OSTEOARTHRITIS

BY
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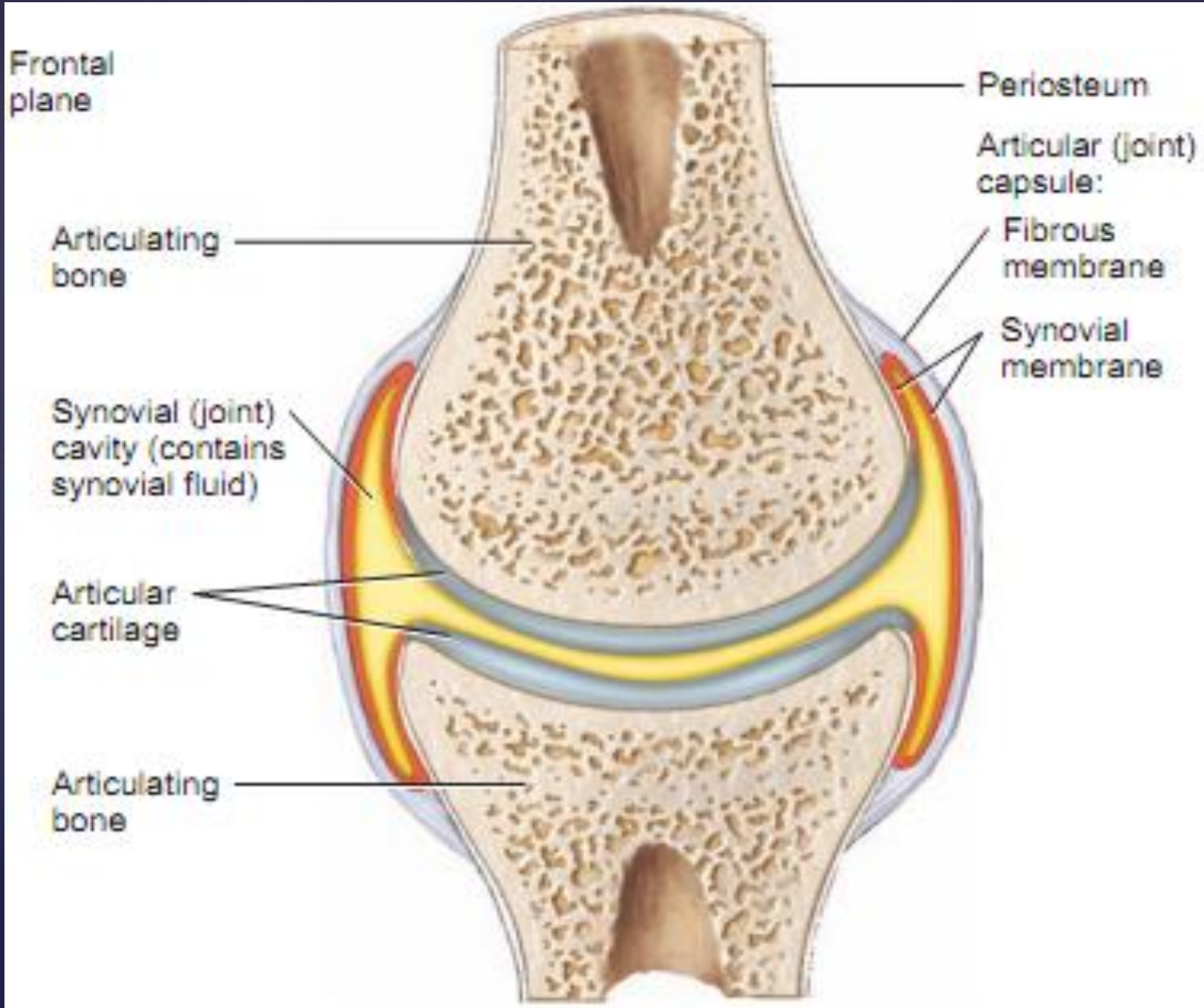
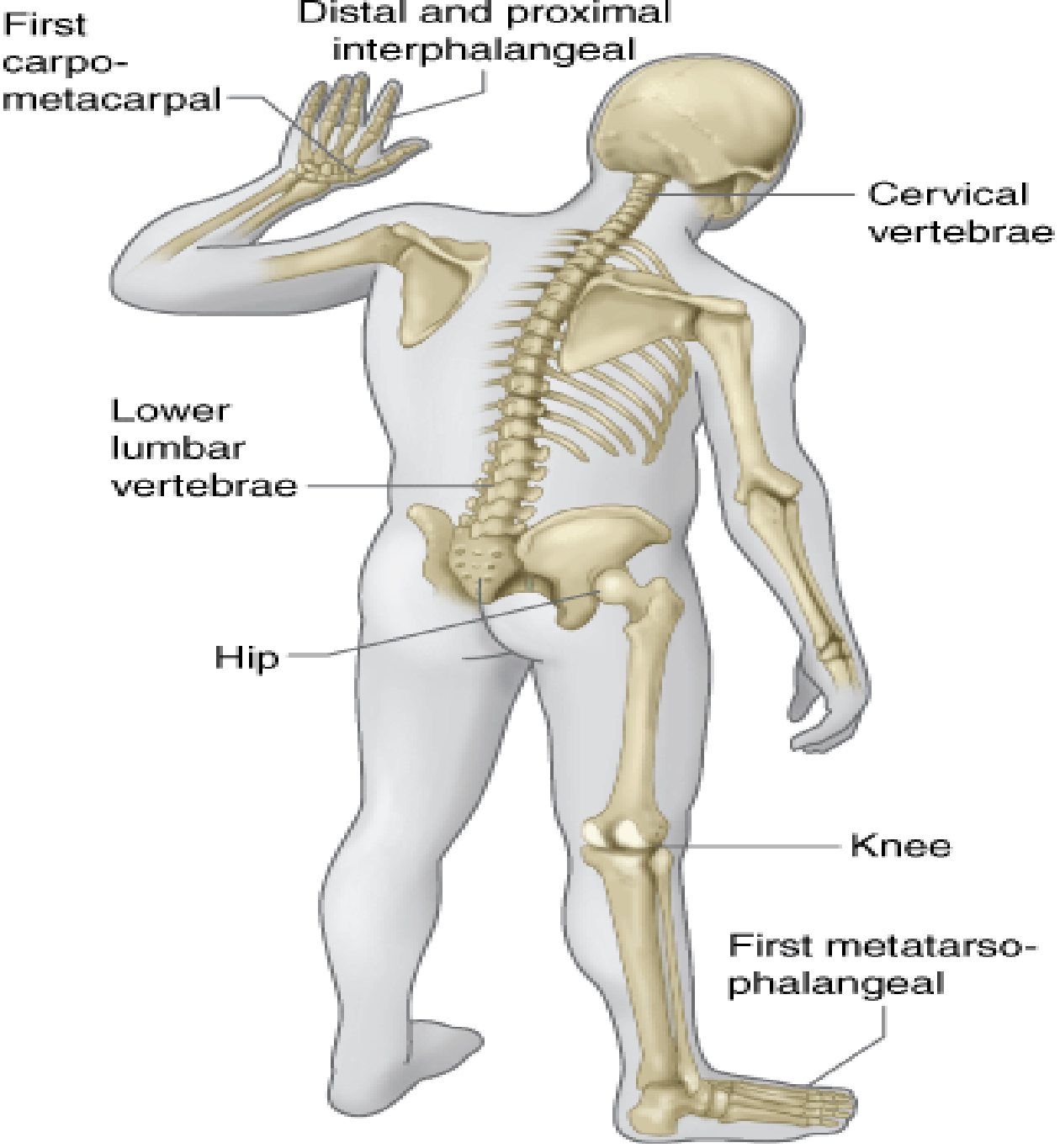

