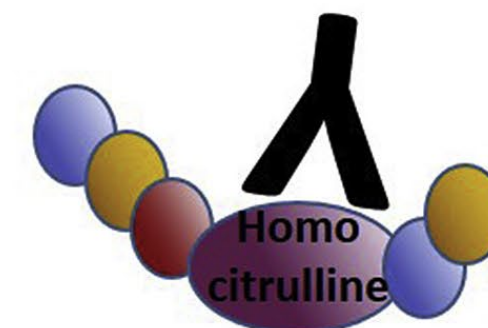
C. Rheumatoid factor



ACPA

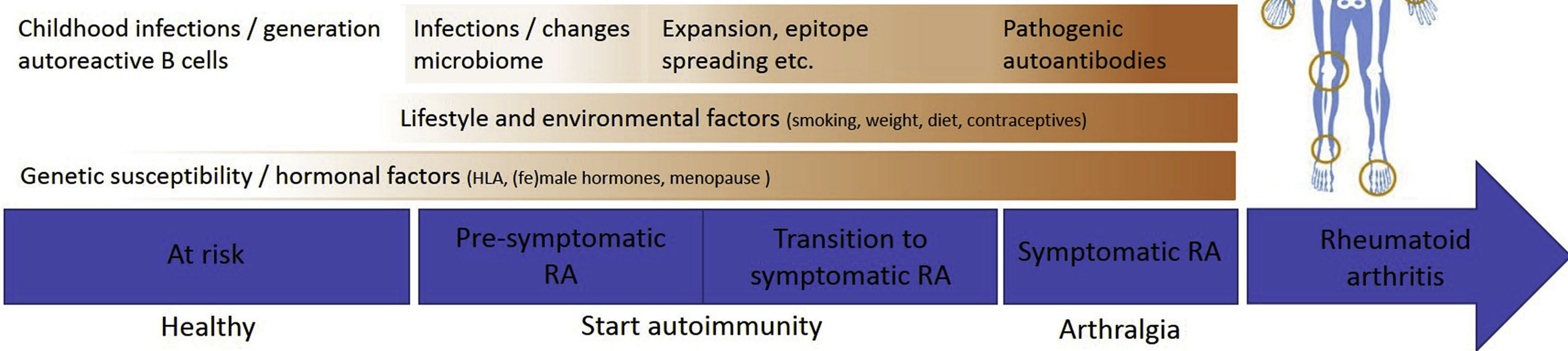


Anti-CarP

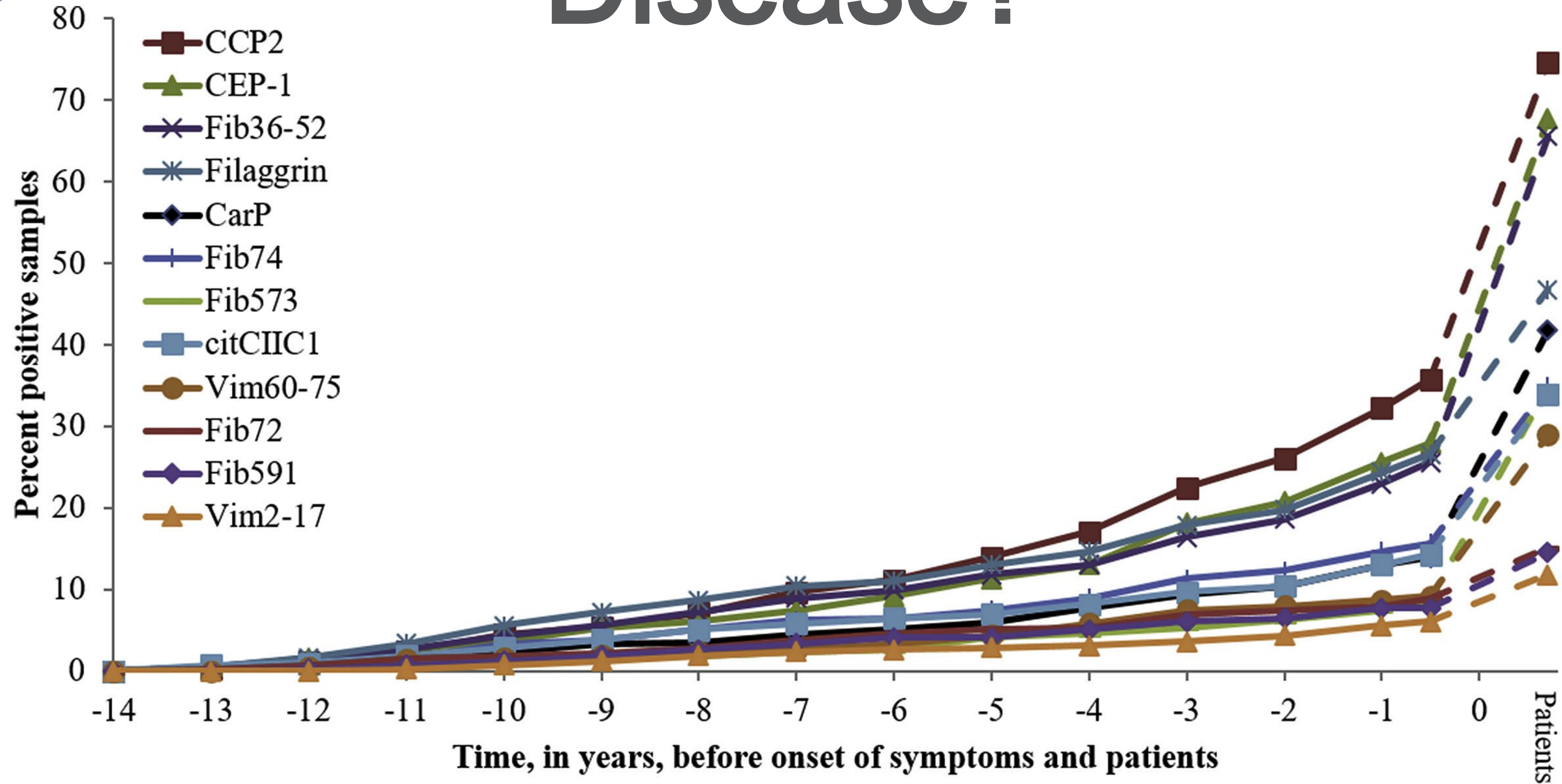


Smoking
Kidney disease
Inflammation

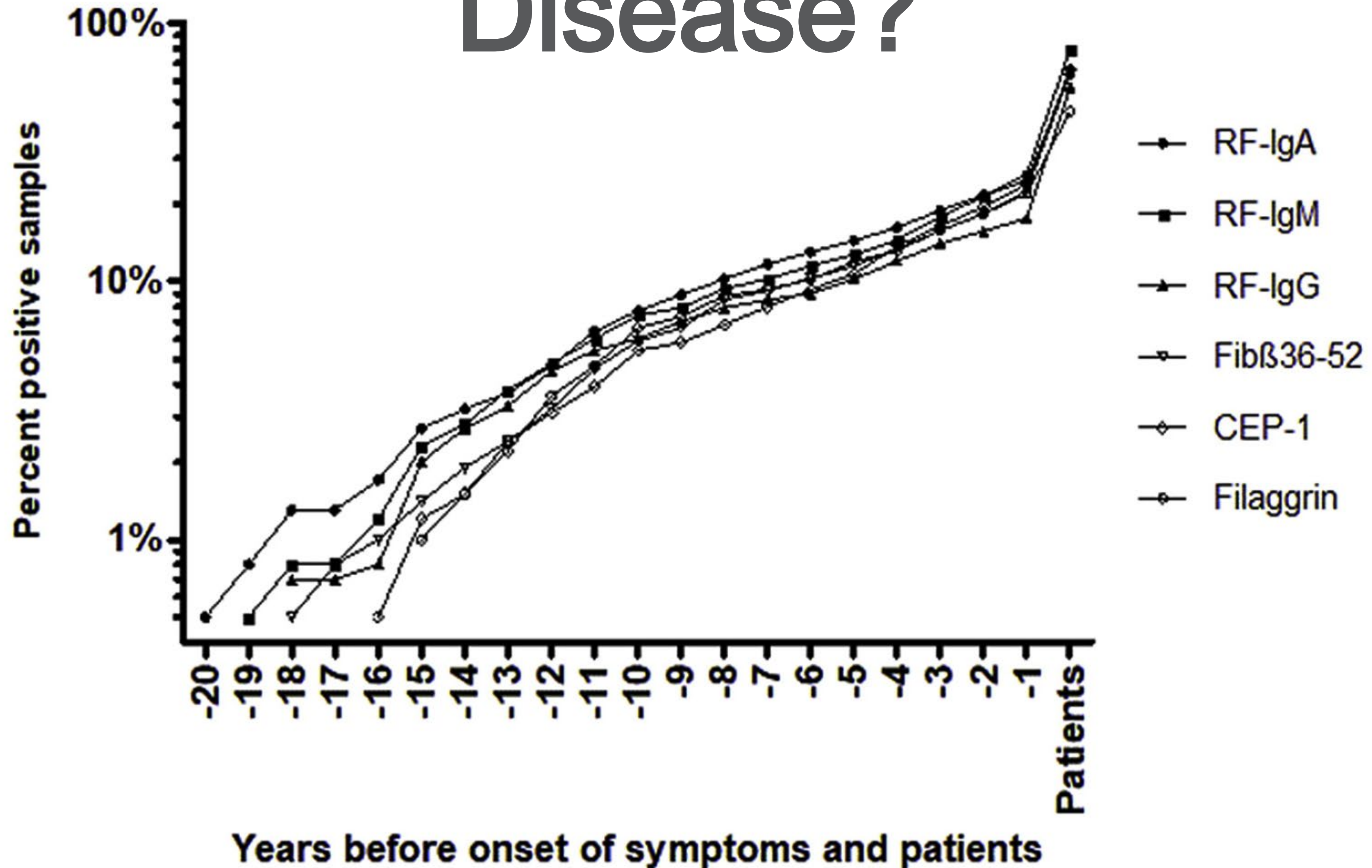
Symptoms are the tip of the iceberg



Do Positive Tests Mean Active Disease?

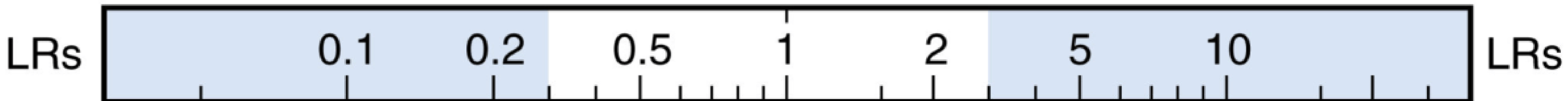
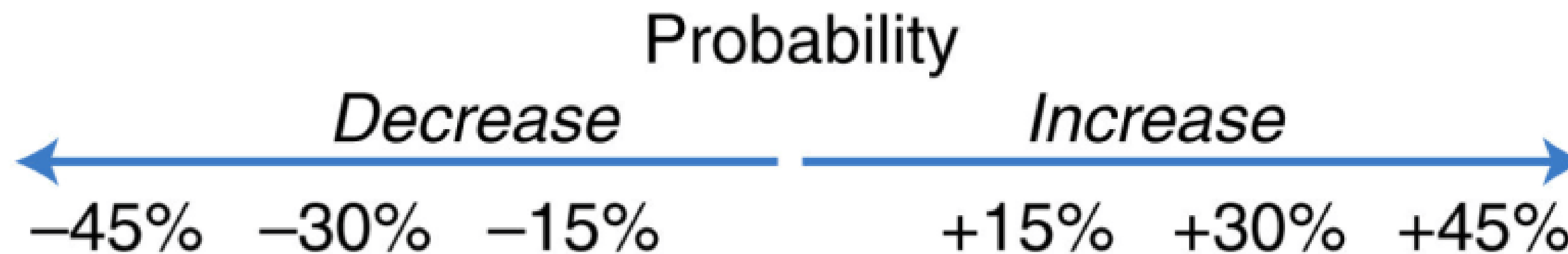


Do Positive Tests Mean Active Disease?



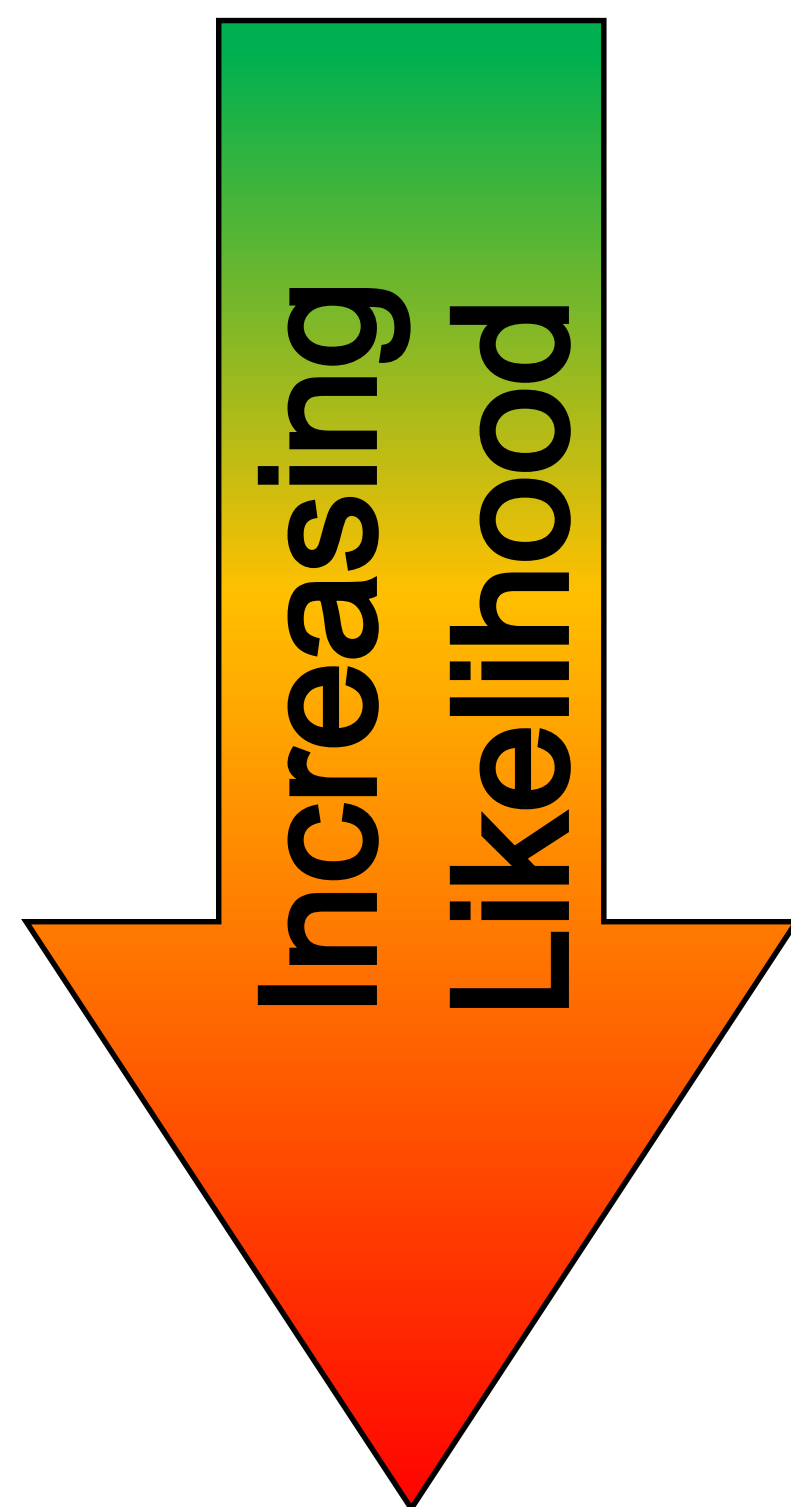
Likelihood Ratios (LR)

$$LR = \frac{\text{Probability of a positive test with disease}}{\text{Probability of a positive test without disease}}$$



RA LR Based on Serologies

| Test combination | Likelihood ratio | 95% CI | % Posttest probability ^a | 95% CI |
|-----------------------------------|------------------|--------------|-------------------------------------|--------------|
| Anti-CCP negative/ RF negative | 0.3 | 0.2 to 0.4 | 6.4 | 4.9 to 8.1 |
| Anti-CCP negative/ RF positive | 1.0 | 0.6 to 1.8 | 17.2 | 10.3 to 27.4 |
| Anti-CCP positive/ RF negative | 3.4 | 1.6 to 7.6 | 41.3 | 24.2 to 60.8 |
| Anti-CCP positive/ RF positive | 43.4 | 21.4 to 87.8 | 90.0 | 81.4 to 94.2 |



Cutoffs, >15 IU/ml for RF and >20 U/l for anti-CCP were considered.

^a Posttest probabilities were calculated from the prevalence of RA in the group=17%.

Likelihood of RA

RF

- +

Anti -CCP

| | | |
|---|-----|------|
| - | 0.3 | 1.0 |
| + | 3.4 | 43.4 |

Likelihood of RA

| | | RF | |
|----------|---|-----|------|
| | | - | + |
| Anti-CCP | - | 0.3 | 1.0 |
| | + | 3.4 | 43.4 |

If I have negative rheumatoid arthritis blood tests, does that mean I don't have rheumatoid arthritis?

If I have positive rheumatoid arthritis blood tests, does that mean I have rheumatoid arthritis?

Positive RF or anti-CCP ≠ RA

2010 ACR/EULAR Criteria for RA Diagnosis

| A. Joint involvement | | |
|--|--|---|
| 1 large joint | | 0 |
| 2-10 large joints | | 1 |
| 1-3 small joints | | 2 |
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| C. Acute-phase reactants (≥1 test result needed) | | |
| Normal CRP and normal ESR | | 0 |
| Abnormal CRP or abnormal ESR | | 1 |
| D. Duration of symptoms | | |
| <6 wk | | 0 |
| ≥6 wk | | 1 |

Definite diagnosis requires total score ≥6/10.

**Positive Blood Tests
Alone Don't Diagnose
Rheumatoid Arthritis**

Symptoms and Physical Exam are Critical

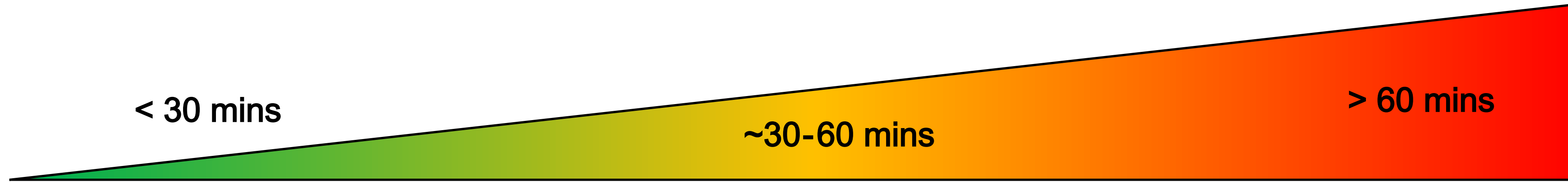
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| | ≥6 wk | 1 |
| Definite diagnosis requires total score ≥6/10. | | |

Multiple swollen joints for over 6 weeks are enough to diagnose as inflammatory arthritis

Again, which questions do you ask?

How long does it take to loosen your joints in the morning?

Non-inflammatory



Inflammatory

Do you have swelling of any joints?

