Bone & Cartilage

Histology Lab.

*v2

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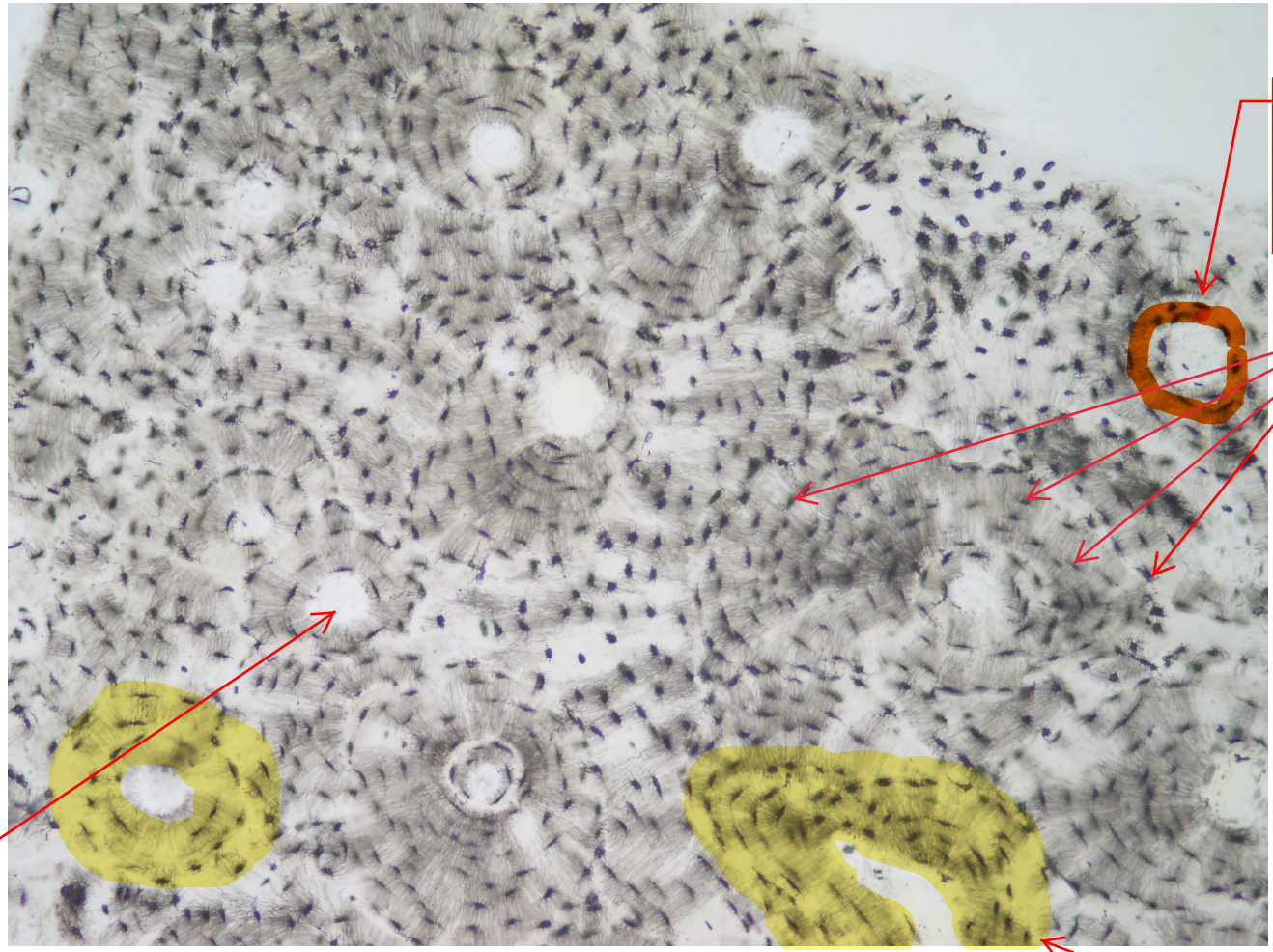
Compact Bone-ground

-One of the members of special connective tissues
-made from cells and the solid matrix around them
-what distinguishes the matrix of bone from all other tissues is the inorganic component: Ca and phosphatase in the form of crystalline hydroxyapatite



concentric lamellae (layers of matrix in the osteon)