Frontal plane
Periosteum
Articular (joint) capsule:
Fibrous membrane
Synovial membrane
Articulating bone
Synovial (joint) cavity (contains synovial fluid)
Articular cartilage
Articulating bone

Introduction

Osteoarthritis (OA) is a common, slowly progressive disorder affecting primarily the weight-bearing diarthrodial joints of the peripheral and axial skeleton.

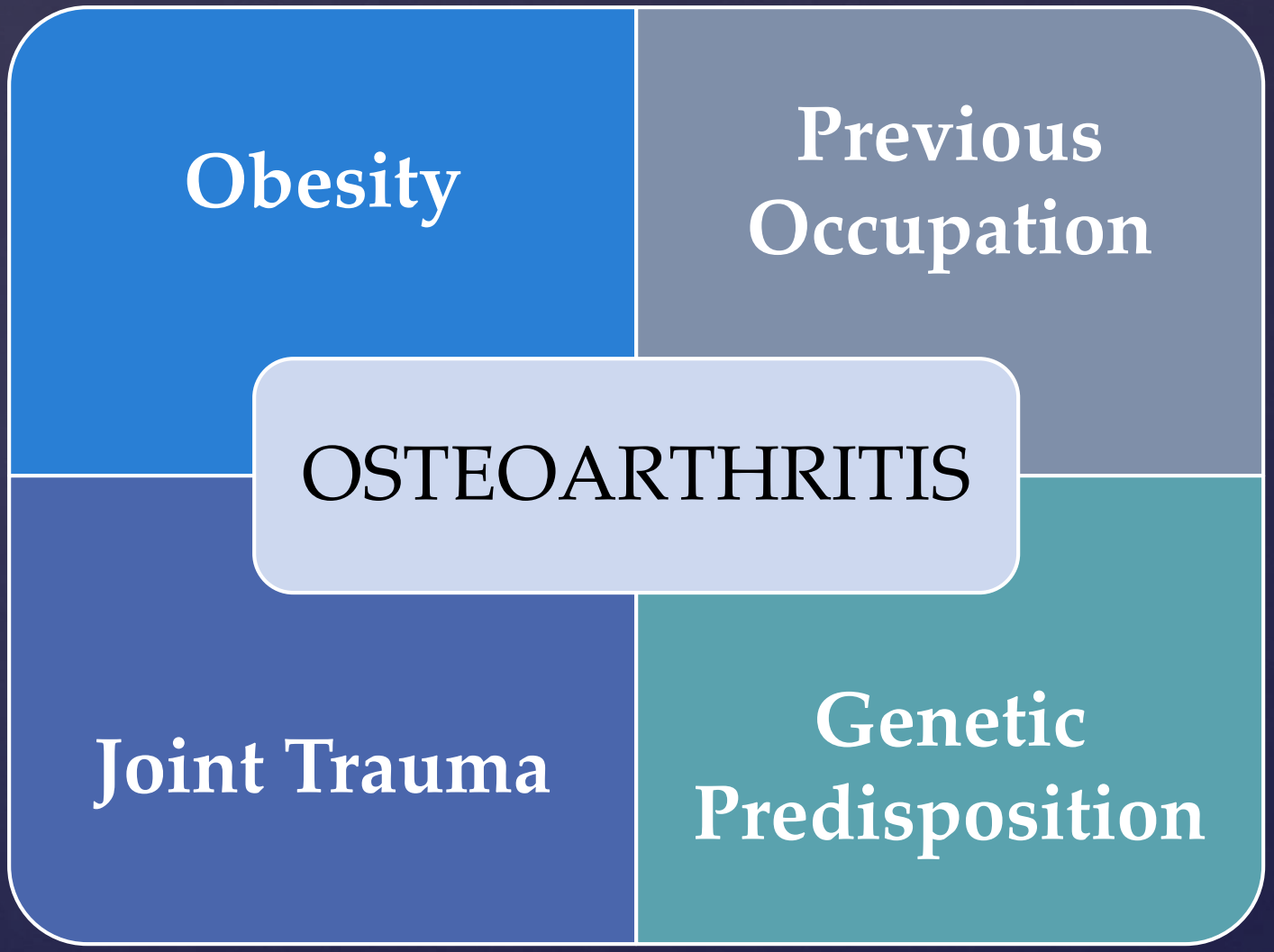
- It is characterized by progressive deterioration and loss of articular cartilage, resulting in osteophyte formation, pain, limitation of motion, deformity, and progressive disability.