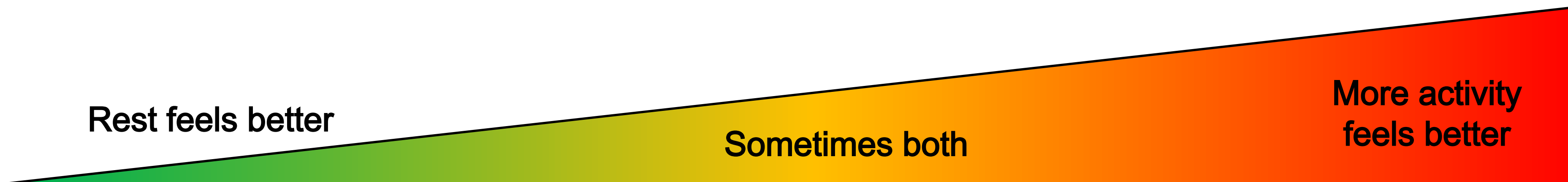
Non-inflammatory



Inflammatory

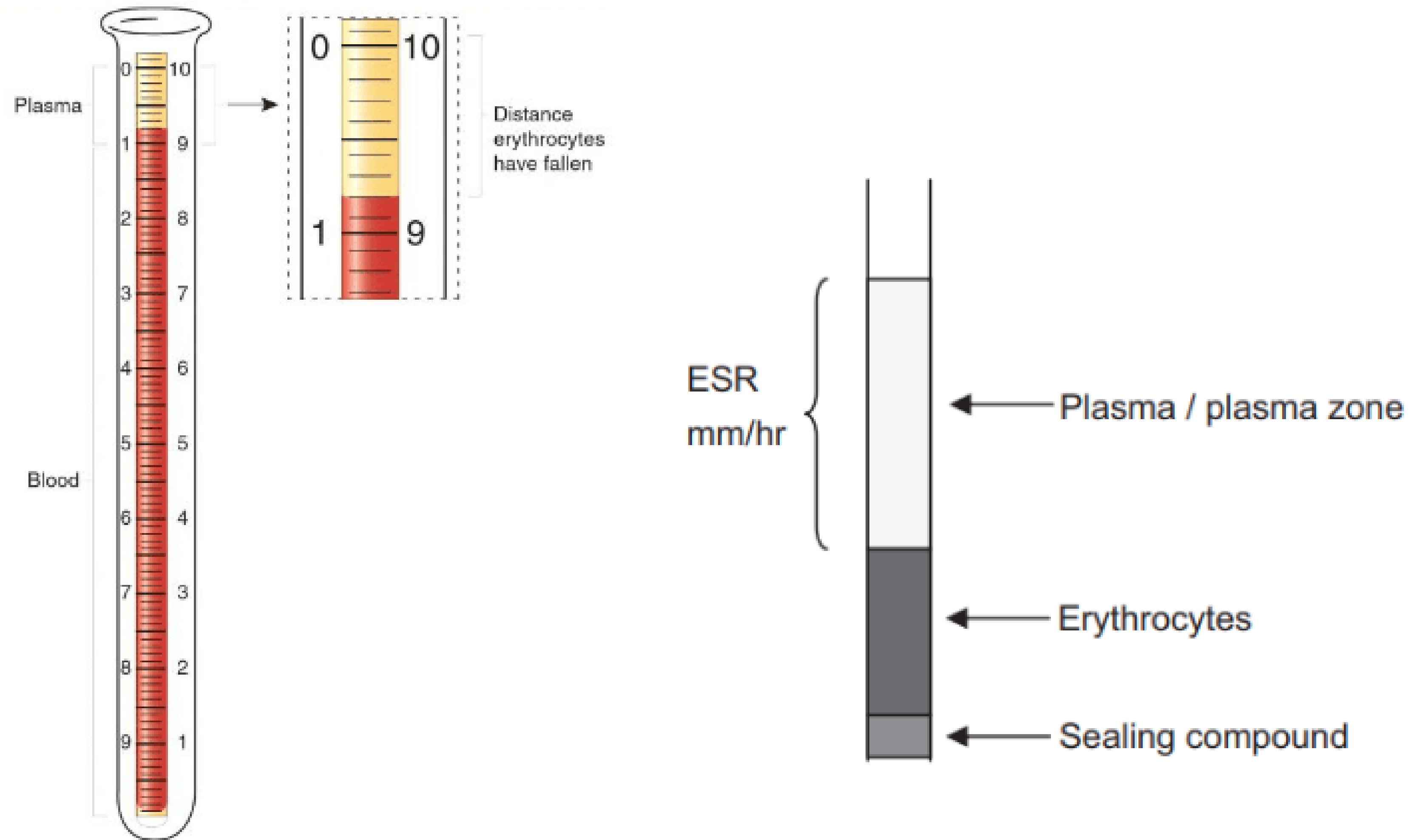
Do the joints usually feel better with activity, or worse with activity?

Non-inflammatory



Inflammatory

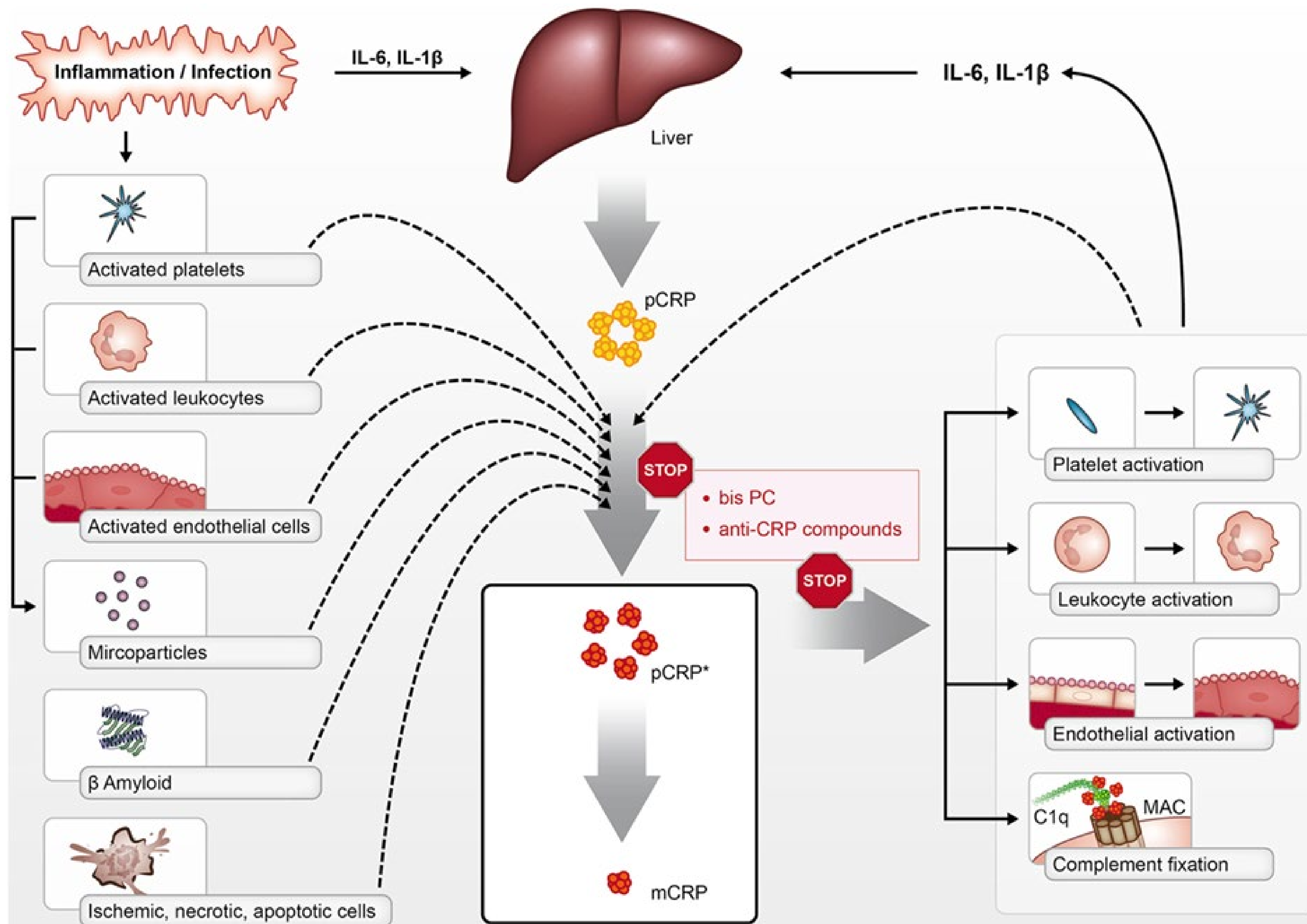
Erythrocyte Sedimentation Rate (ESR)



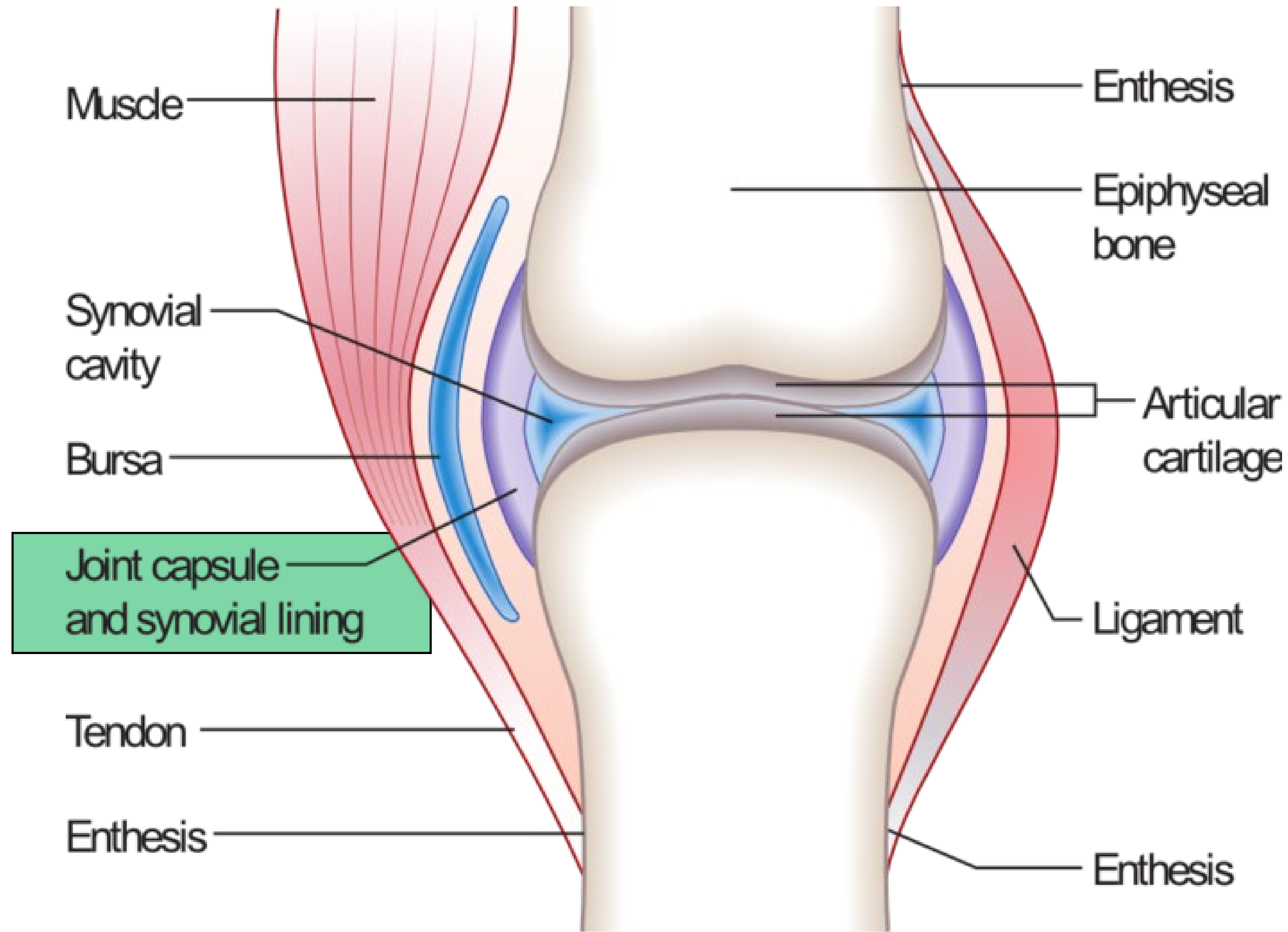
$$\text{Males} = \frac{\text{Age}}{2}$$

$$\text{Females} = \frac{\text{Age} + 10}{2}$$

C-reactive protein (CRP)



Normal Joint Anatomy

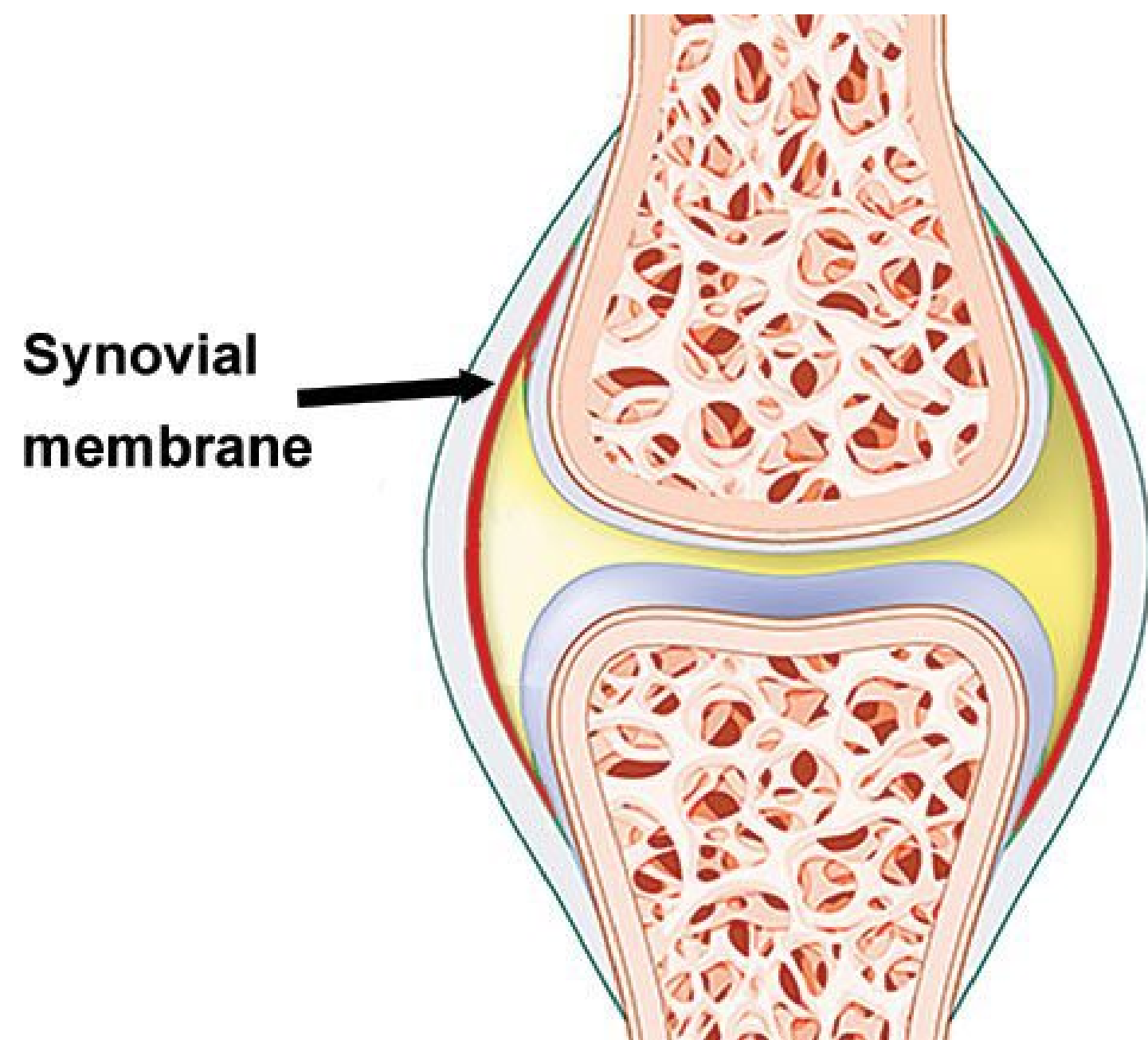


Defining Terms

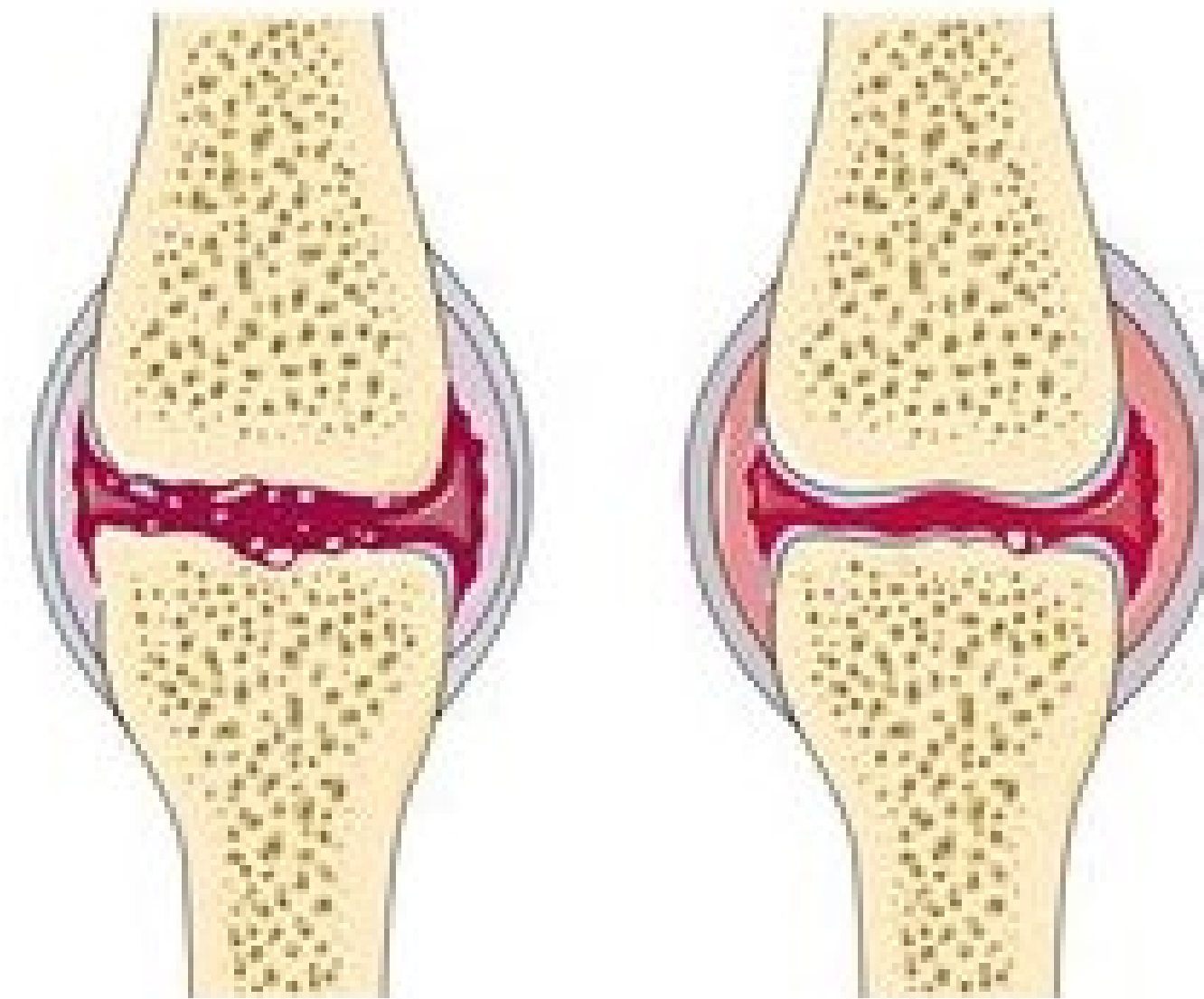
“Syno-”

“-itis”