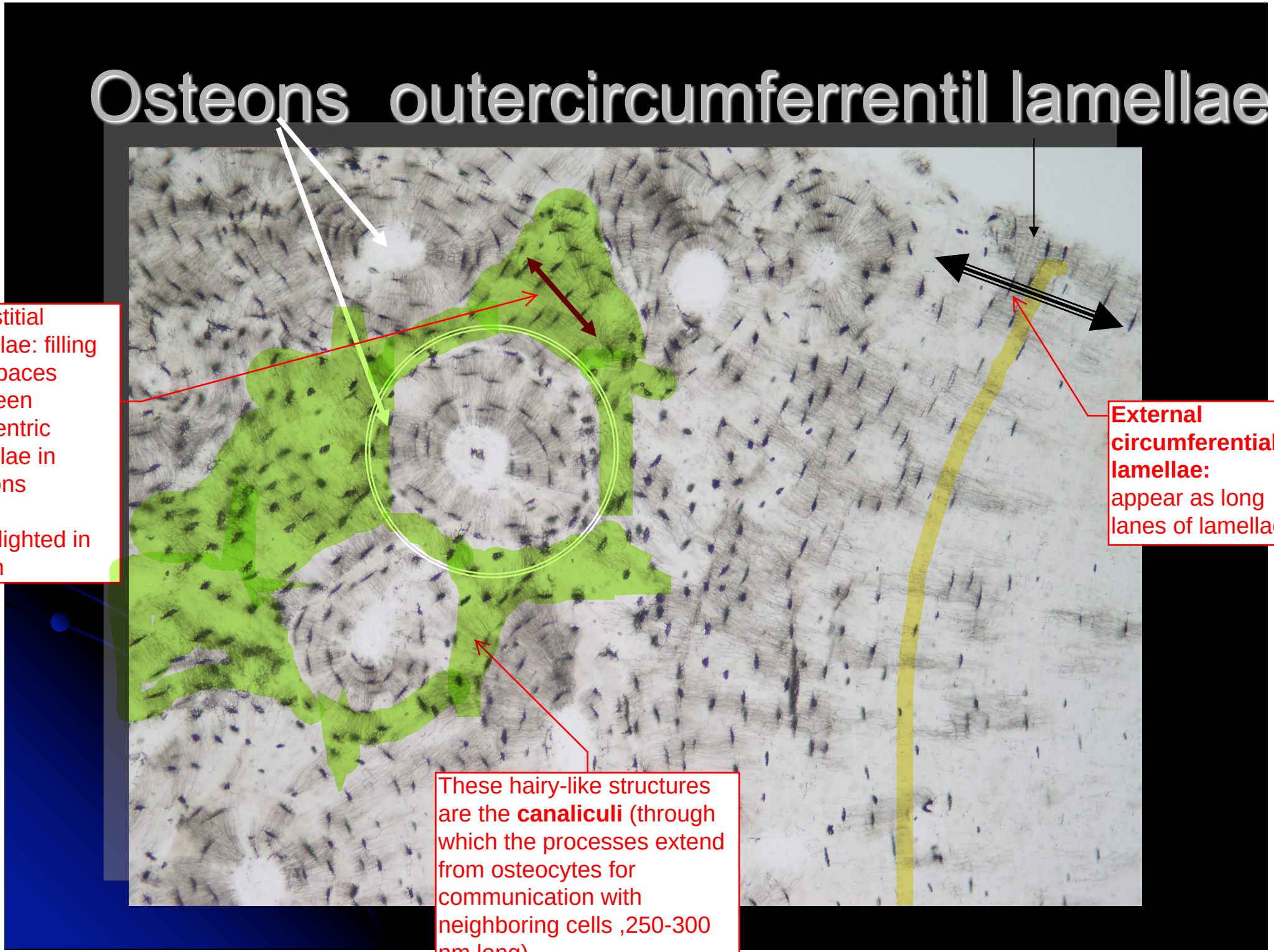
osteocytes (mature cells) squeezed between lamellae and imprisoned in the lacunae

Central canal: where tiny neurovascular bundles (vein, artery & nerve) pass through

osteons/ haversian systems (onion rings shaped structures) *highlighted in yellow

-This is calcified bone tissue with its complete structure
-Embedded in strong plastics/ resin to overcome its hardness and sectioned with a special microtome
-this is a section from inside the bone so neither the perichondium nor external circumferential lamellae are visible here