- Inflammation may or may not be present in the affected joints.



Source: Fauci AS, Kasper DL, Braunwald E, Hauser SL, Longo DL, Jameson JL, Loscalzo J

ETIOLOGY


Obesity
Previous Occupation
OSTEOARTHRITIS
Joint Trauma
Genetic Predisposition

Obesity

- Strongly associated with hip, knee, and hand OA
- Preventable
- 10% Increases with each additional kilogram of weight

Occupation, Sports, and Trauma

- Activities involving **repetitive motion or injury** are at **increased risk** for developing OA

- OA is associated with participation in wrestling, boxing, baseball pitching, cycling, and football.

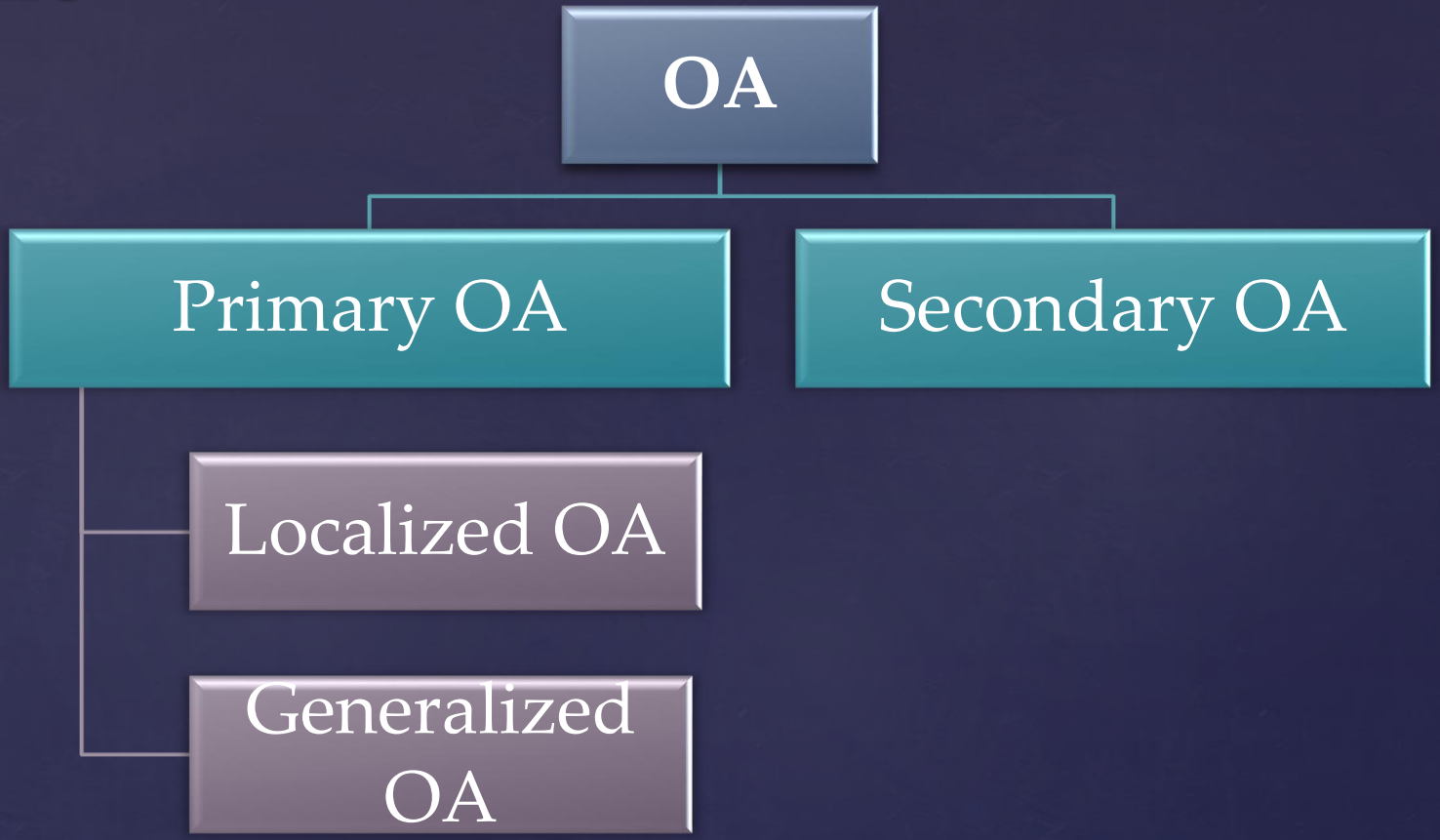
Genetic Factors

Variants in the

- Interleukin-1 family,
- Interleukin-4 receptor,
- Secreted frizzled-related protein (*FRZB* is a gene for a Frizzle protein) plays a critical role in matrix synthesis and joint development.
- All showed very significant associations with OA

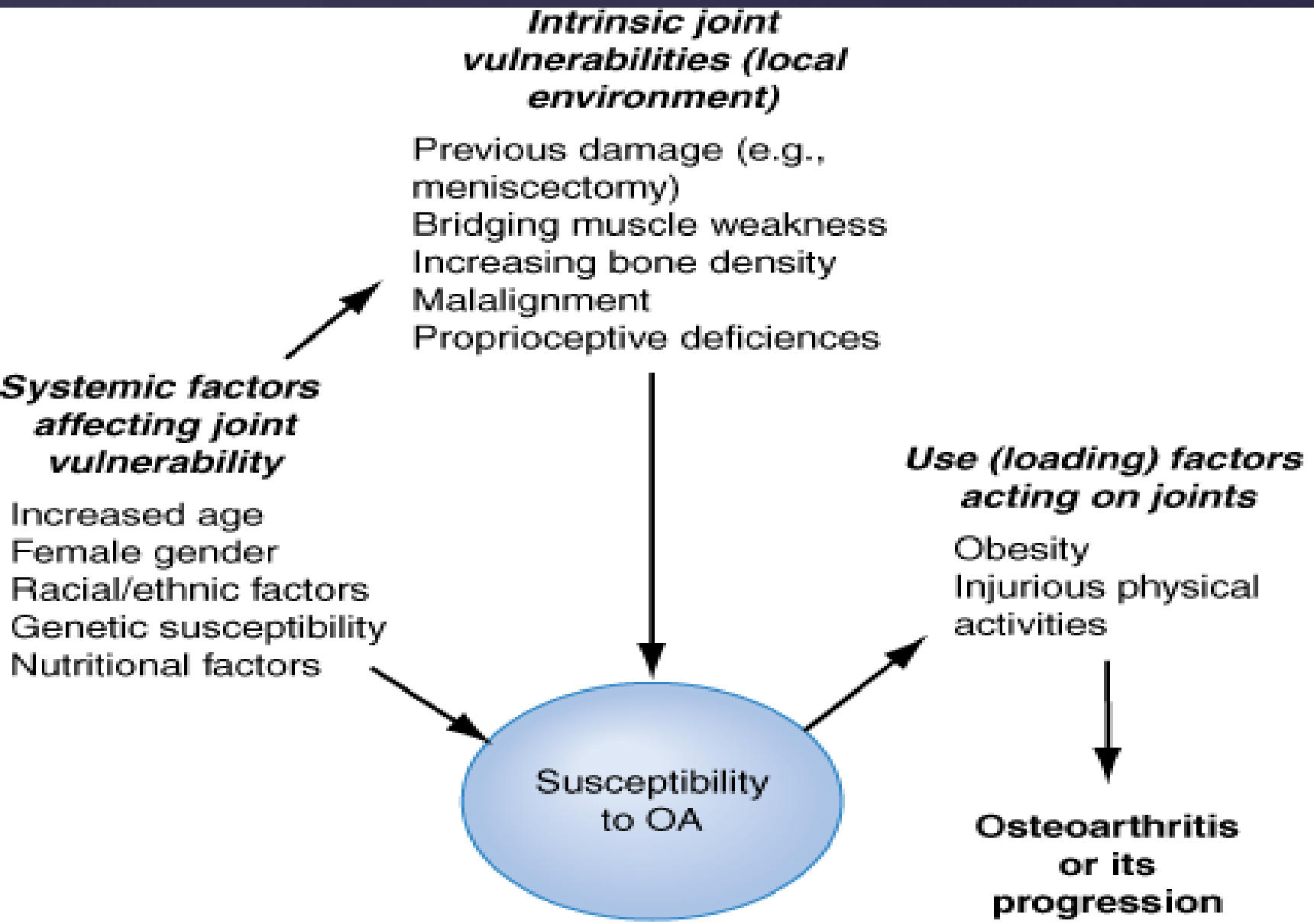
- Genetic mutations in proteins that regulate the transcription of major cartilage molecules are at high risk of OA.