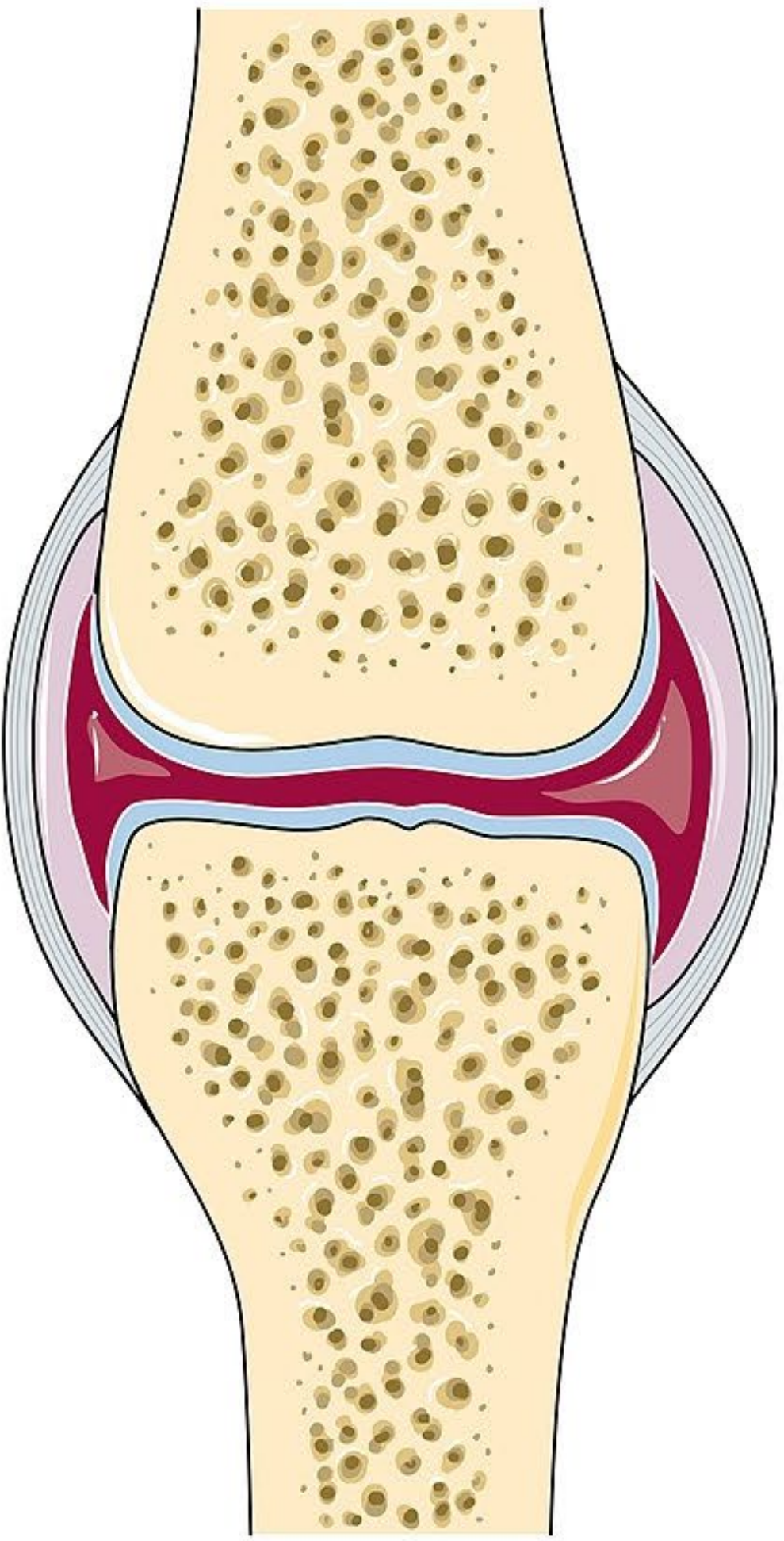
Synovial lining



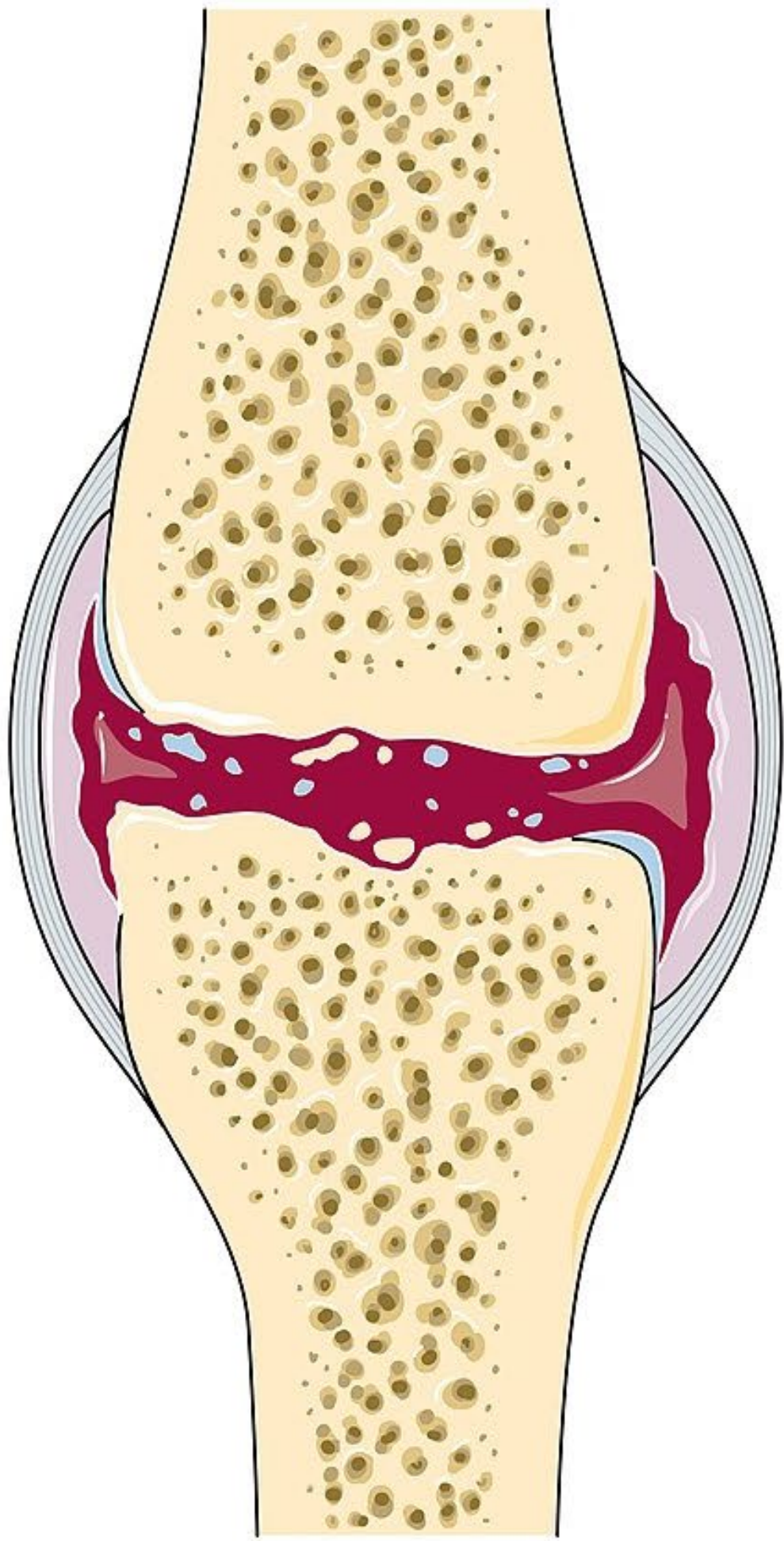
Inflammation



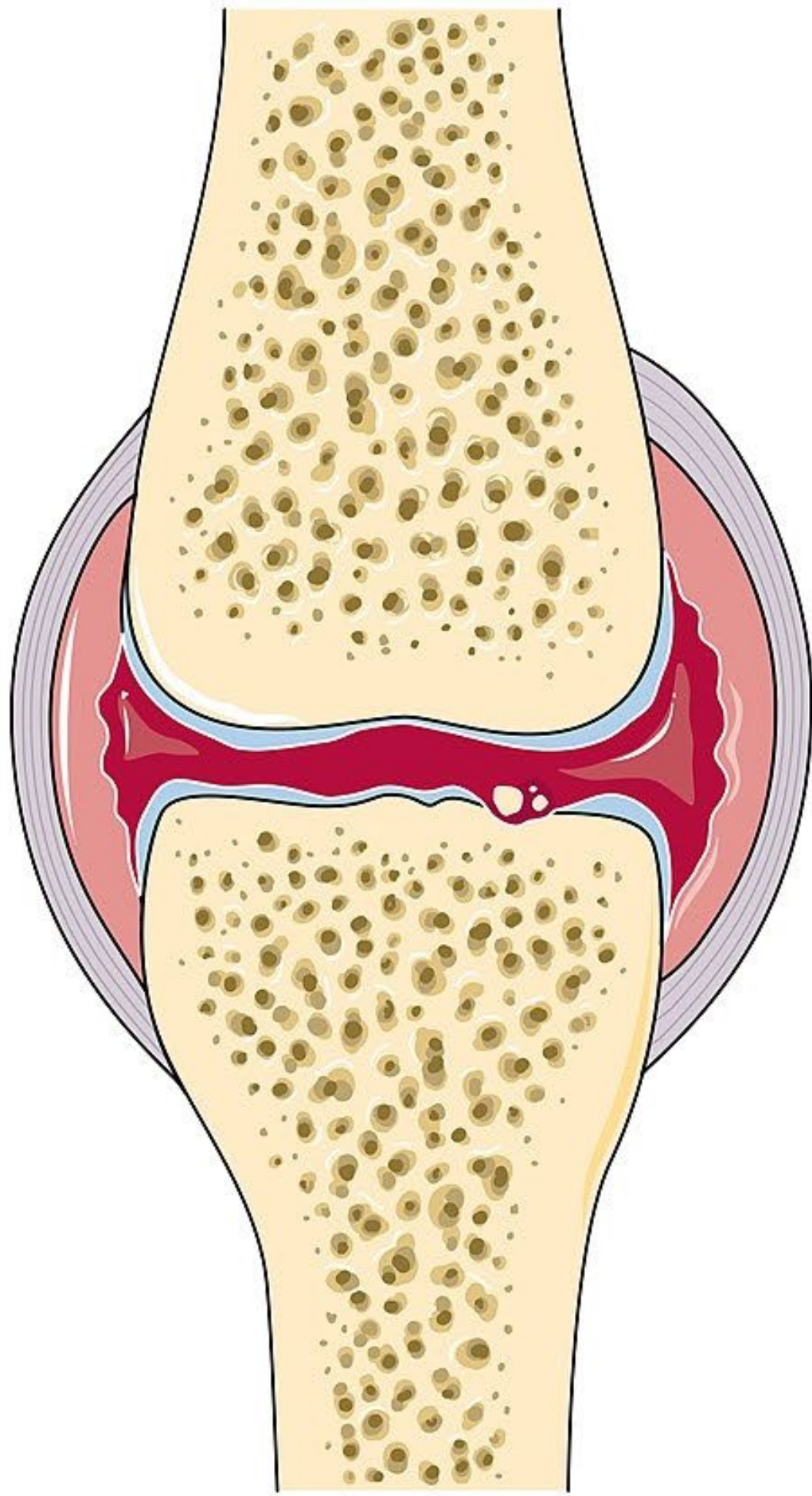
RA vs OA



Normal

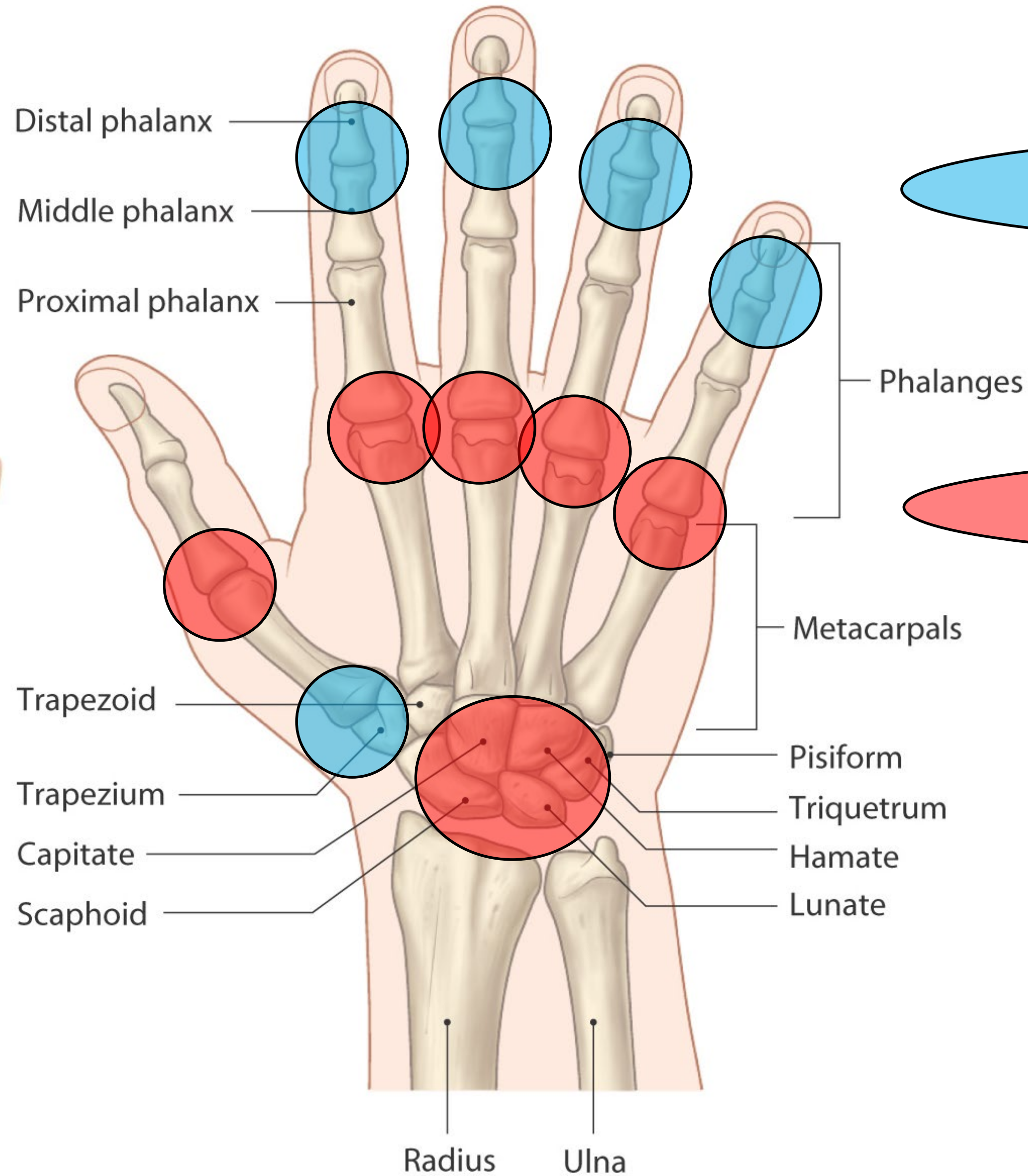
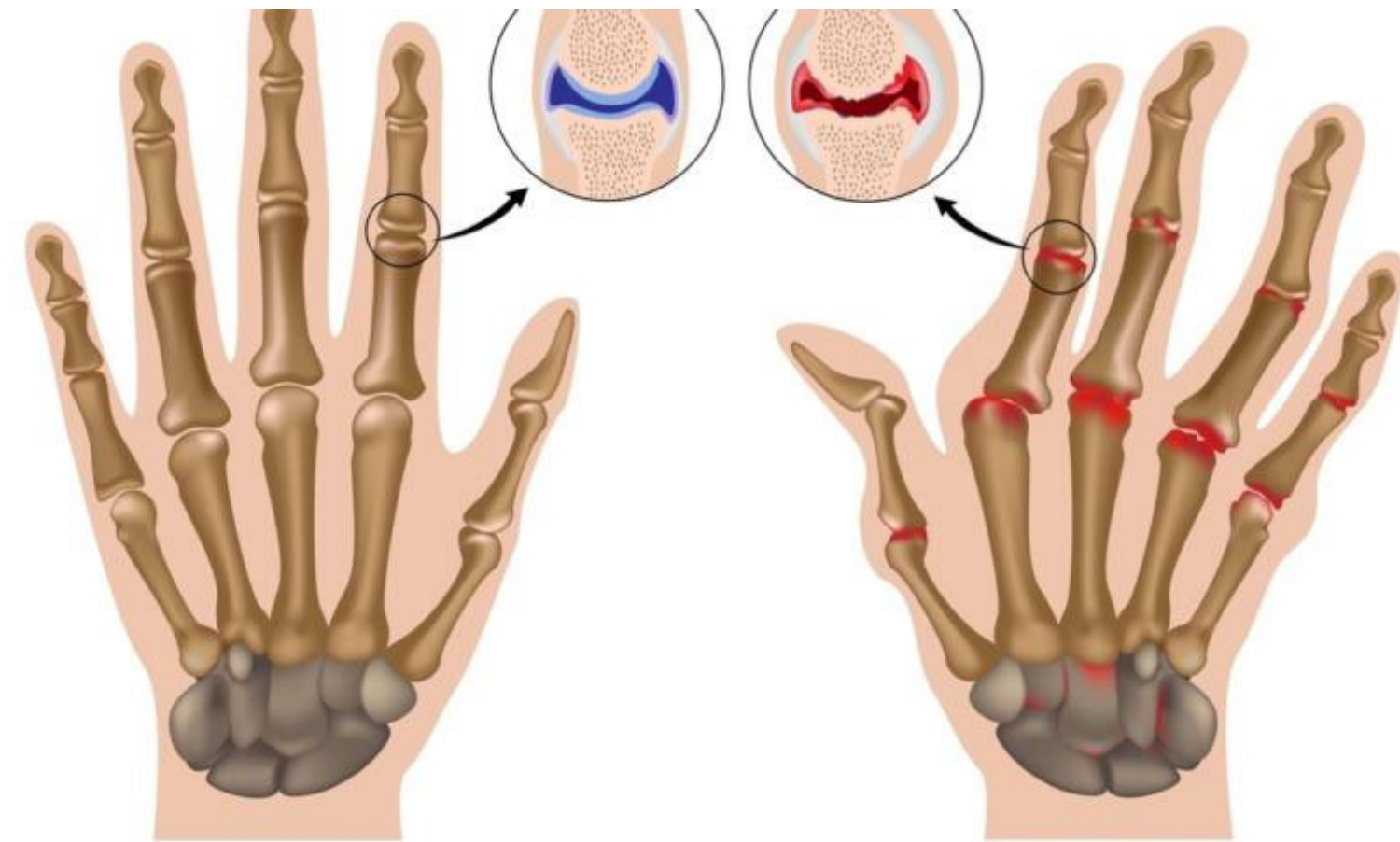