Osteons outercircumferrentil lamellae

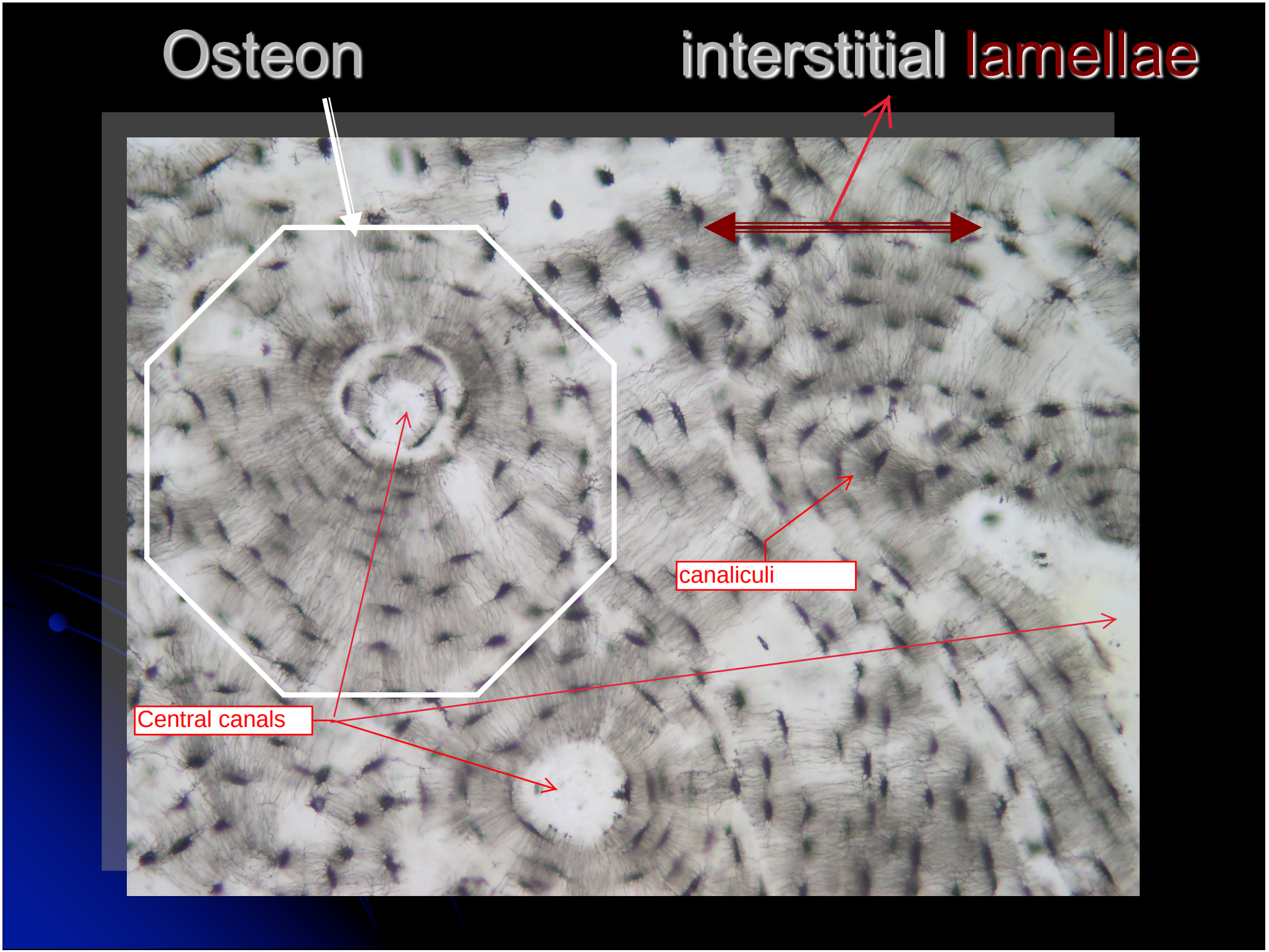


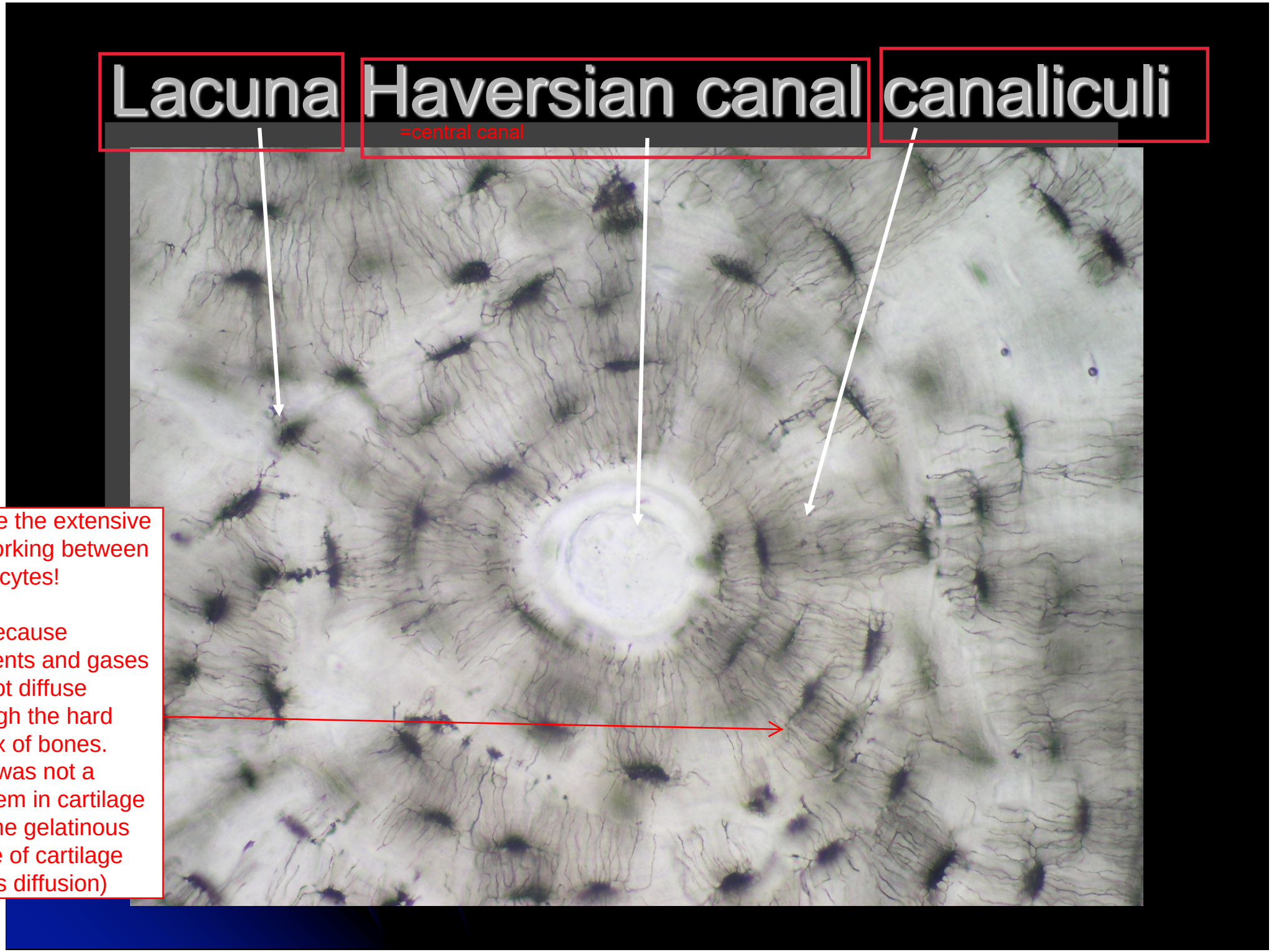
Interstitial lamellae: filling the spaces between concentric lamellae in osteons