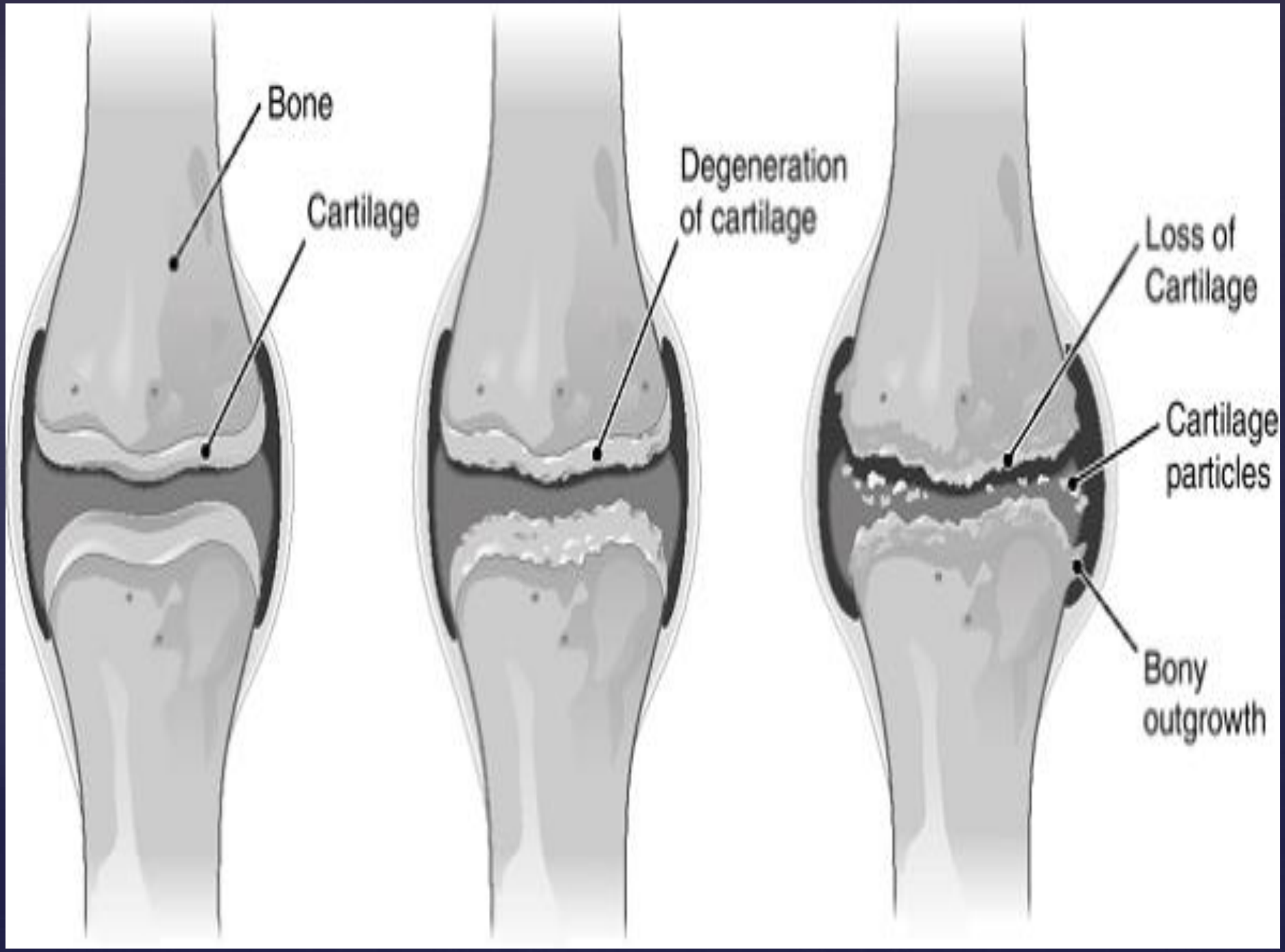
TYPES



Erosive osteoarthritis is presence of erosion and marked proliferation in the proximal and distal interphalangeal joints of the hands

Risk Factors for OA




Bone
Cartilage
Degeneration of cartilage
Loss of Cartilage
Cartilage particles
Bony outgrowth

Cartilage function

Cartilage has 2 major molecules

- Type 2 collagen, (Provides cartilage its tensile strength)
- Aggrecan, (A proteoglycan macromolecule gives cartilage its compressive stiffness)

- Chondrocytes, in avascular tissue, synthesize all elements of the matrix & in addition produce enzymes that break down the matrix and cytokines and growth factors.