OA



RA

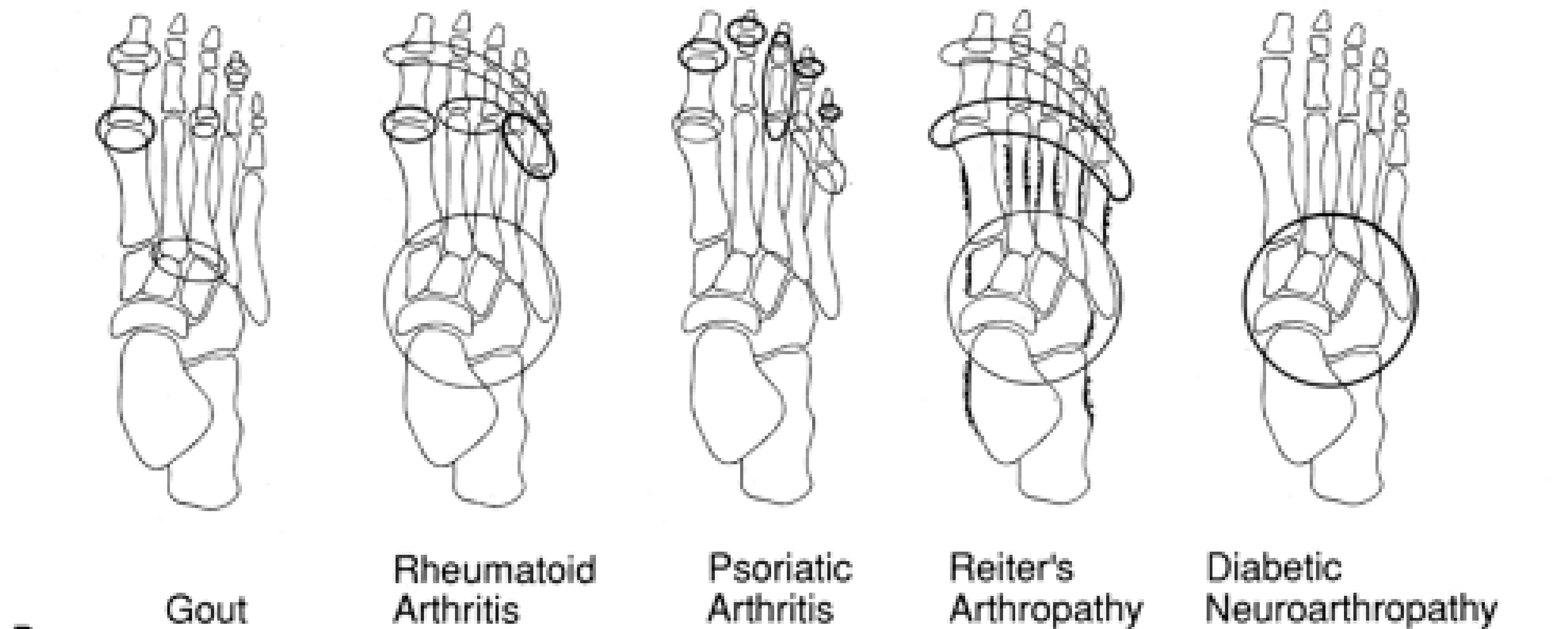
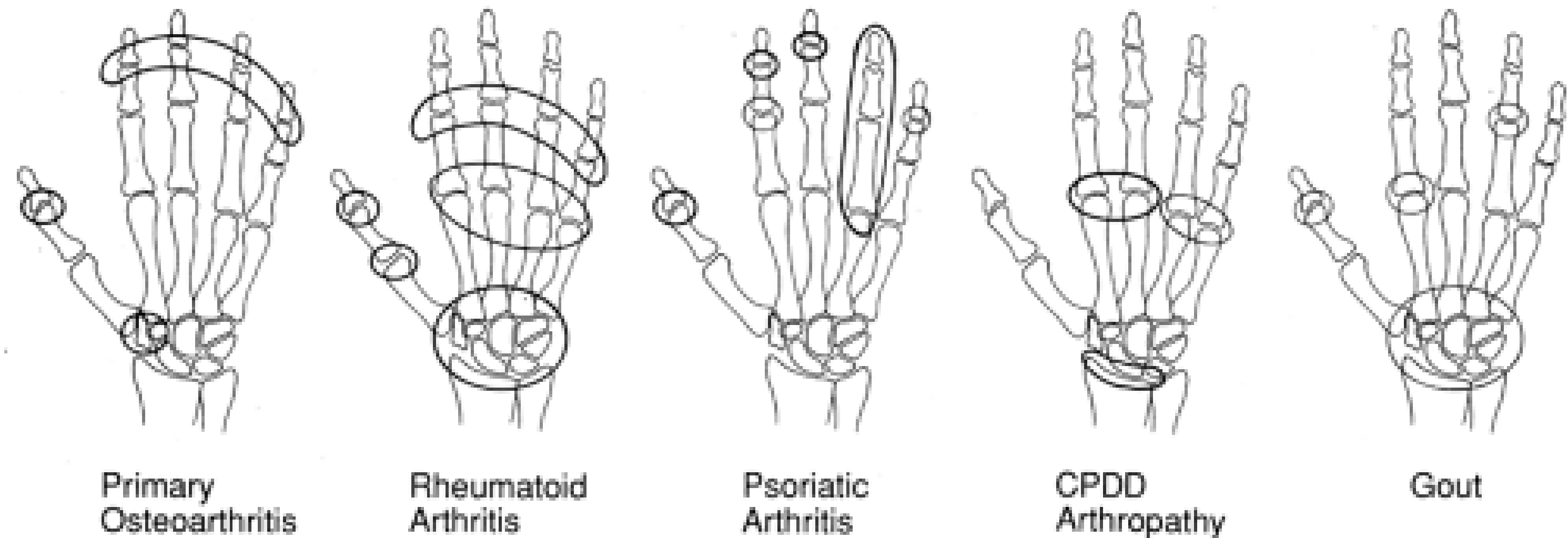
OA vs RA: Hand Clues



Osteoarthritis

Rheumatoid Arthritis

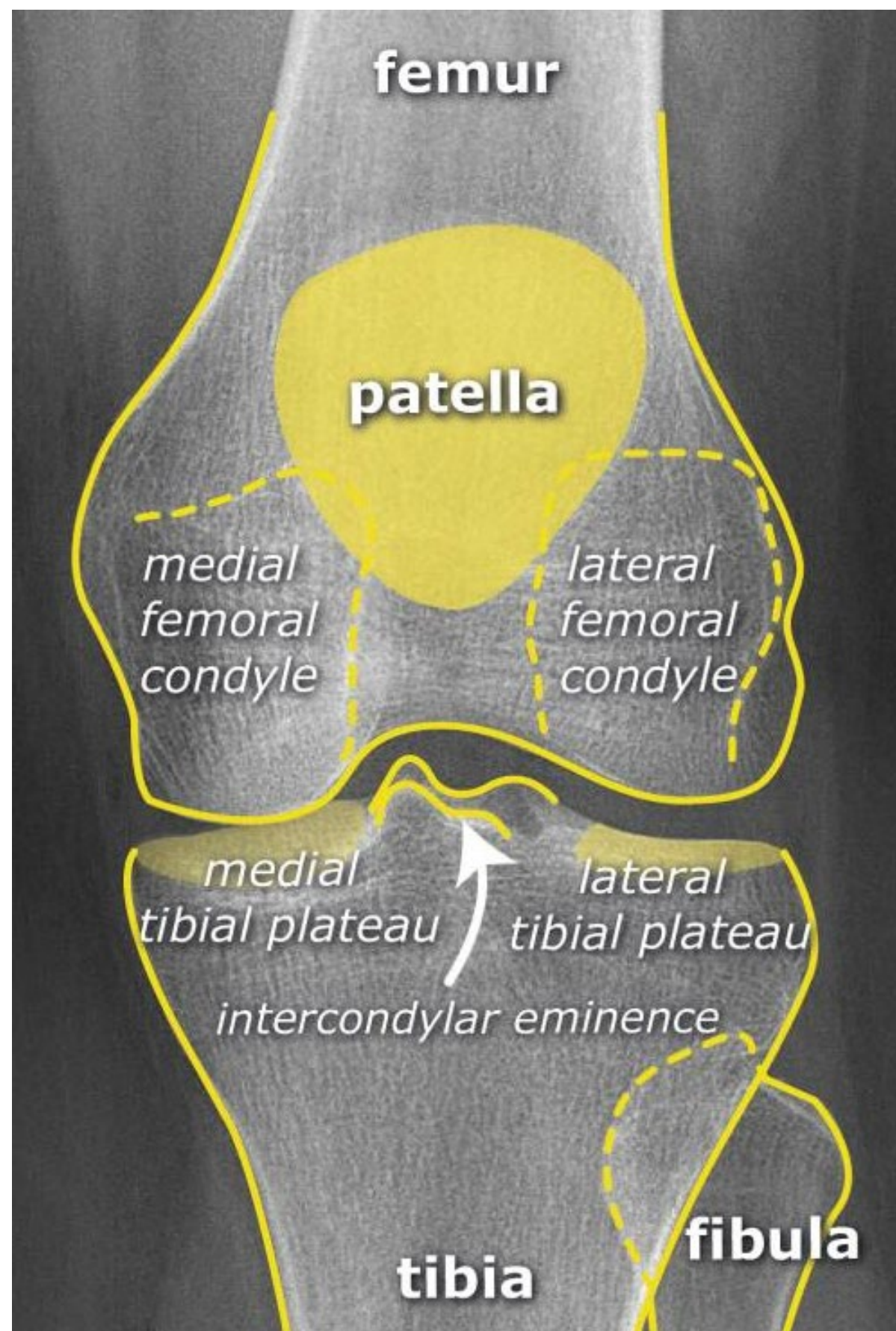
Reading Hands



OA vs RA: Knee Clues

**Asymmetric
Narrowing**

**Symmetric
Narrowing**



Normal



OA



RA

Normal Hand Xray





RA Hand Xray



Late - Stage RA Hand Xray



OA Hand Xray



Overlap Inflammatory OA



How can Ultrasound Help?

Lower Frequency



Lower image resolution
Deeper image depth

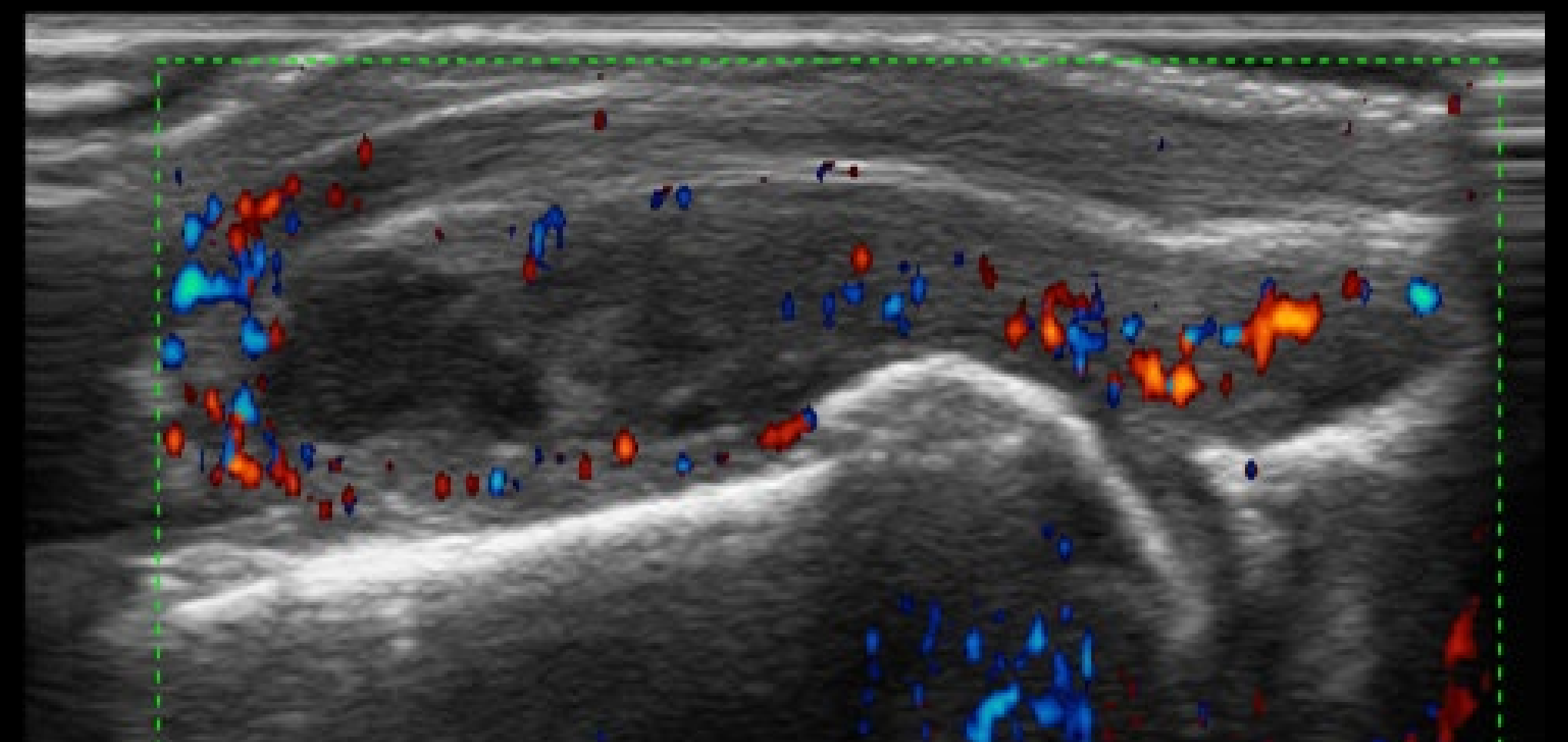
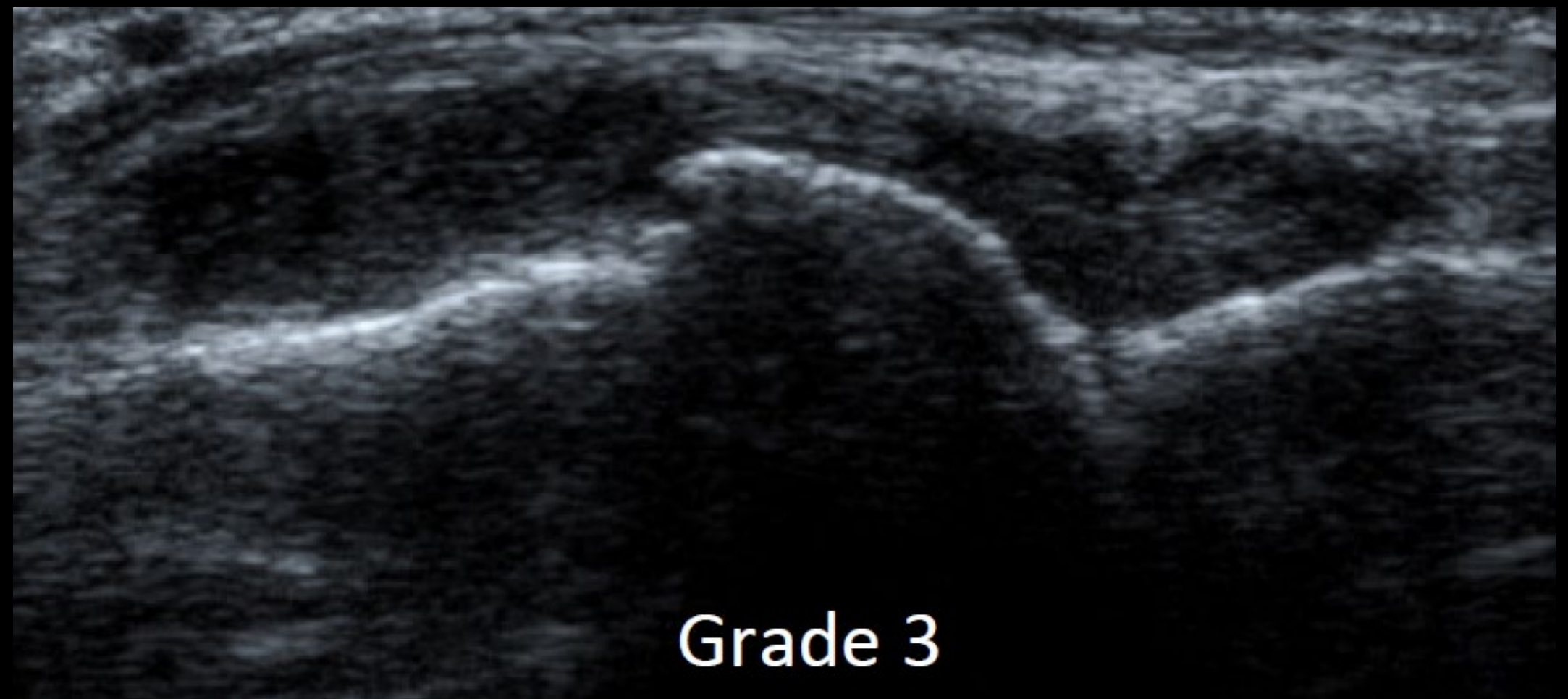
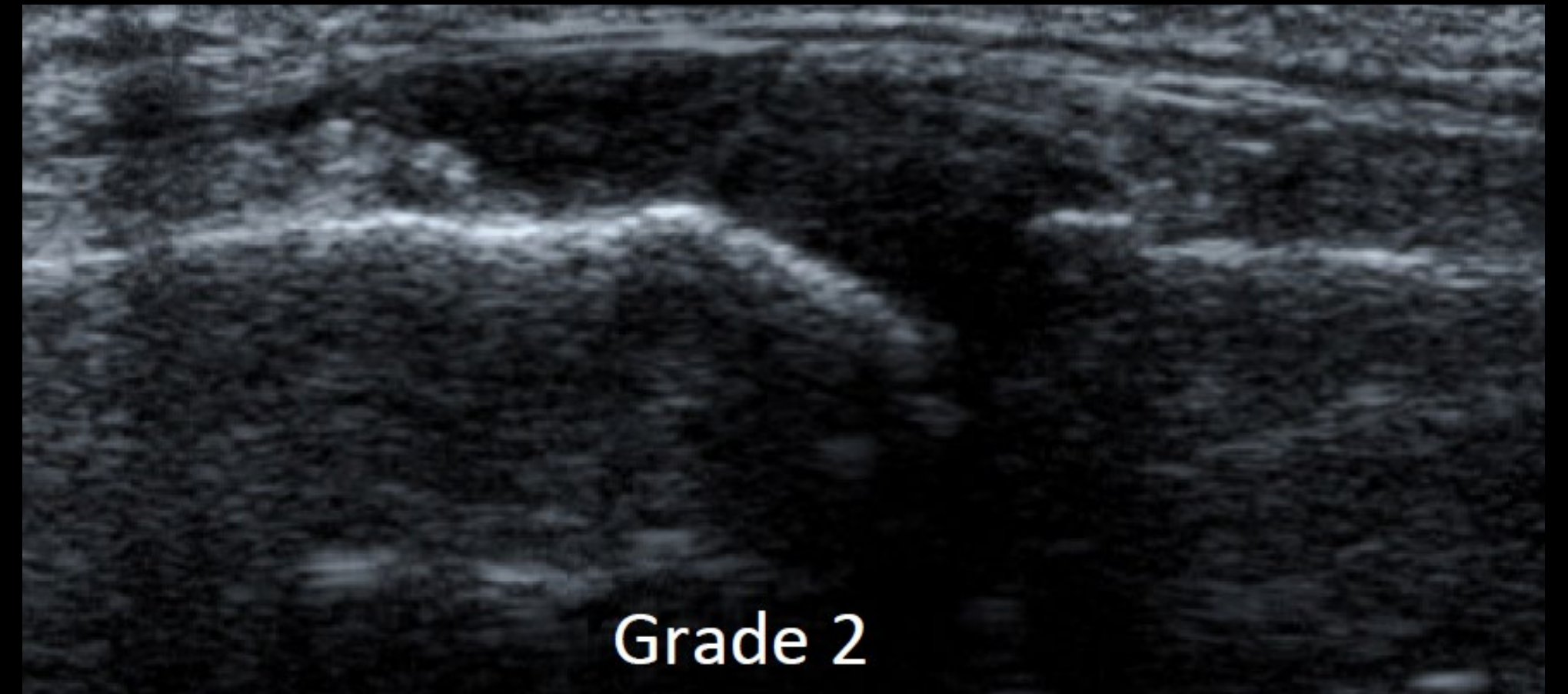
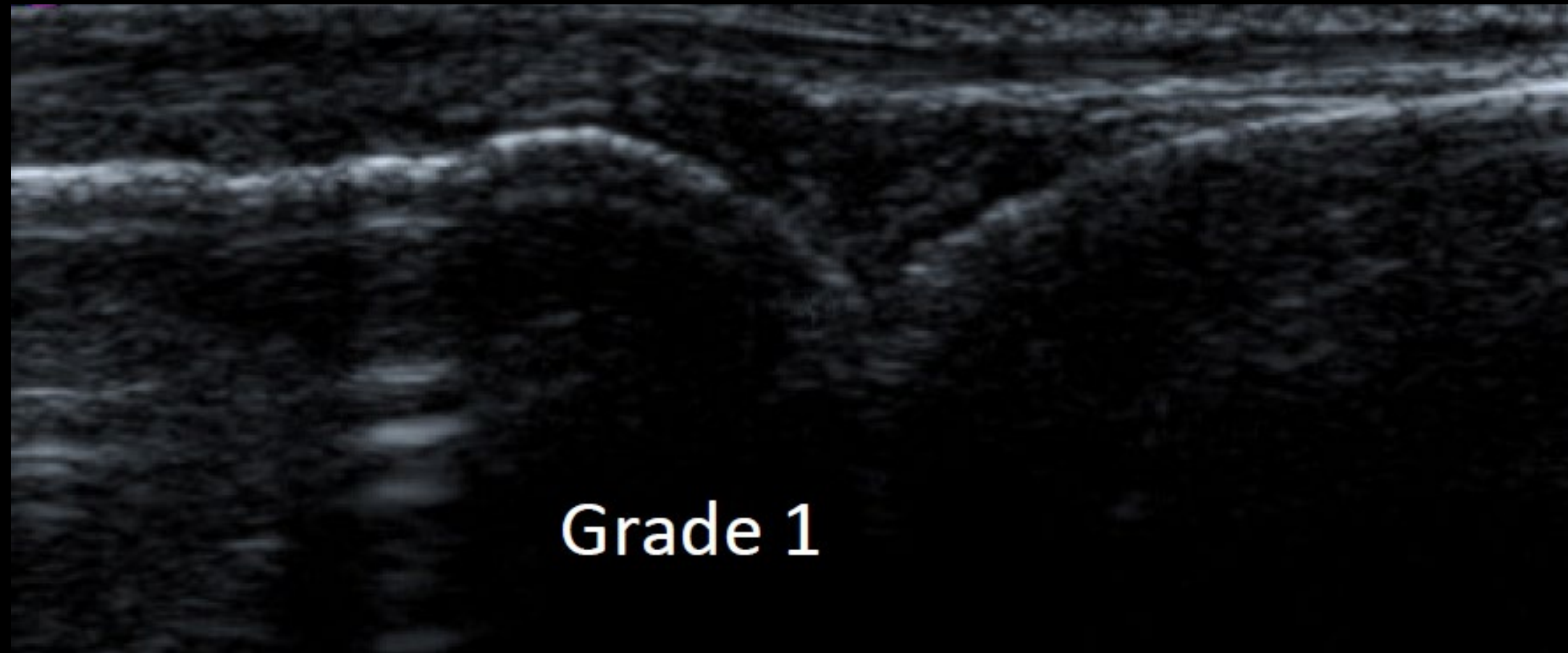