*highlighted in green

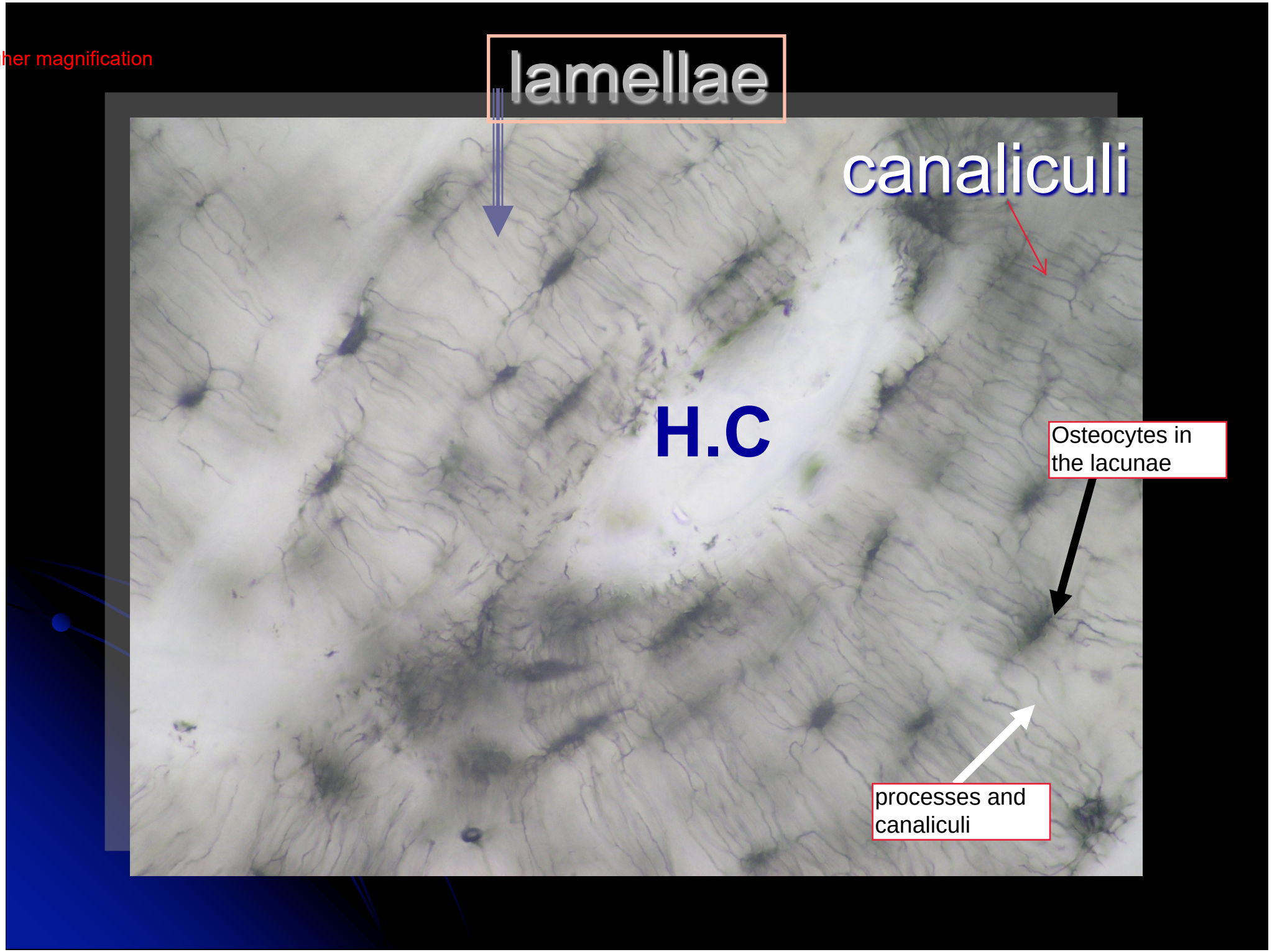
External circumferential lamellae: appear as long lanes of lamellae