- Cartilage matrix synthesis and catabolism are in a dynamic equilibrium influenced by the cytokine and growth factor environment and by mechanical stress

Cytokines

- **Interleukin (IL) 1** (stimulating production of proteinases and suppressing cartilage matrix synthesis)
- **Tumor necrosis factor (TNF)** (same function as IL1)

- Cytokines also induce chondrocytes to synthesize
  - Prostaglandin E_2,
  - Nitric oxide (Inhibits aggrecan synthesis and enhances proteinase activity)
  - Bone morphogenic protein 2 (BMP-2) (potent stimulator of anabolic activity)

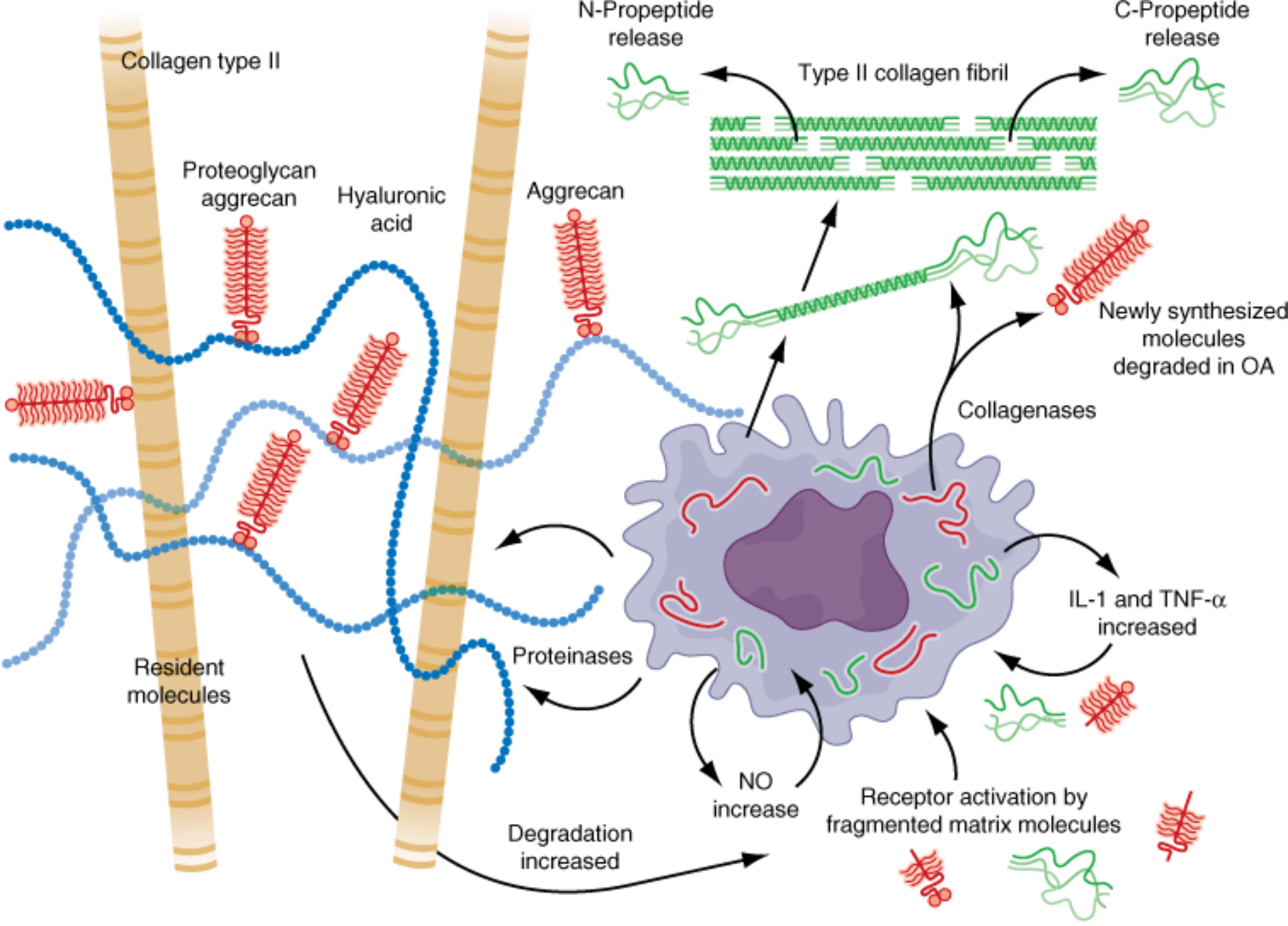
- At early stages in the matrix response to injury cytokine stimulation may be matrix turnover ultimately, excess IL-1 triggers a process of matrix degradation

- Growth factors insulin-like growth factor type 1 stimulate anabolism by chondrocytes.

- Cartilage in early OA is highly metabolically active.
- In the latter situation, stimulated chondrocytes synthesize degrading enzymes & release of degraded aggrecan and type 2 collagen into cartilage and into the synovial fluid.
- Type 2 cartilage is degraded primarily by MMP-13 (collagenase 3)
- Aggrecan degradation is complex but appears to be a consequence, in part, of activation of aggrecanase 1 (ADAMTS-4) and perhaps of MMPs.