Higher Frequency



Higher image resolution
Shallower image depth

Hand Synovitis - RA



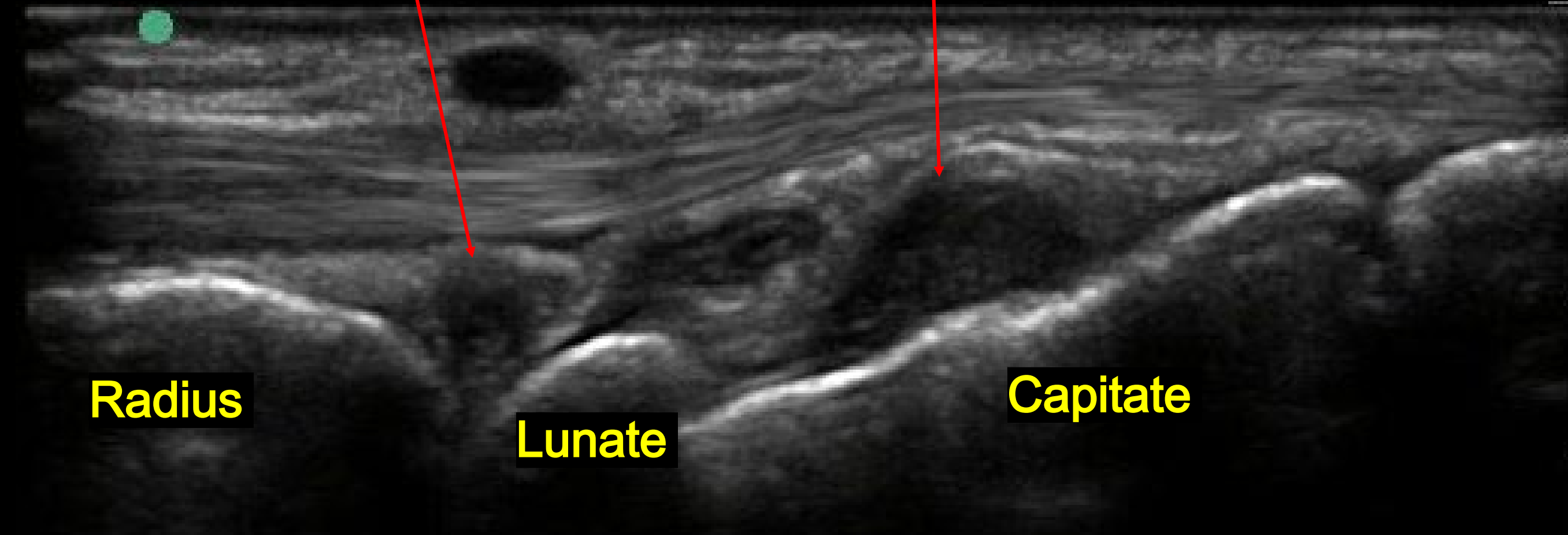
Wrist Synovitis - RA



Radio-ulnar synovitis

Radio-carpal synovitis

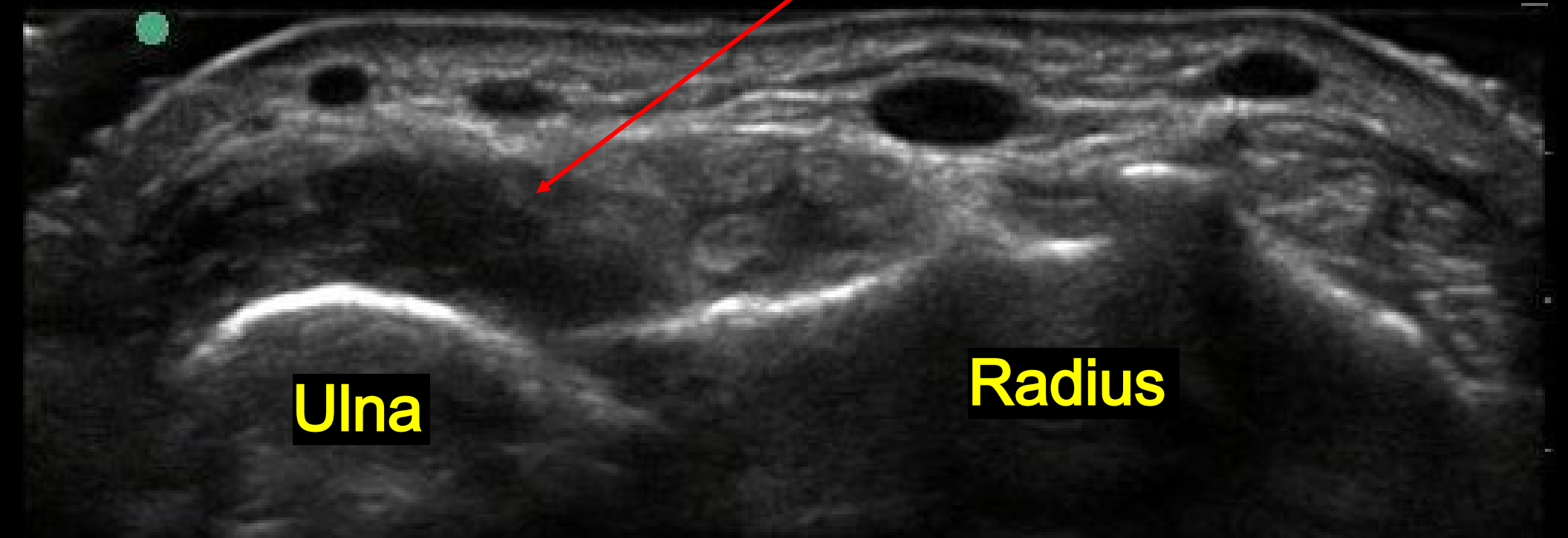
Inter-carpal synovitis



Radius

Lunate

Capitate

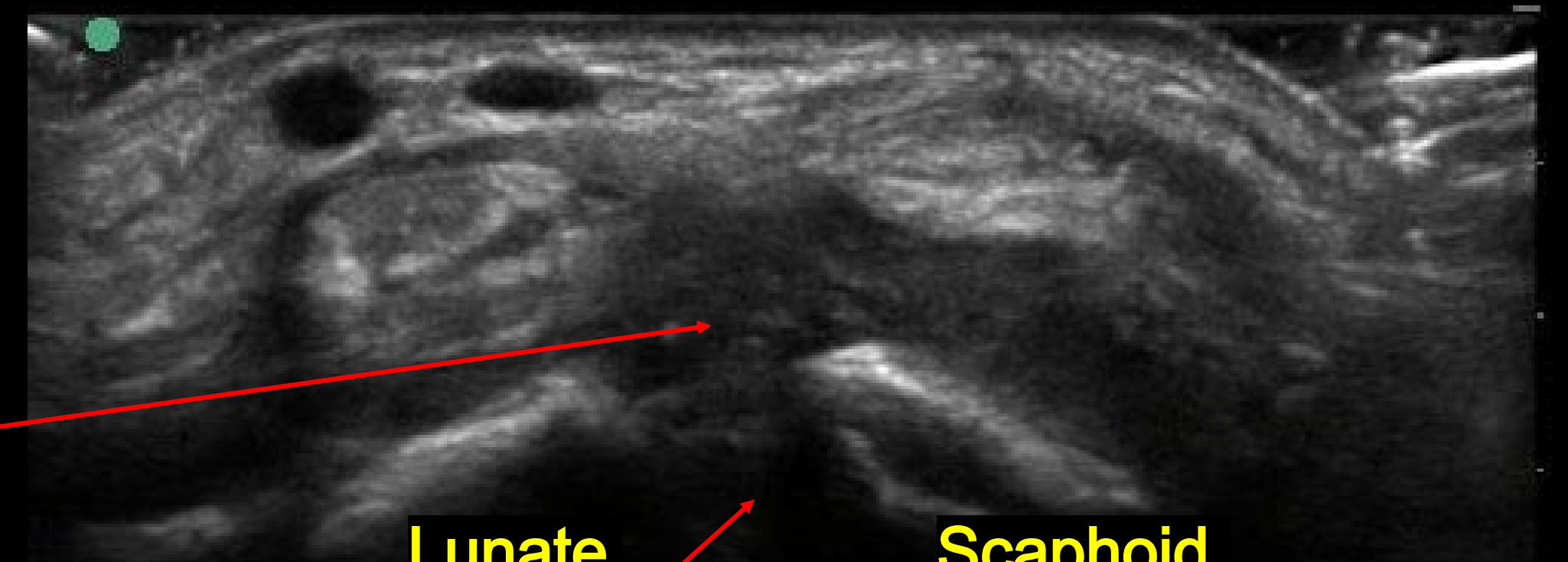


Ulna

Radius



Synovitis



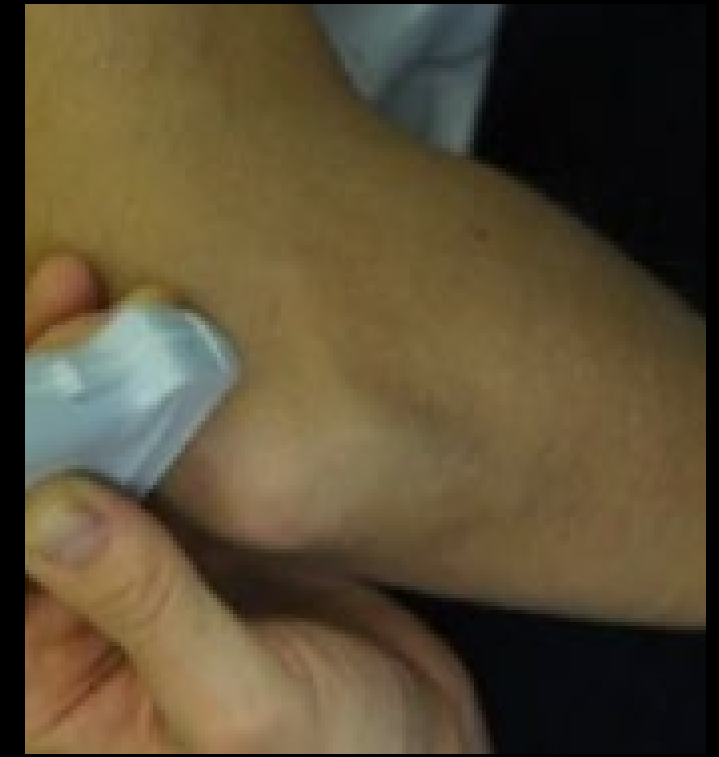
Lunate

Scaphoid

Scapholunate ligament

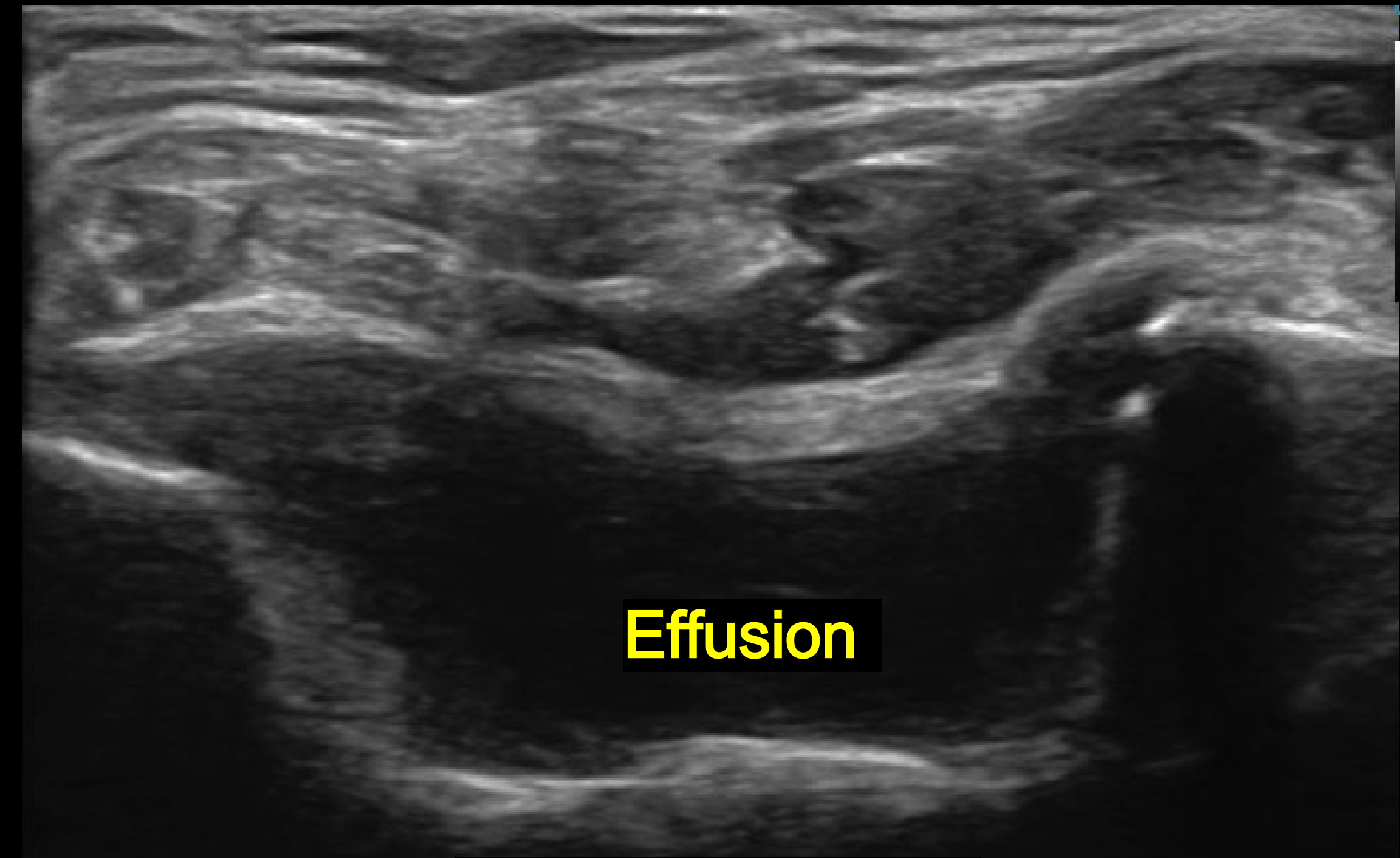
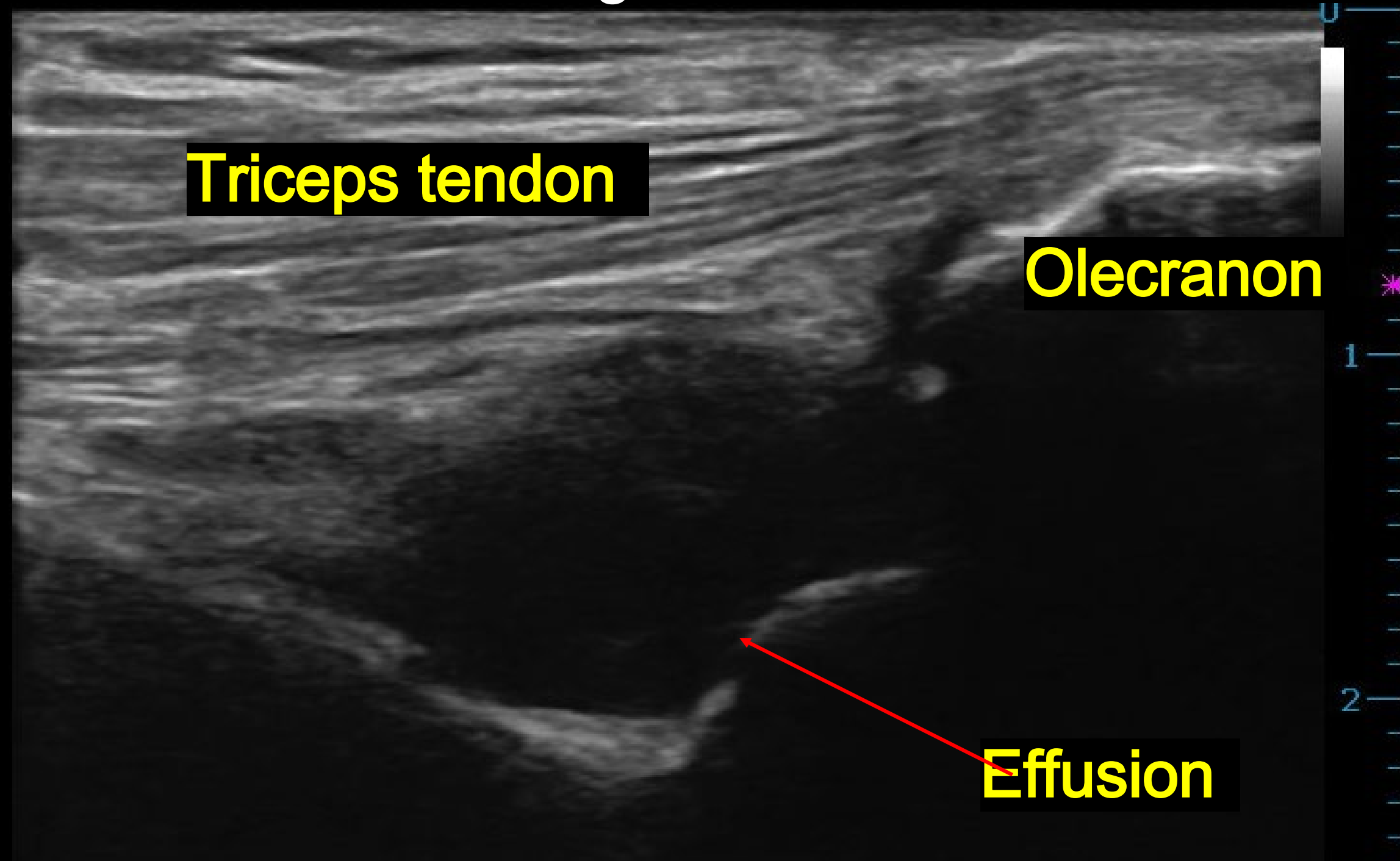