These hairy-like structures are the **canaliculi** (through which the processes extend from osteocytes for communication with neighboring cells ,250-300 nm long)

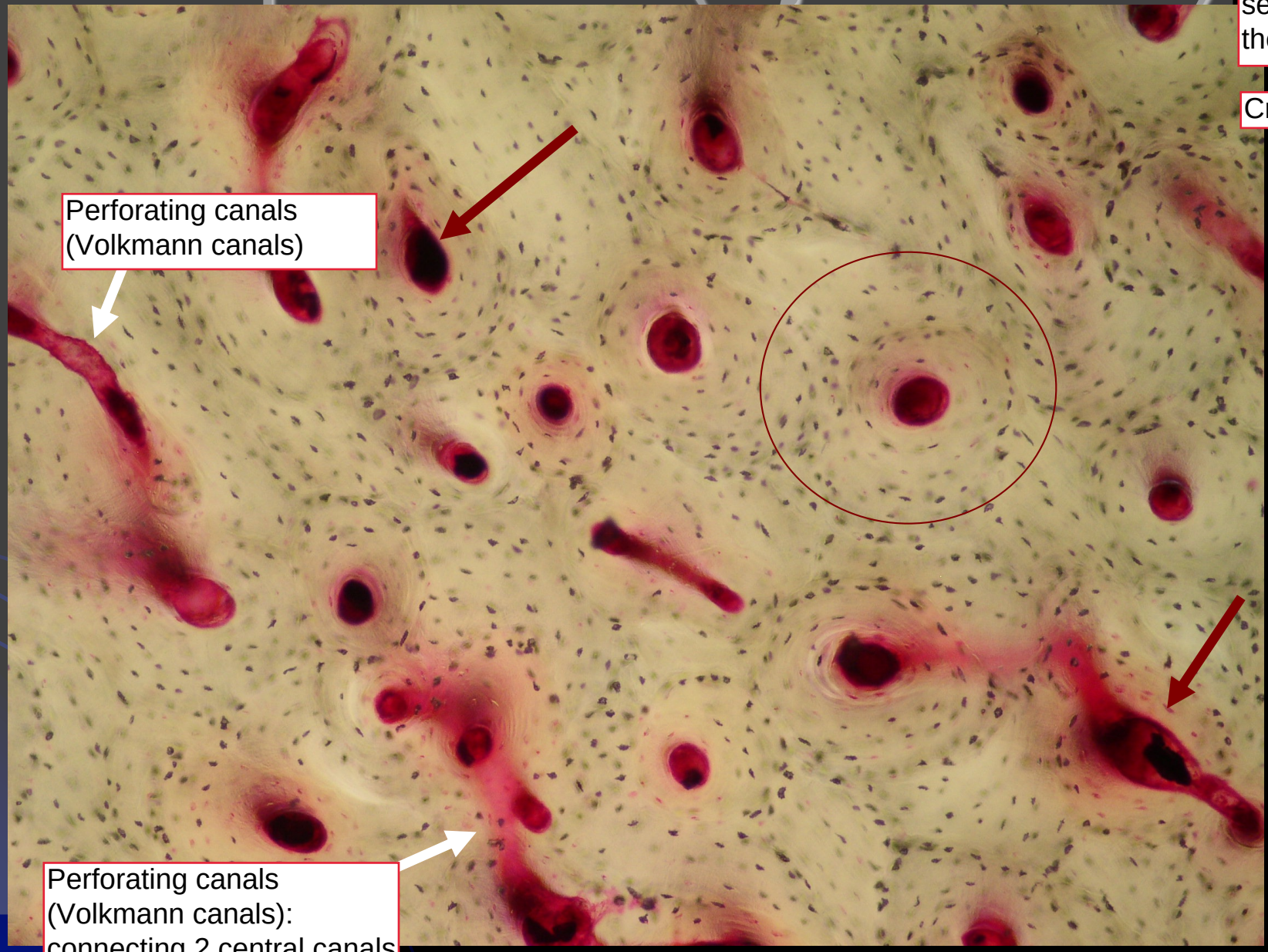

Osteon
interstitial lamellae
canaliculi
Central canals


Lacuna
Haversian canal
=central canal
canaliculi
Notice the extensive networking between osteocytes!
ofc because Nutrients and gases cannot diffuse through the hard matrix of bones. (that was not a problem in cartilage cuz the gelatinous tissue of cartilage allows diffusion)