- OA cartilage is characterized by
  - Depletion of aggrecan,
  - An unfurling of the tightly woven collagen matrix,
  - Loss of type 2 collagen.

- With these changes comes increasing vulnerability of cartilage, which no longer has compressive stiffness.


N-Propeptide release
C-Propeptide release
Collagen type II
Type II collagen fibril
Proteoglycan aggrecan
Hyaluronic acid
Aggrecan
Newly synthesized molecules degraded in OA
Collagenases
IL-1 and TNF-α increased
Proteinases
Resident molecules
NO increase
Receptor activation by fragmented matrix molecules
Degradation increased

PATHOGENESIS

Injury to cartilage

Catabolic activity ⬆ promote proteoglycan depletion in the matrix

Negative charges of proteoglycans get exposed, and cartilage swells from ionic attraction to water molecules

Cartilage does not bounce back after loading vulnerable to further injury

Chondrocytes at the basal level of cartilage undergo apoptosis

Cont……..

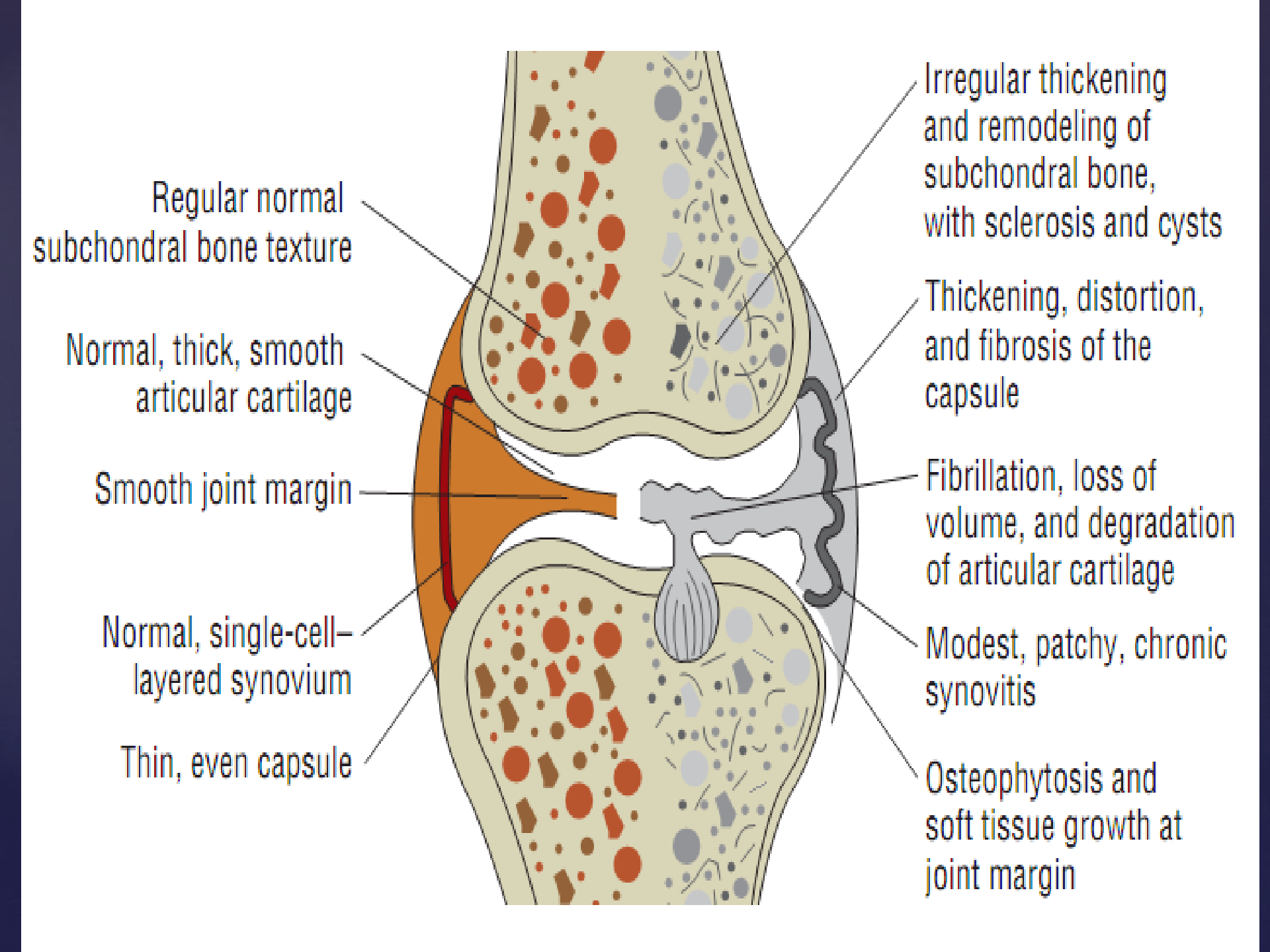
Growth factors and cytokines Stimulate osteoclasts and osteoblasts in the subchondral bony plate

Thickening and stiffness of the subchondral plate occurs & At the margin of the joint, near areas of cartilage loss, osteophytes form.

Synovium become edematous and inflamed, migration of macrophages from the periphery into the tissue, and cells lining the synovium proliferate.