RA – Elbow Synovitis



Posterior
Longitudinal

Posterior Transverse



Triceps tendon

Olecranon

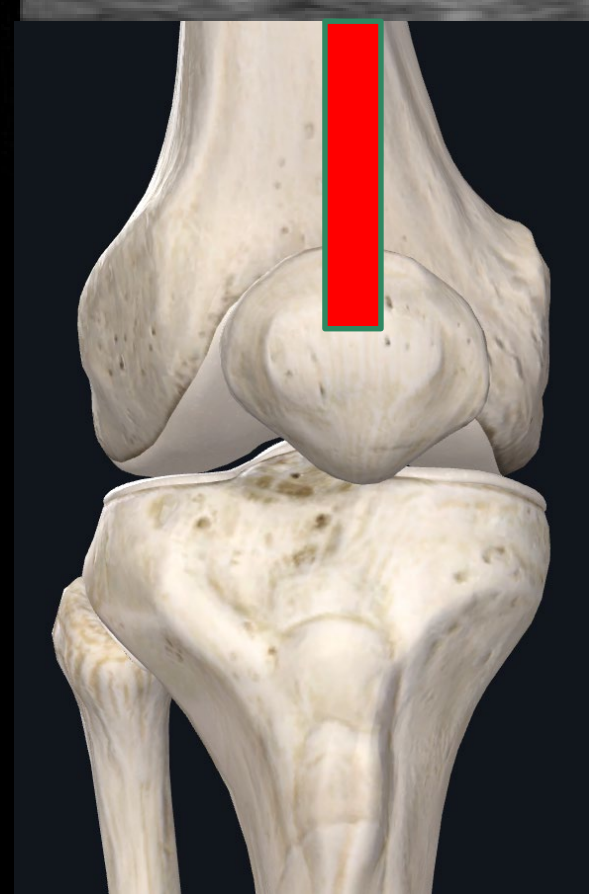
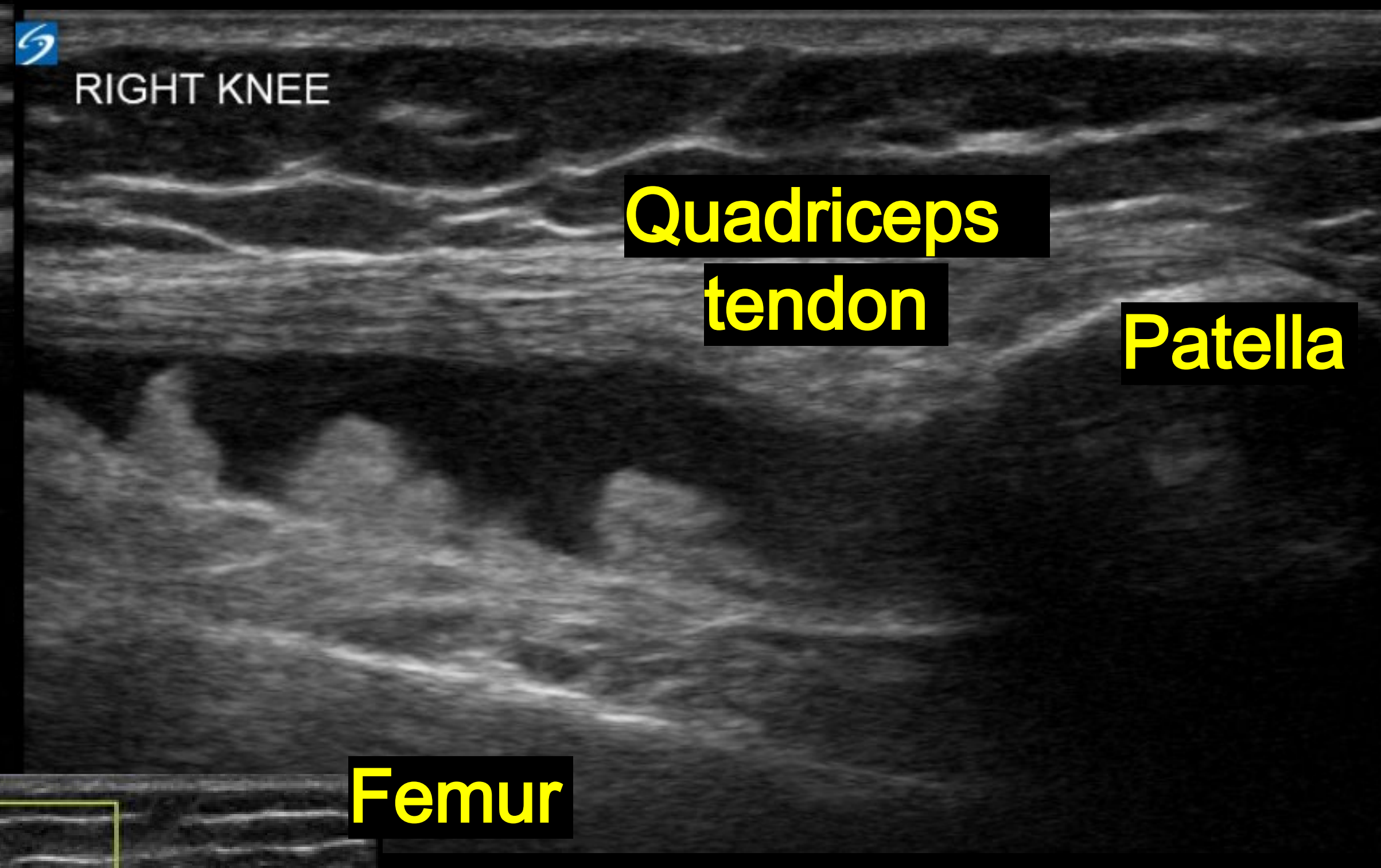
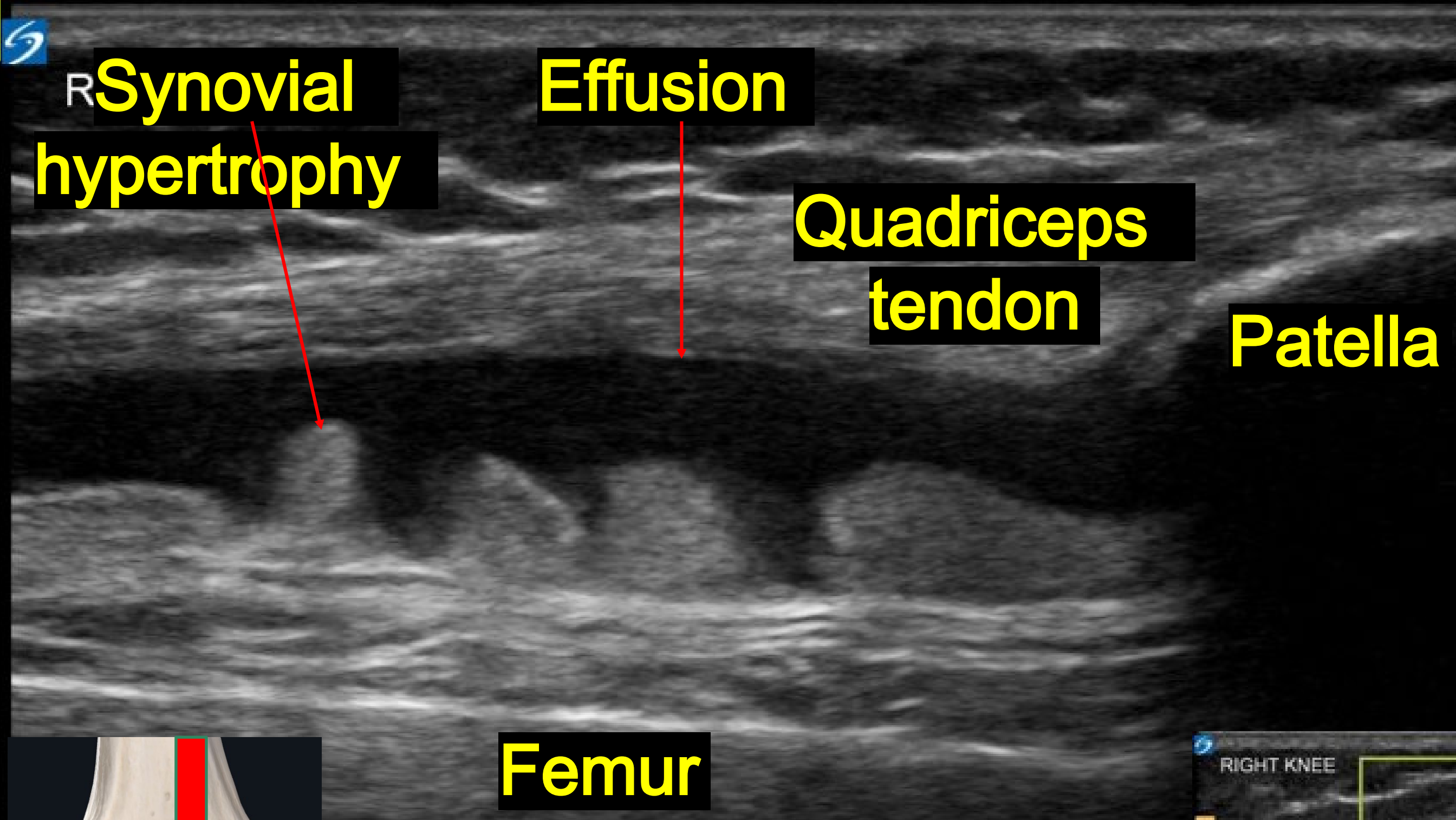
Effusion

Effusion

Olecranon Fossa

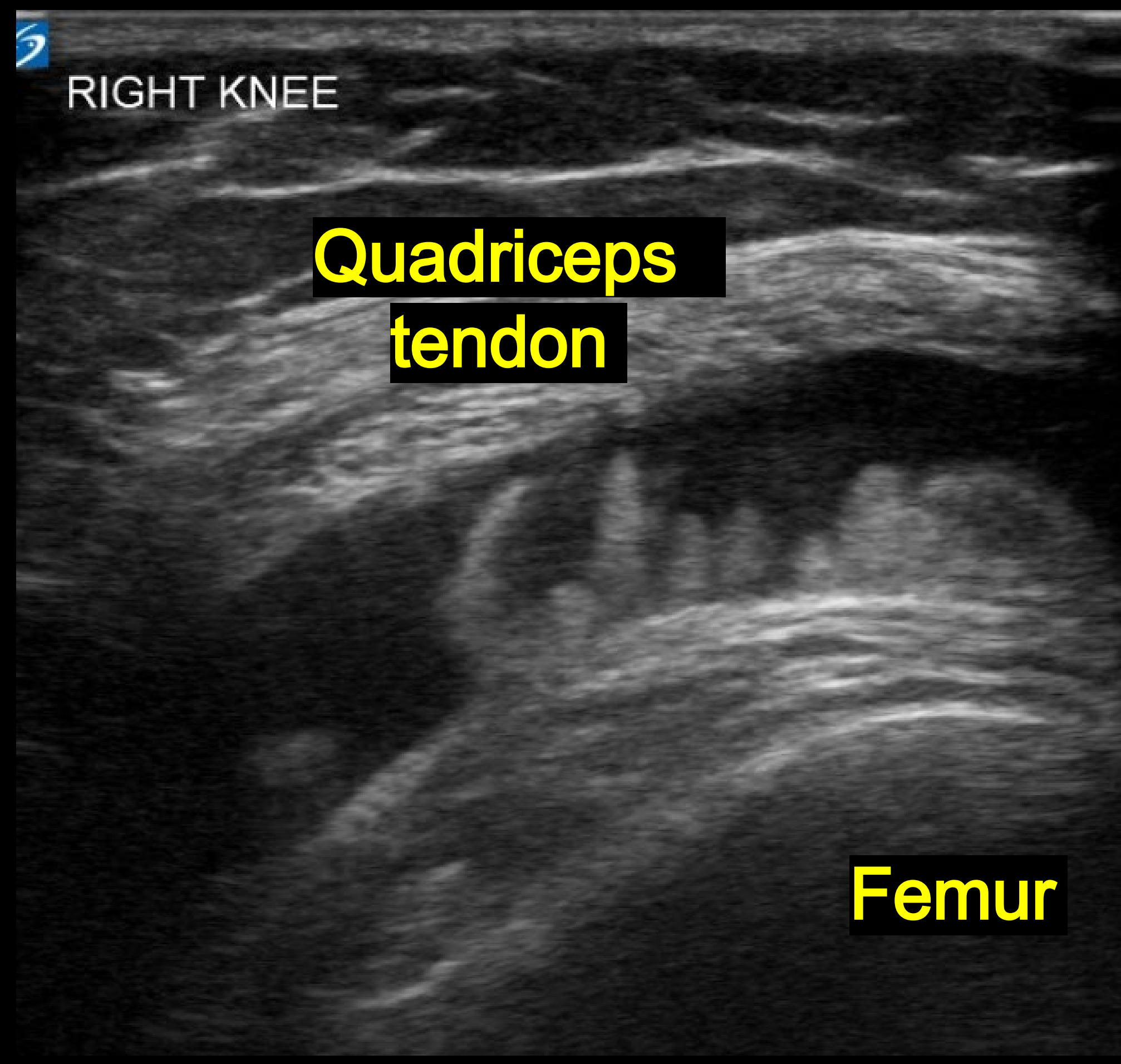
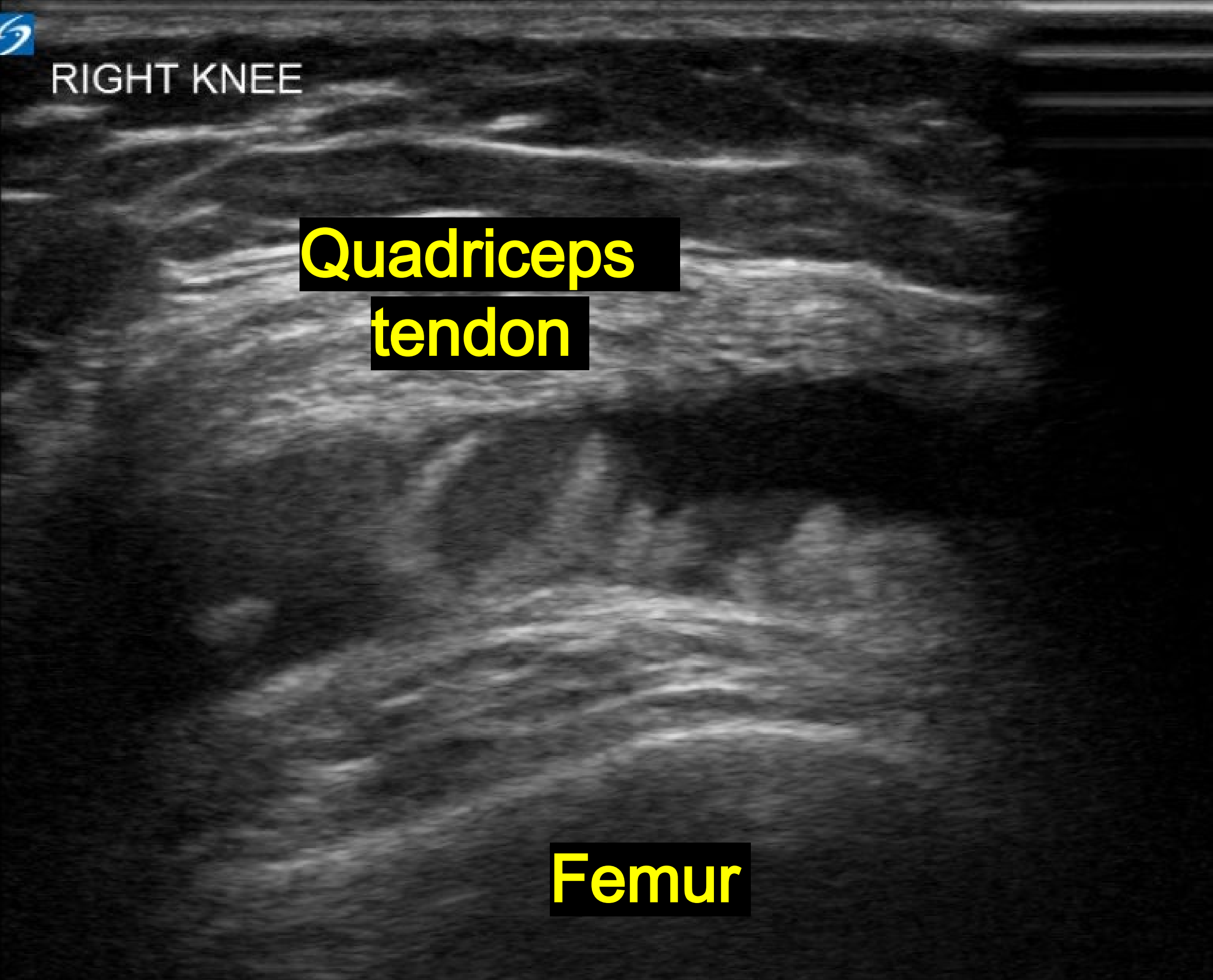
Knee synovitis

Anterior Longitudinal View

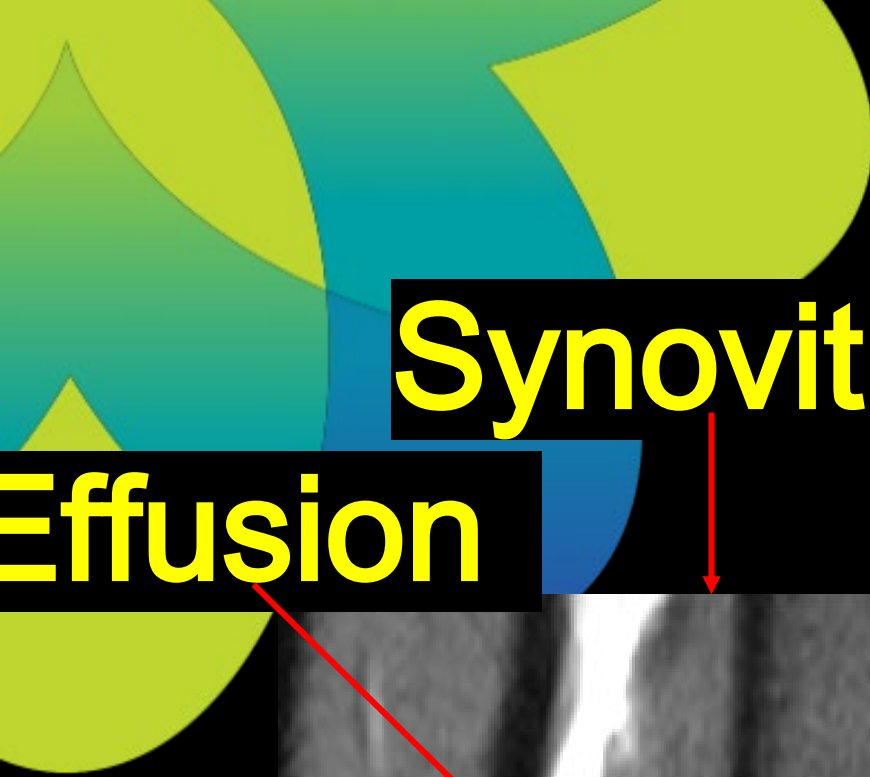




Posterior Longitudinal View



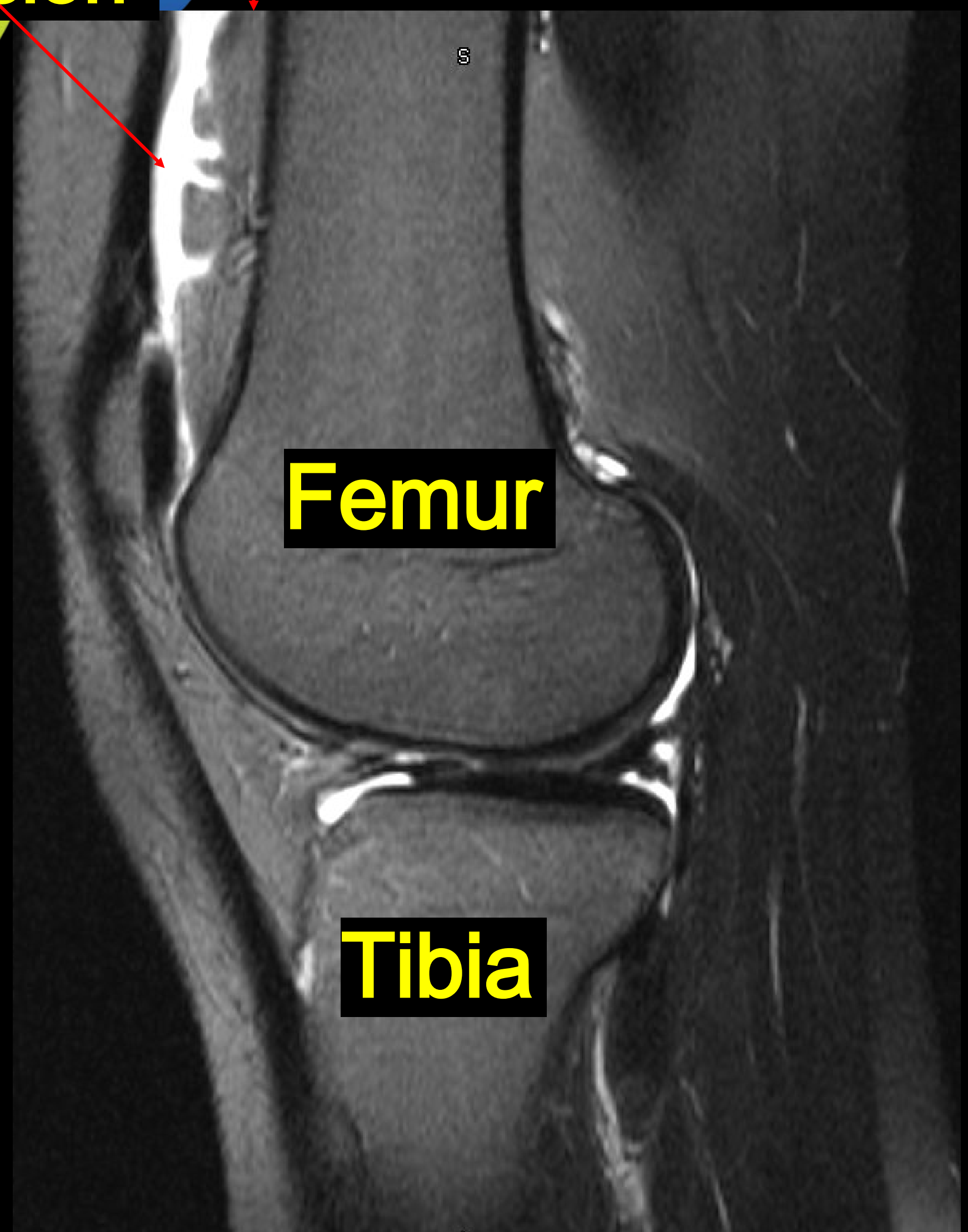
Synovial biopsy consistent with RA.