Higher magnification



Compact bone(injected ink)



In this section we have injected ink inside so you can see the location of the central canals

Cross section

Perforating canals (Volkmann canals)

Perforating canals (Volkmann canals): connecting 2 central canals

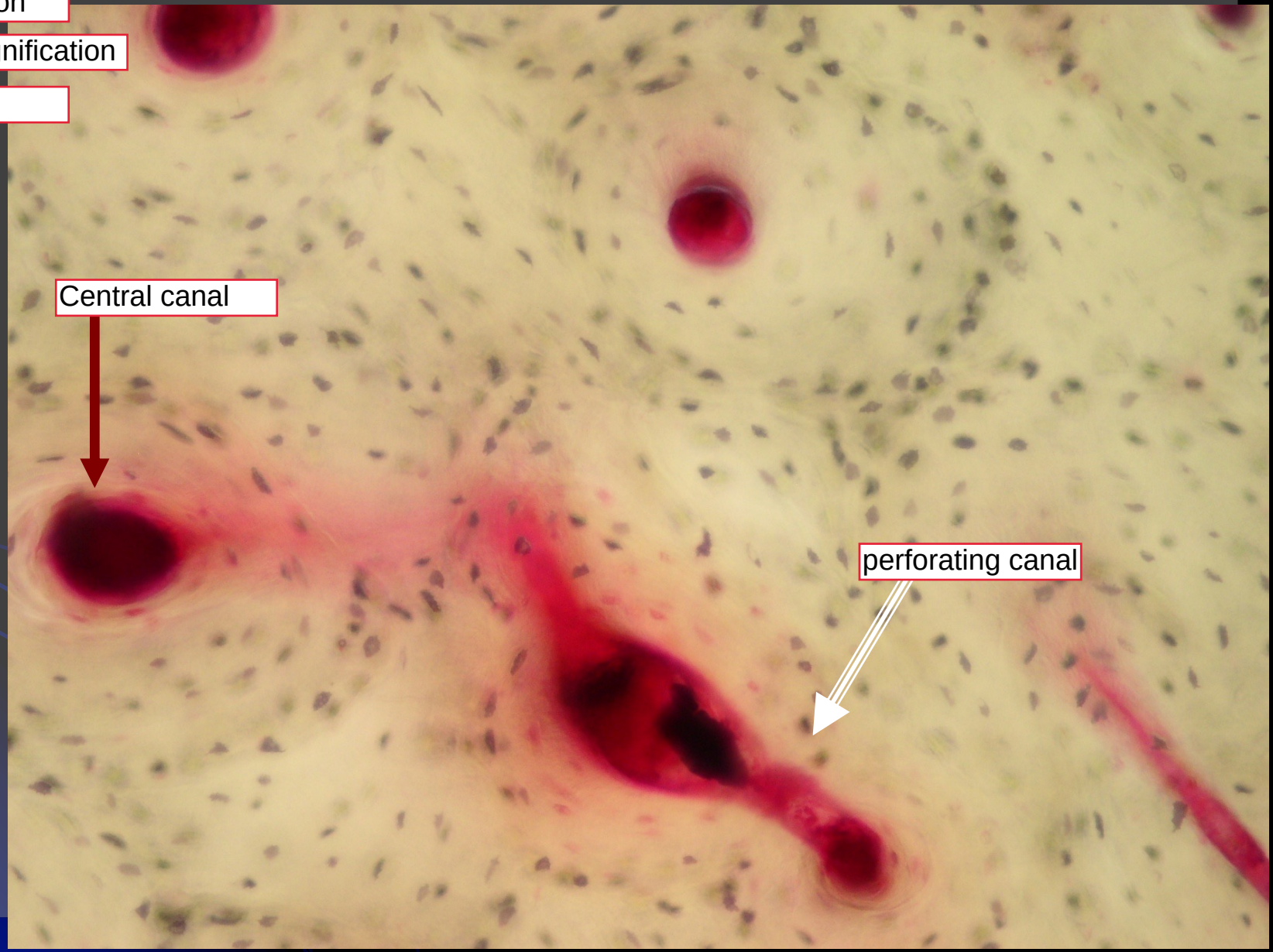
Haversian&Volkman's canal

Cross section

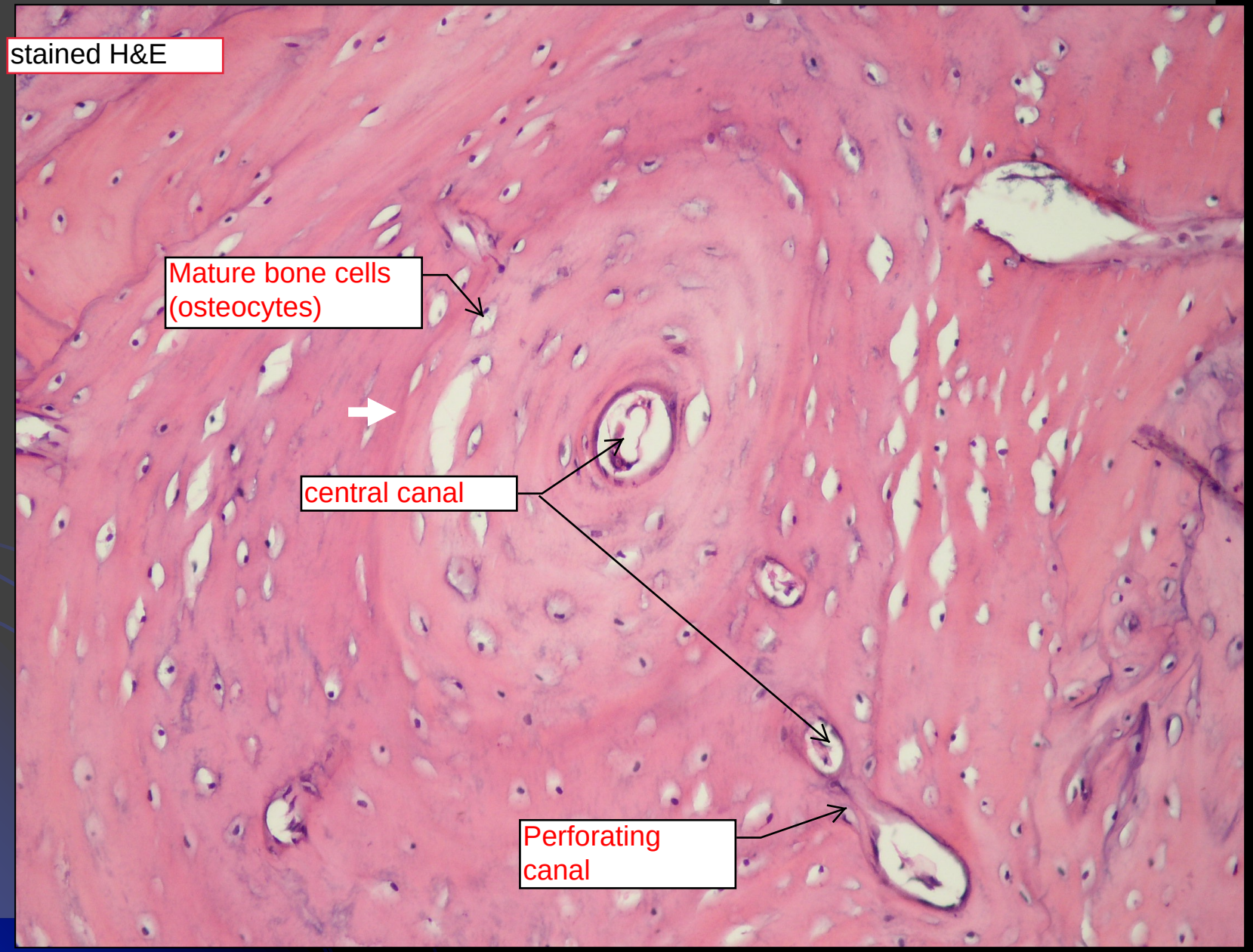
Higher magnification

decalcified

Unstained



Decalcified compact bone



compact bone

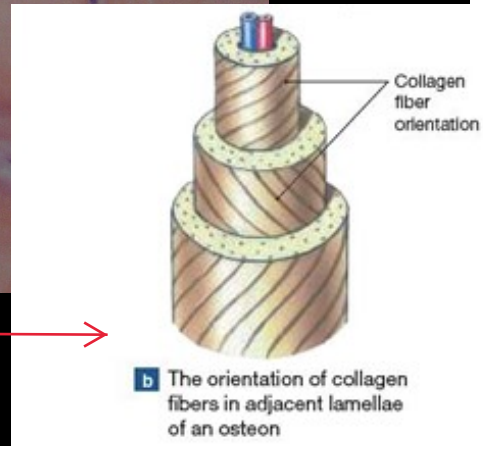
V.C.

Volkmann canal

H.C.