Enzymes secreted by the synovium digest cartilage matrix . cartilage erosions produced by bony pressure from the opposite side of the joint.

Basic calcium phosphate and calcium pyrophosphate dihydrate crystals are present microscopically in most joints with end-stage OA.


Regular normal subchondral bone texture
Normal, thick, smooth articular cartilage
Smooth joint margin
Normal, single-cell–layered synovium
Thin, even capsule
Irregular thickening and remodeling of subchondral bone, with sclerosis and cysts
Thickening, distortion, and fibrosis of the capsule
Fibrillation, loss of volume, and degradation of articular cartilage
Modest, patchy, chronic synovitis
Osteophytosis and soft tissue growth at joint margin

Clinical presentation

Symptoms

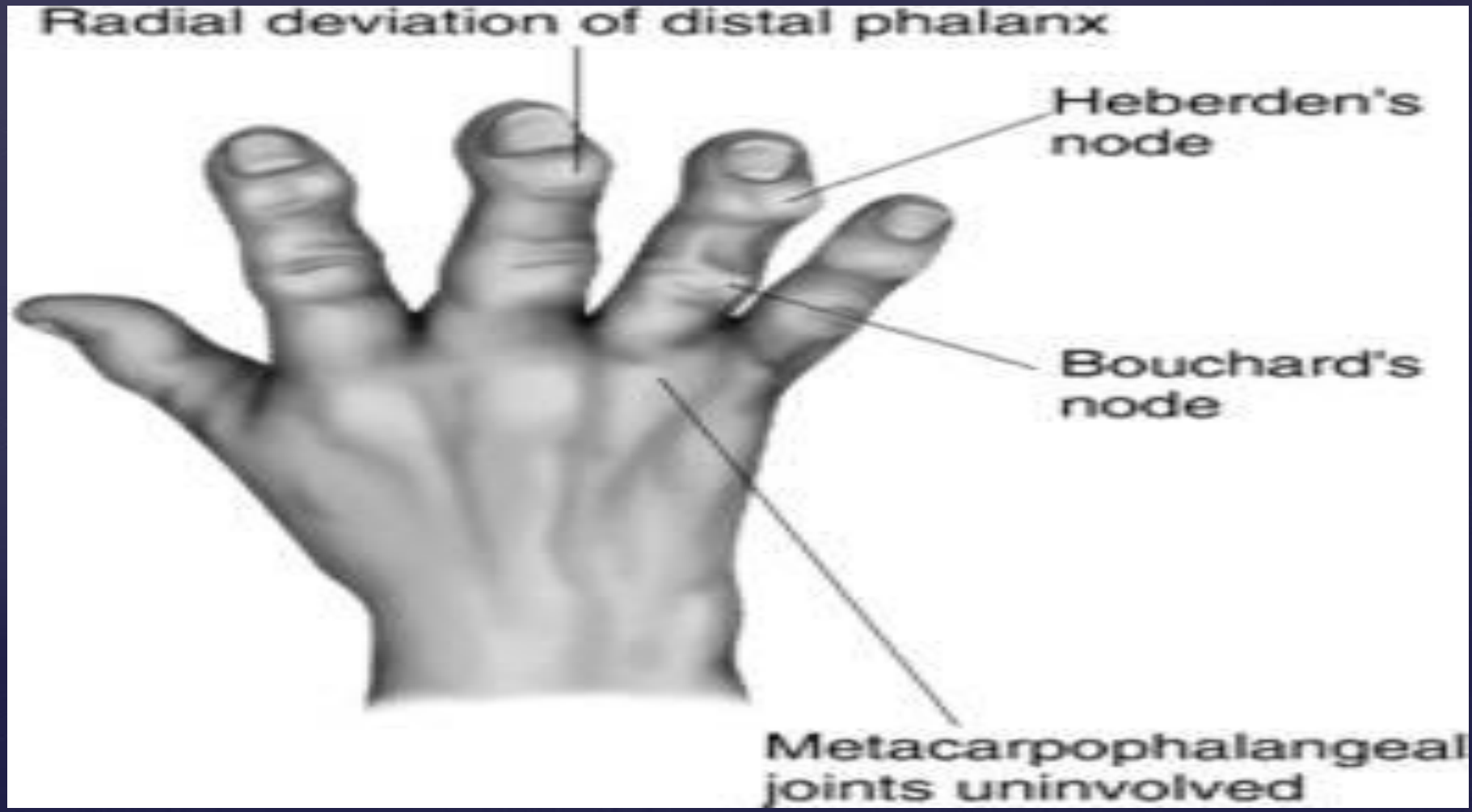
- **Pain** in the affected joints, with the hands, knees, and hips being the most common locations. Associated with motion, but pain in late disease occur with rest.

- **Joint stiffness** resolves with motion; recurs with rest.(Morning joint stiffness in OA **resolves within 30 minutes**)

Signs

- Joint stiffness
- Crepitus
- Limited range of motion
- Joint deformity (late disease)

- In OA, Heberden's nodes are bony enlargements of the DIP joints with loss of joint space and osteophyte formation. A similar bony enlargement of the PIP joint is called a Bouchard's node



Thank you