MRI – Synovitis + Plica

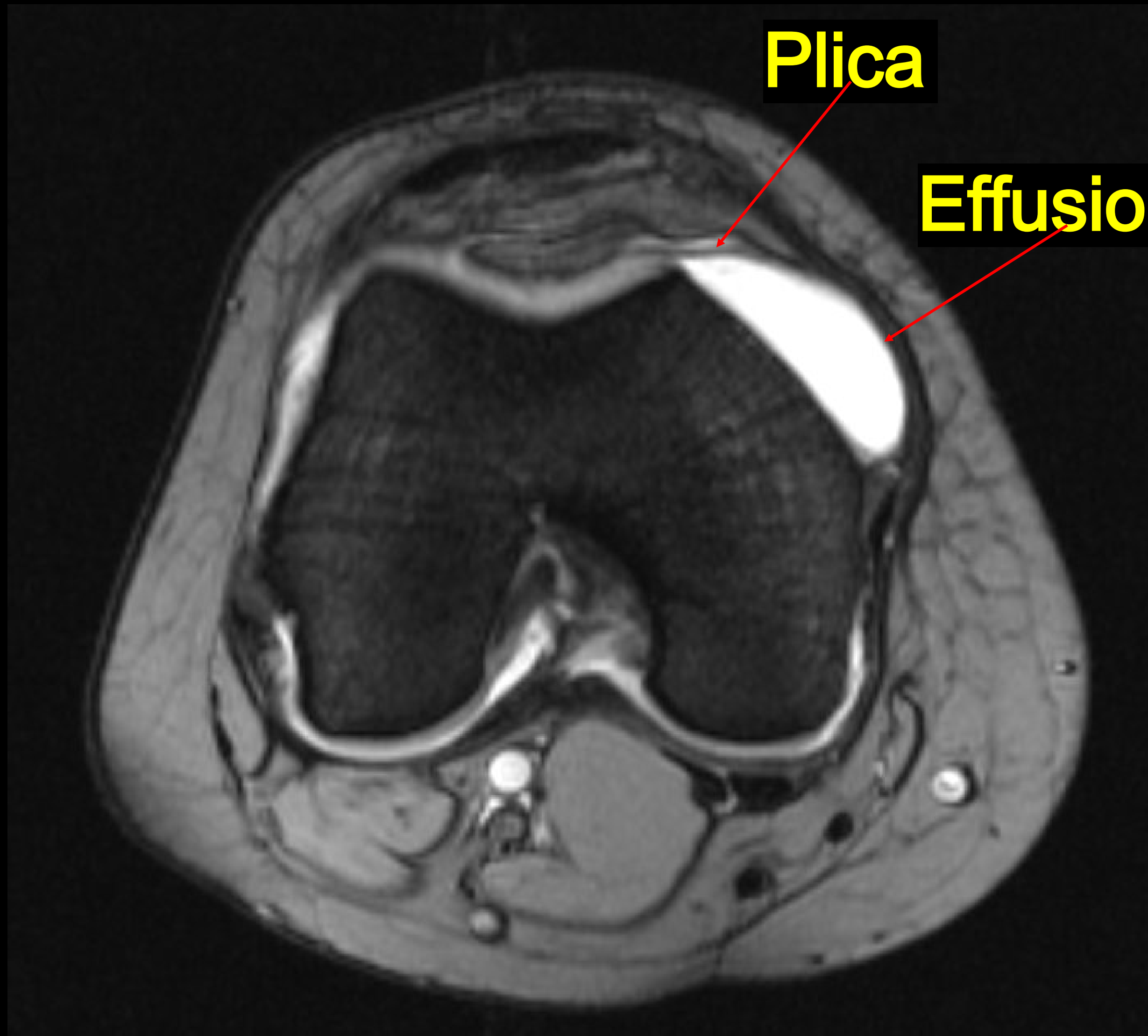
Synovitis

Effusion



Femur

Tibia

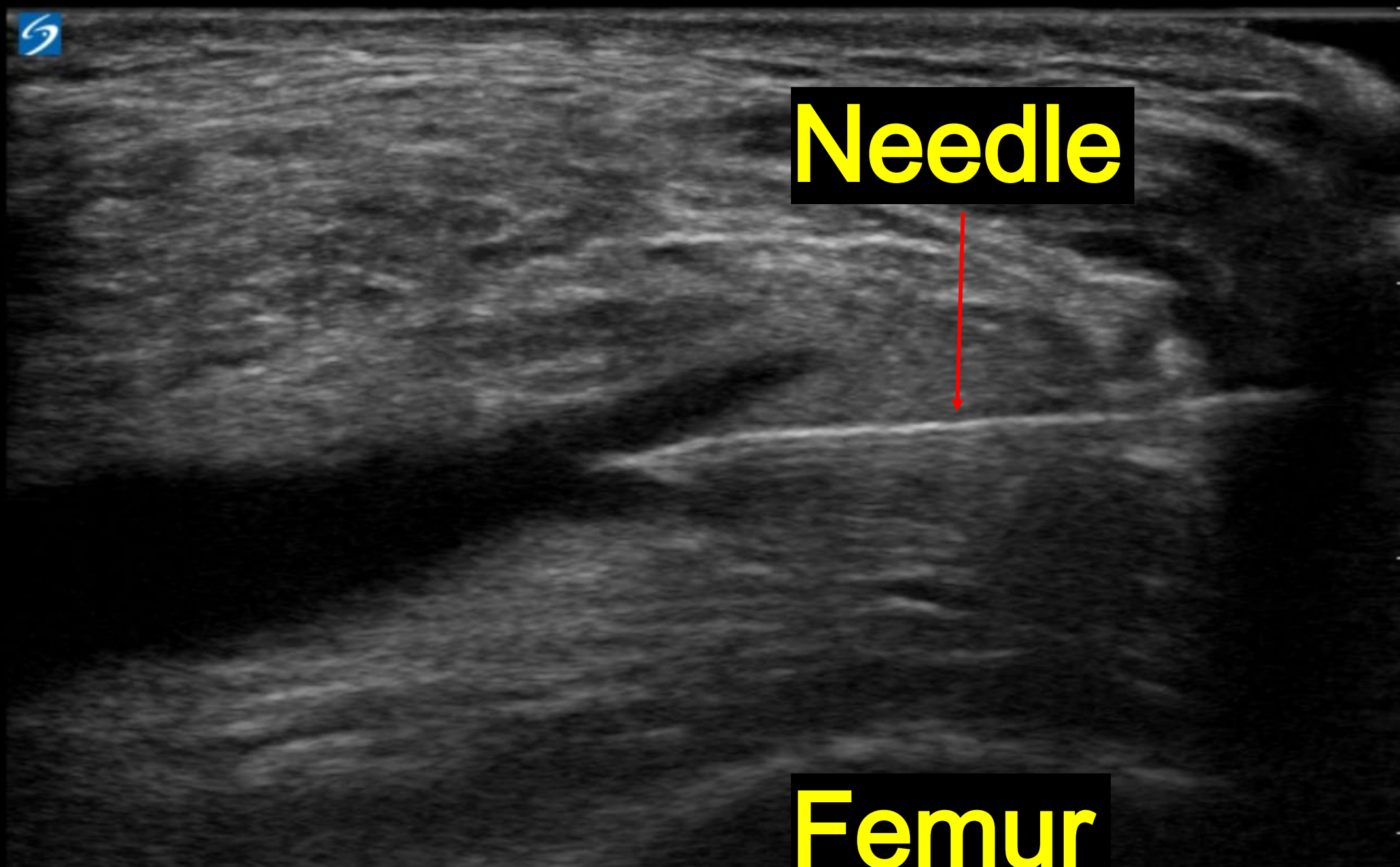
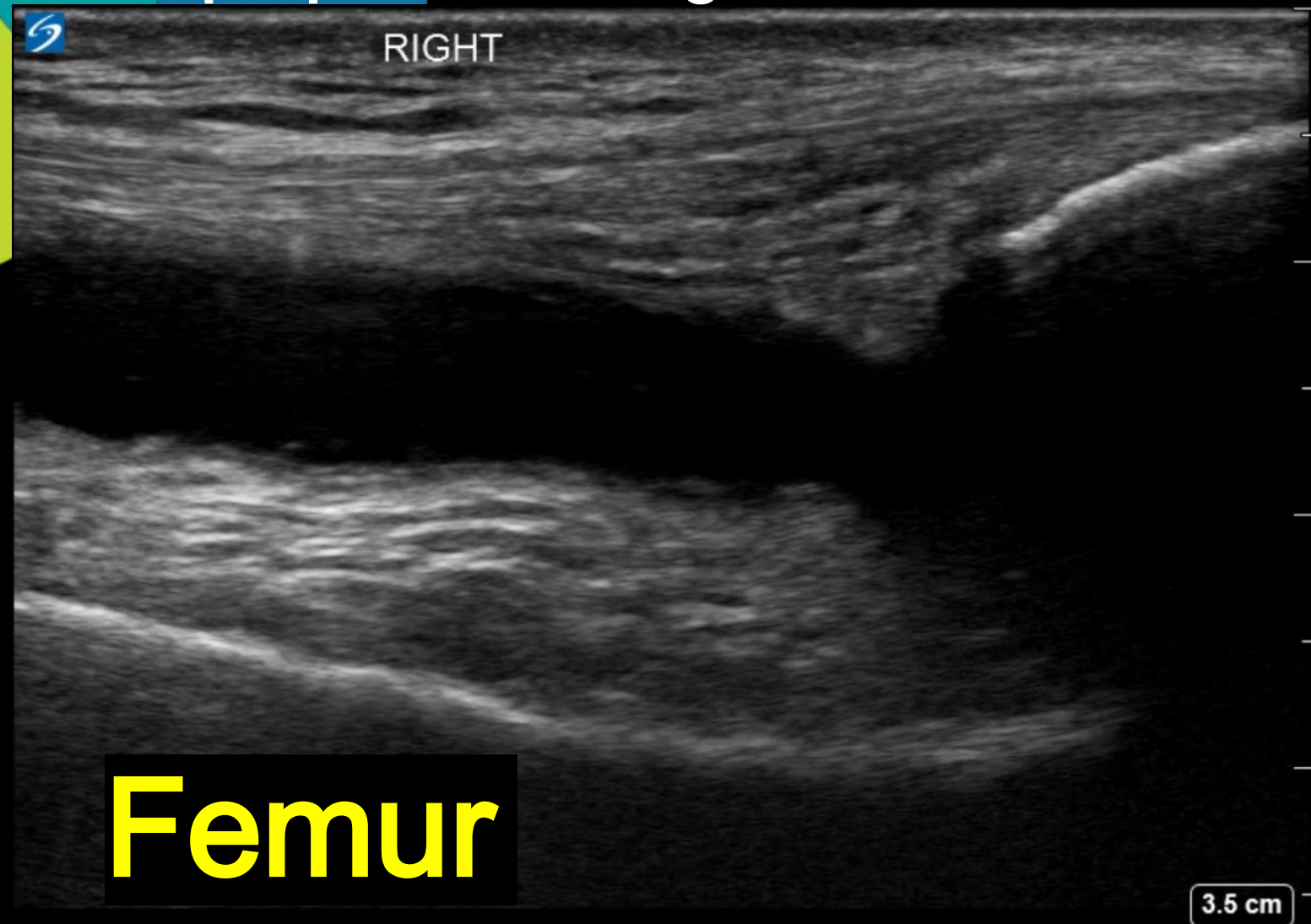


Plica

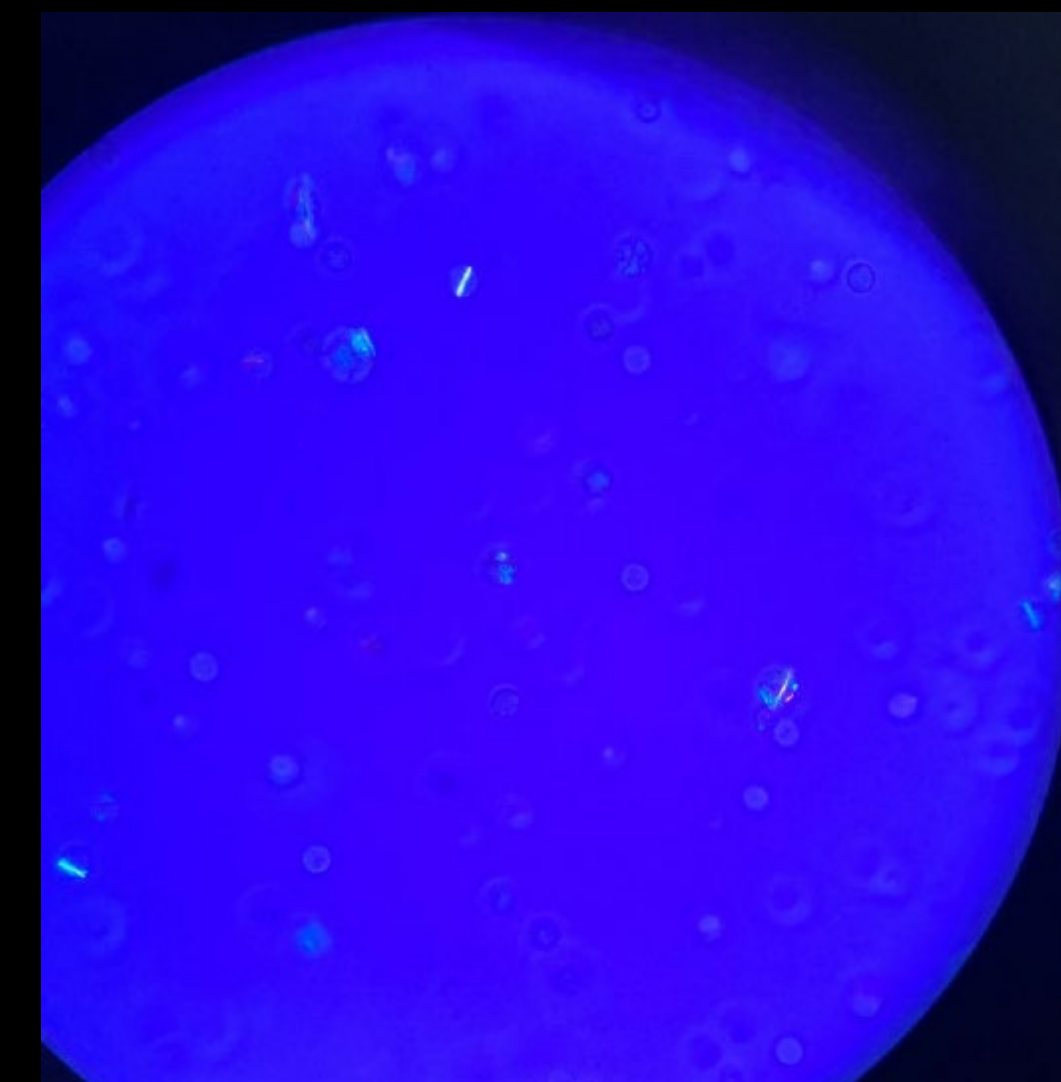
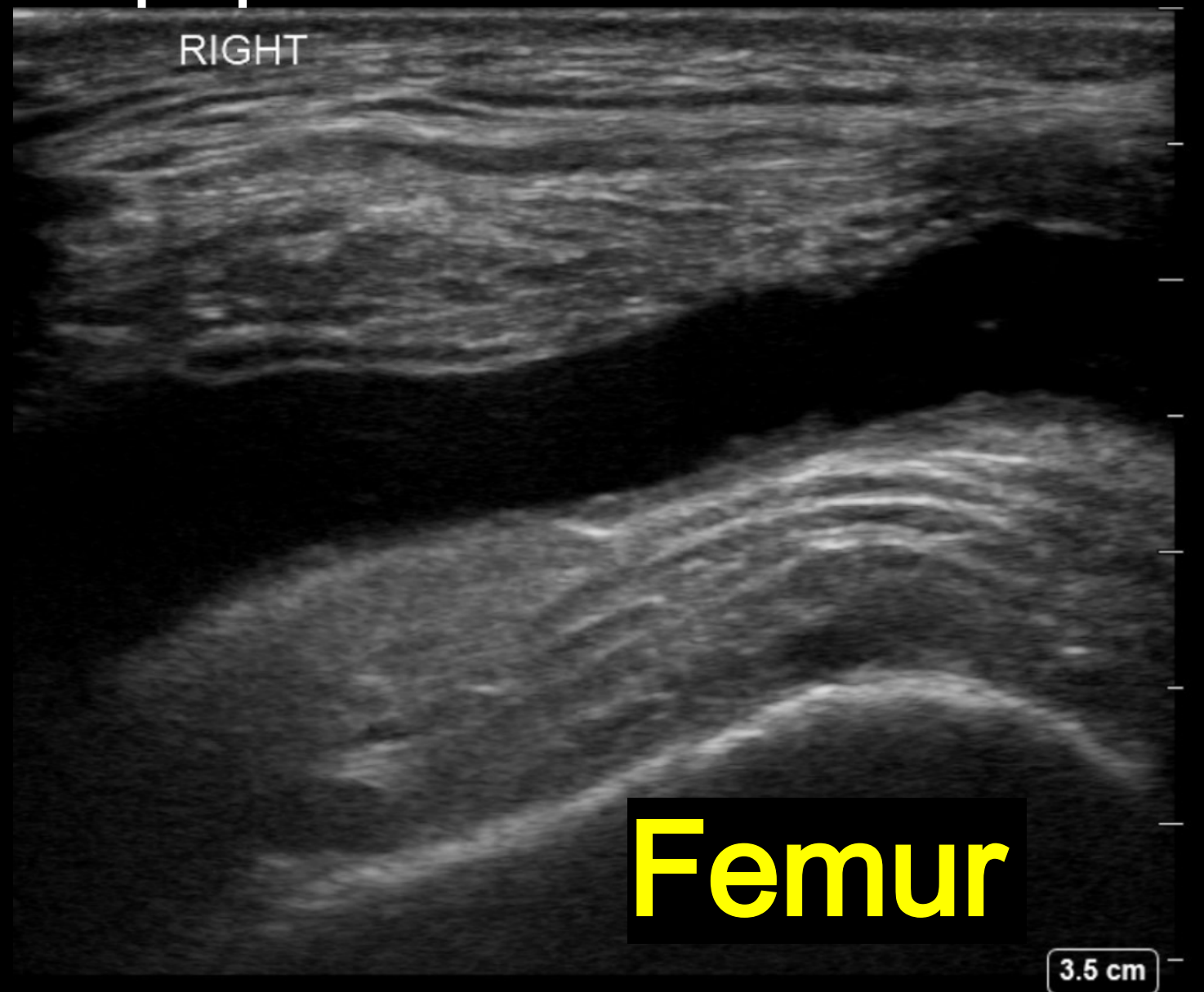
Effusion

US Guided Knee Aspirations

Suprapatellar Longitudinal View

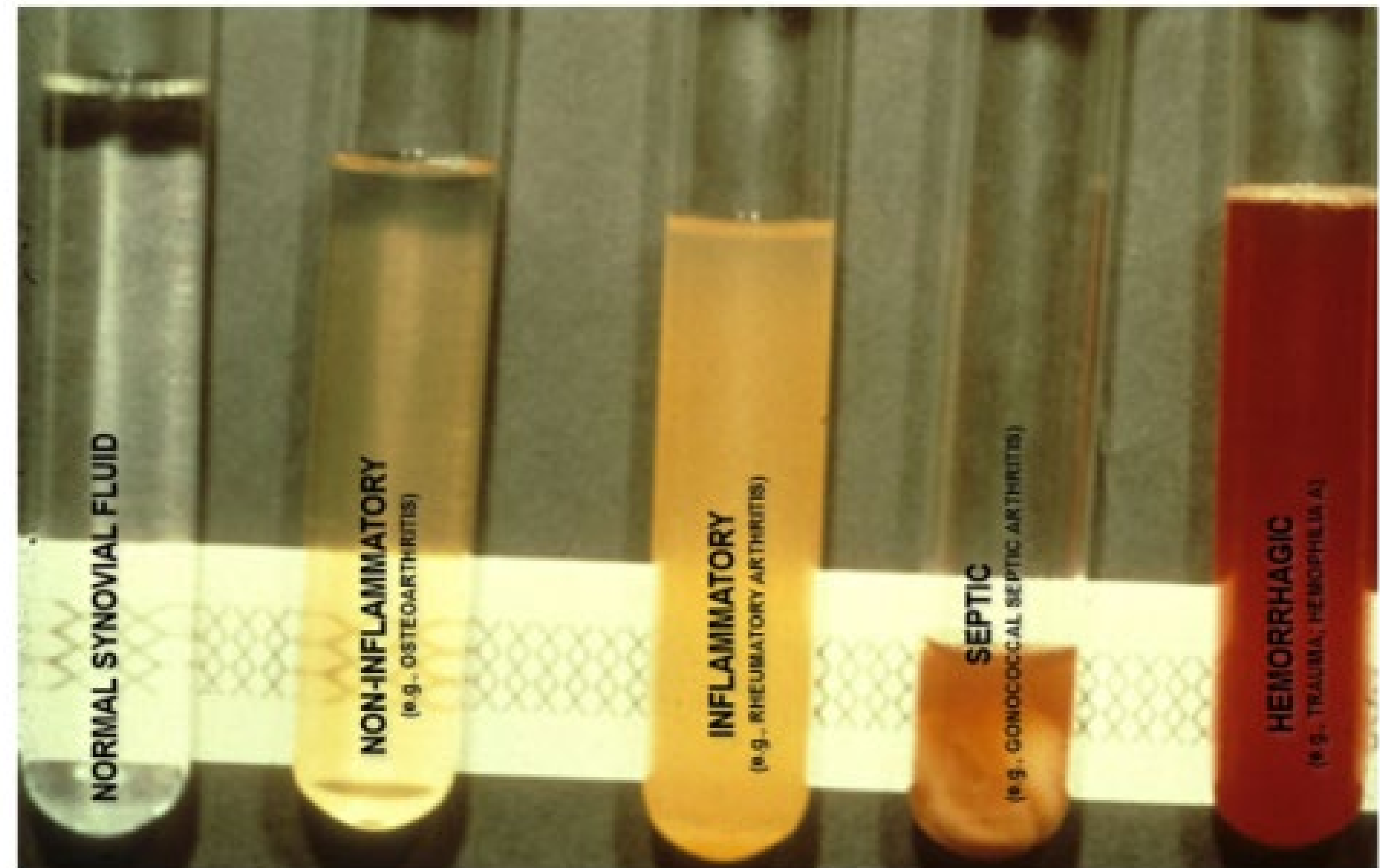


Suprapatellar Transverse View



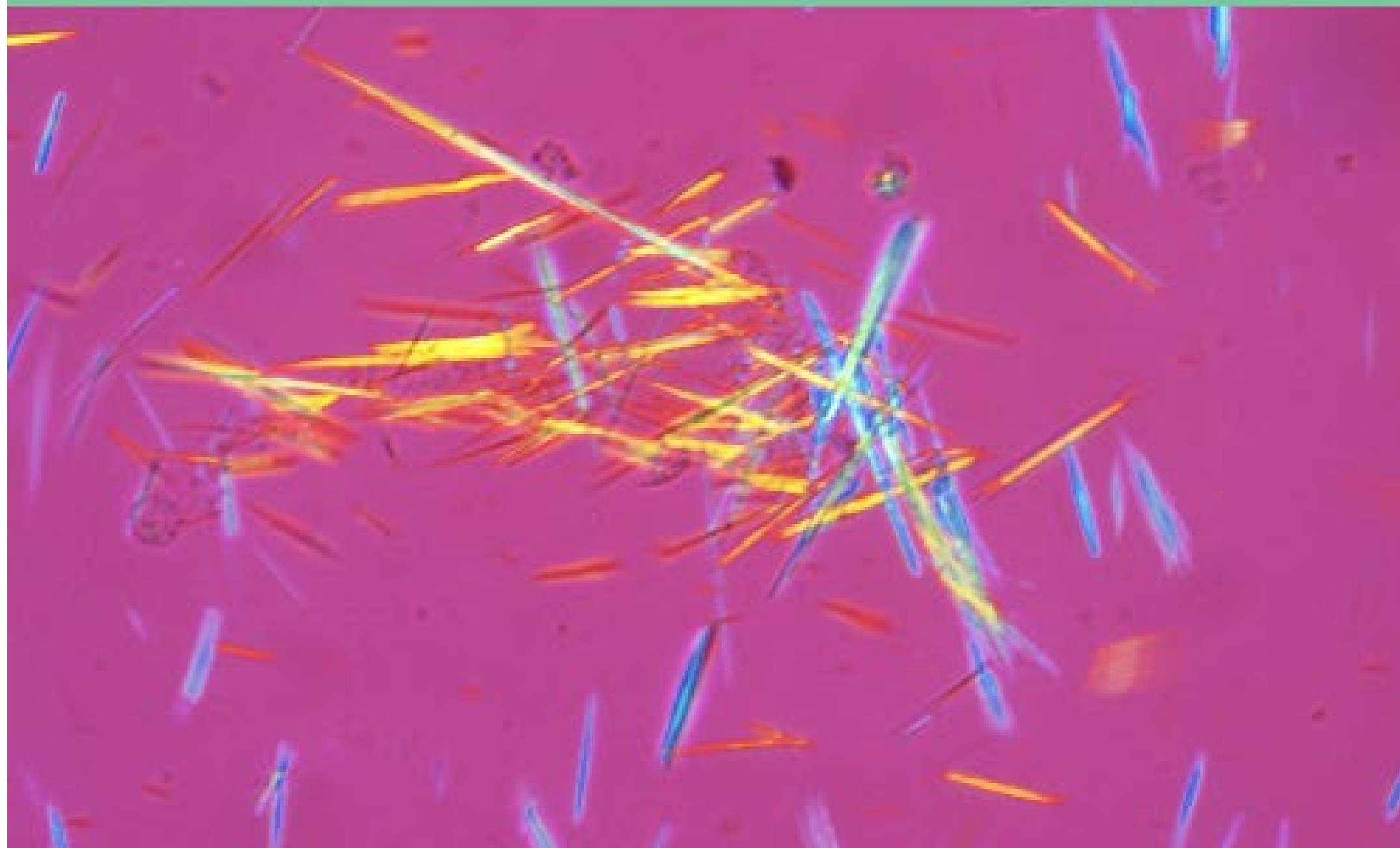
Inflammatory vs Noninflammatory Synovial Fluid

| | WBC/mm ³ | Color | Viscosity |
|-------------------|---------------------|-----------------|-----------|
| Normal | < 150 | Colorless/Straw | High |
| Noninflammatory | < 3,000 | Straw/Yellow | High |
| Inflammatory | > 3,000 | Yellow | Low |
| Septic (purulent) | > 50,000 | Pus/Mixed | Mixed |
| Hemorrhagic | Similar to blood | Red | Low |



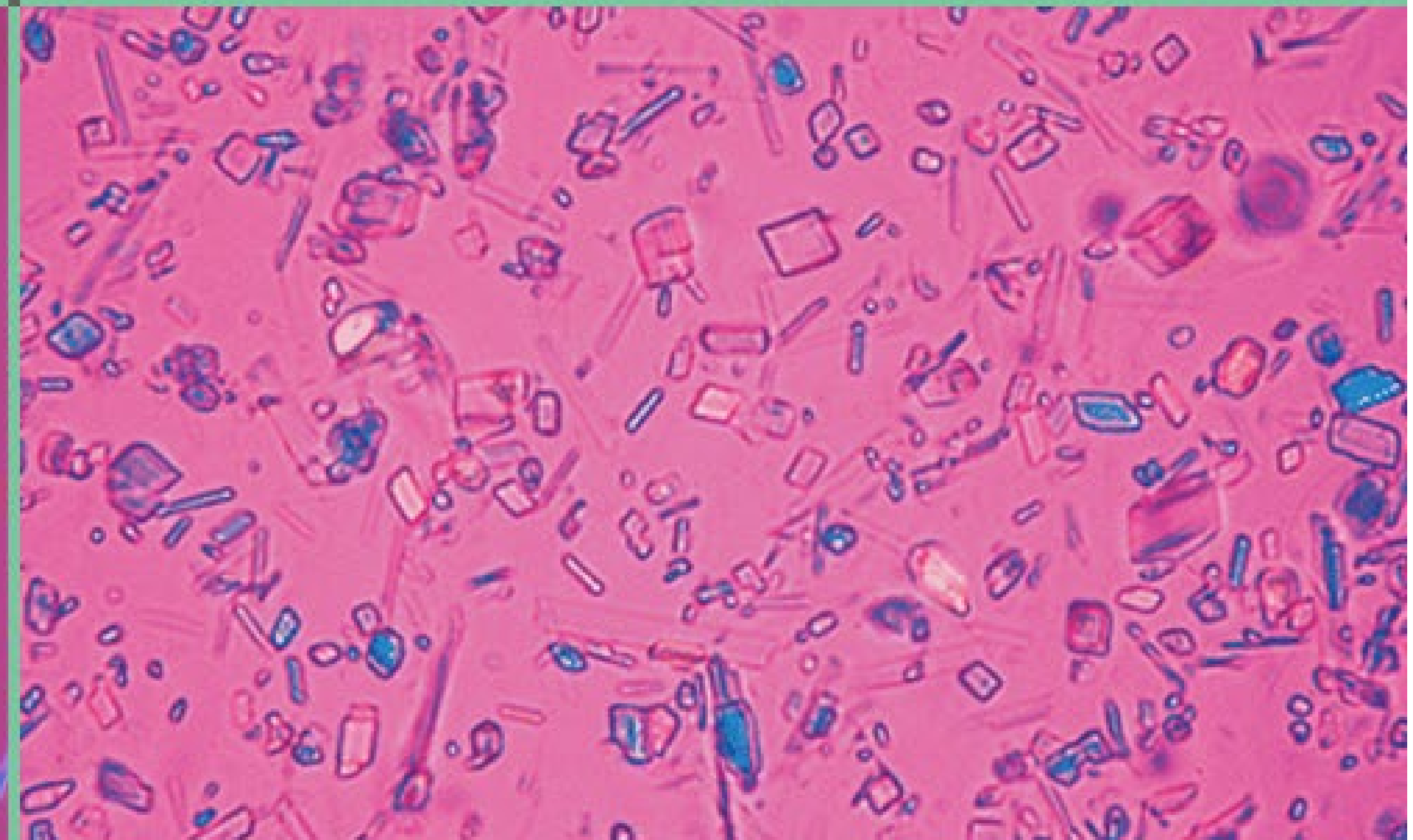
Gout is also Inflammatory

Monosodium Urate (MSU) Crystals



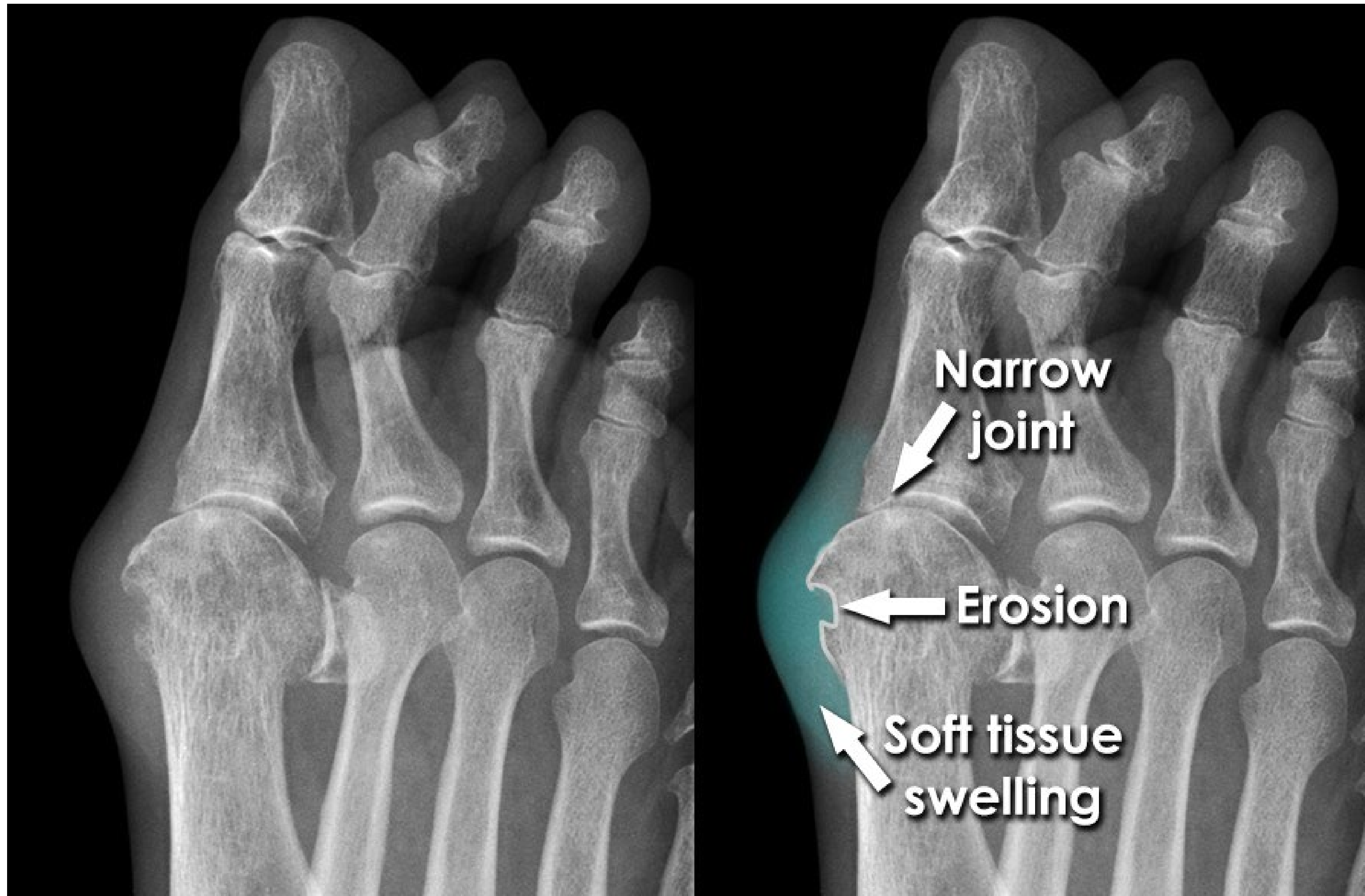
Needle shaped, strong negative birefringence
Yellow when parallel to compensator ray

Calcium Pyrophosphate Dihydrate (CPPD) Crystals



Rod or rhomboid, weak positive birefringence
Blue when parallel to compensator ray

Gout on Xray



RA Erosions Look Different





Pseudo - Rheumatoid Arthritis?

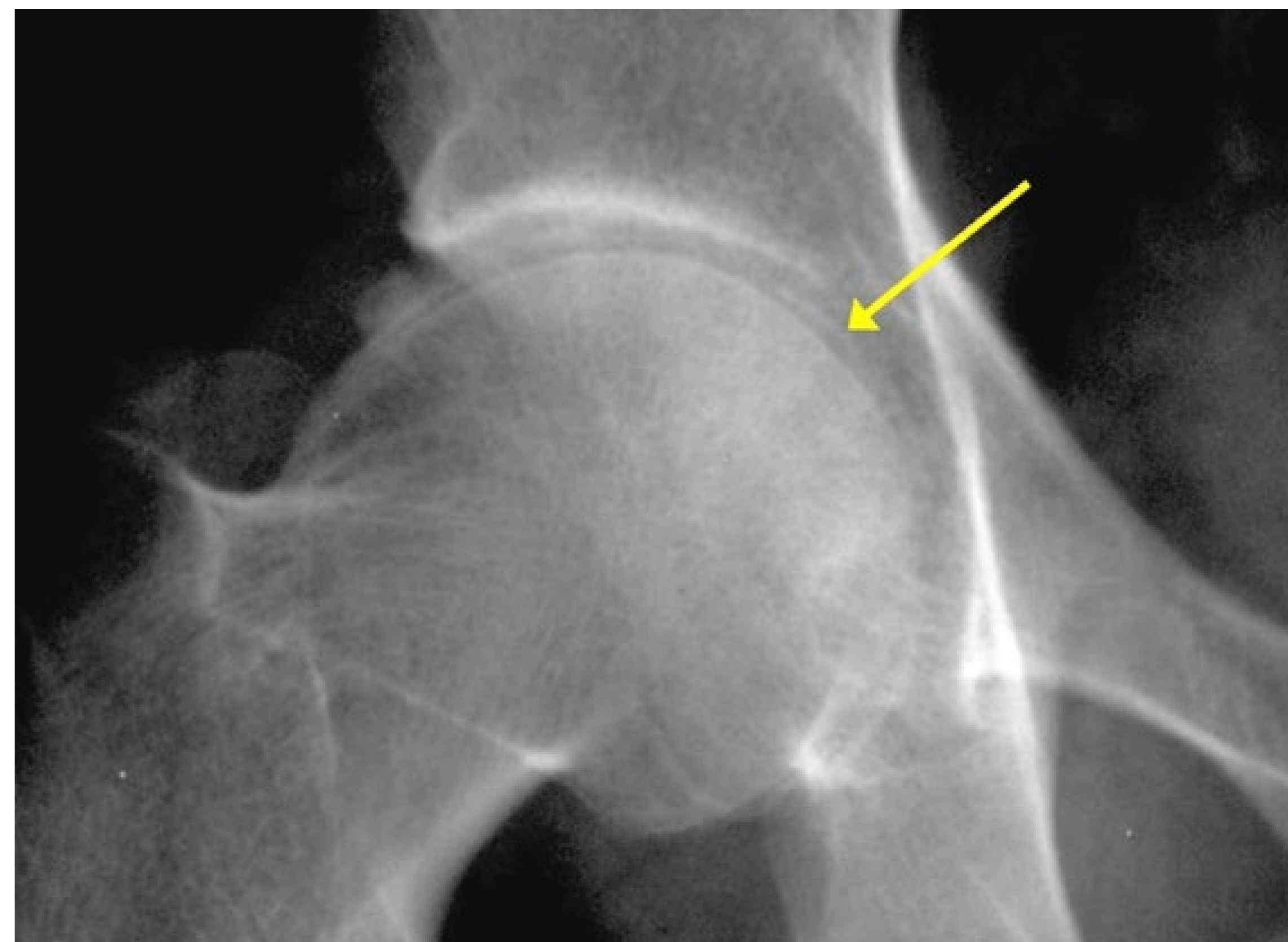
Pseudo

Like

CPPD

Calcium
pyrophosphate
deposition

Pseudogout can mimic RA



CPPD in Hands



Real Case

A 64 year old pleasant gentleman says that he has increasing pain in both knees. He asks if he has rheumatoid arthritis.



His symptoms improved with physical therapy.

He was diagnosed with osteoarthritis.

Questions

We serve together guided by our values

Love & Excellence

We anticipate the needs of others and help with compassion and generosity.

We embrace diversity and show respect to everyone.

We listen actively, seek to understand and assume good intentions.

We tell the truth with courage and empathy.

We accept responsibility for our attitudes and actions.

We commit to being exceptional today and even better tomorrow.

We use resources wisely and effectively.

We seek new knowledge, ask for feedback, and are open to change.

We are curious and continuously look for ways to innovate.

We are true to our word and follow through on our commitments.