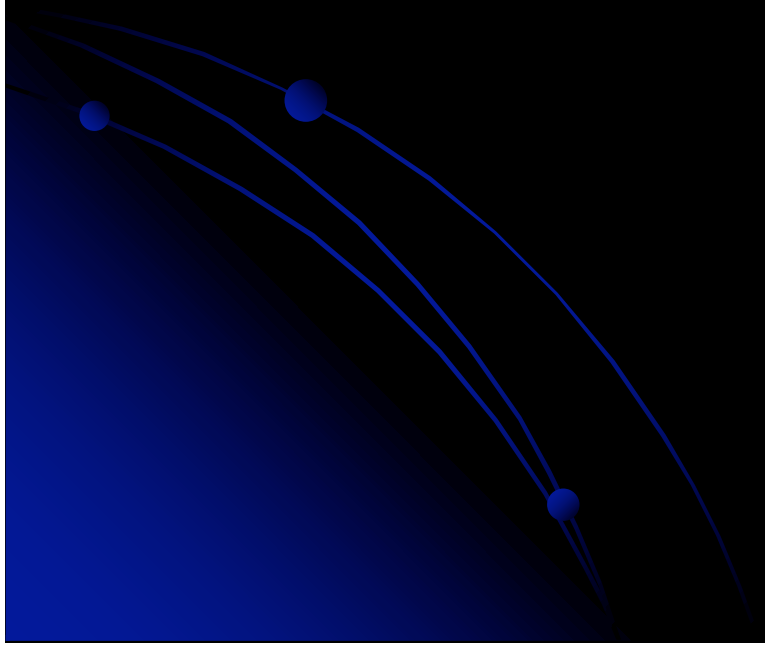
haversian canal

Extensive collagen (orientation of this collagen between lamellae: they tend to go in different directions in adjacent lamellae to ensure coverage of all aspects of the osteons to increase strength of the bone structure)



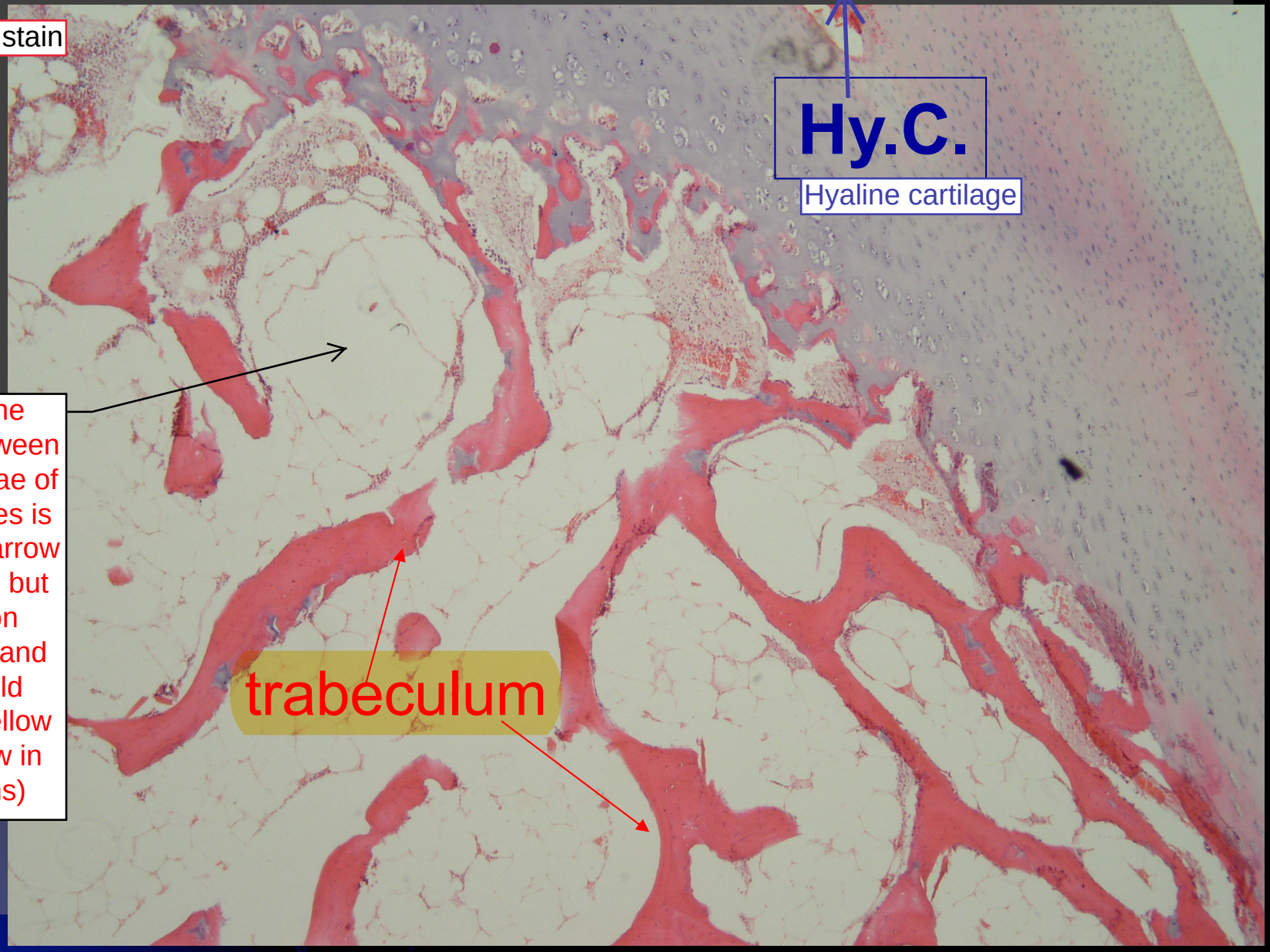
b The orientation of collagen fibers in adjacent lamellae of an osteon

Spongy bone=cancellous bone

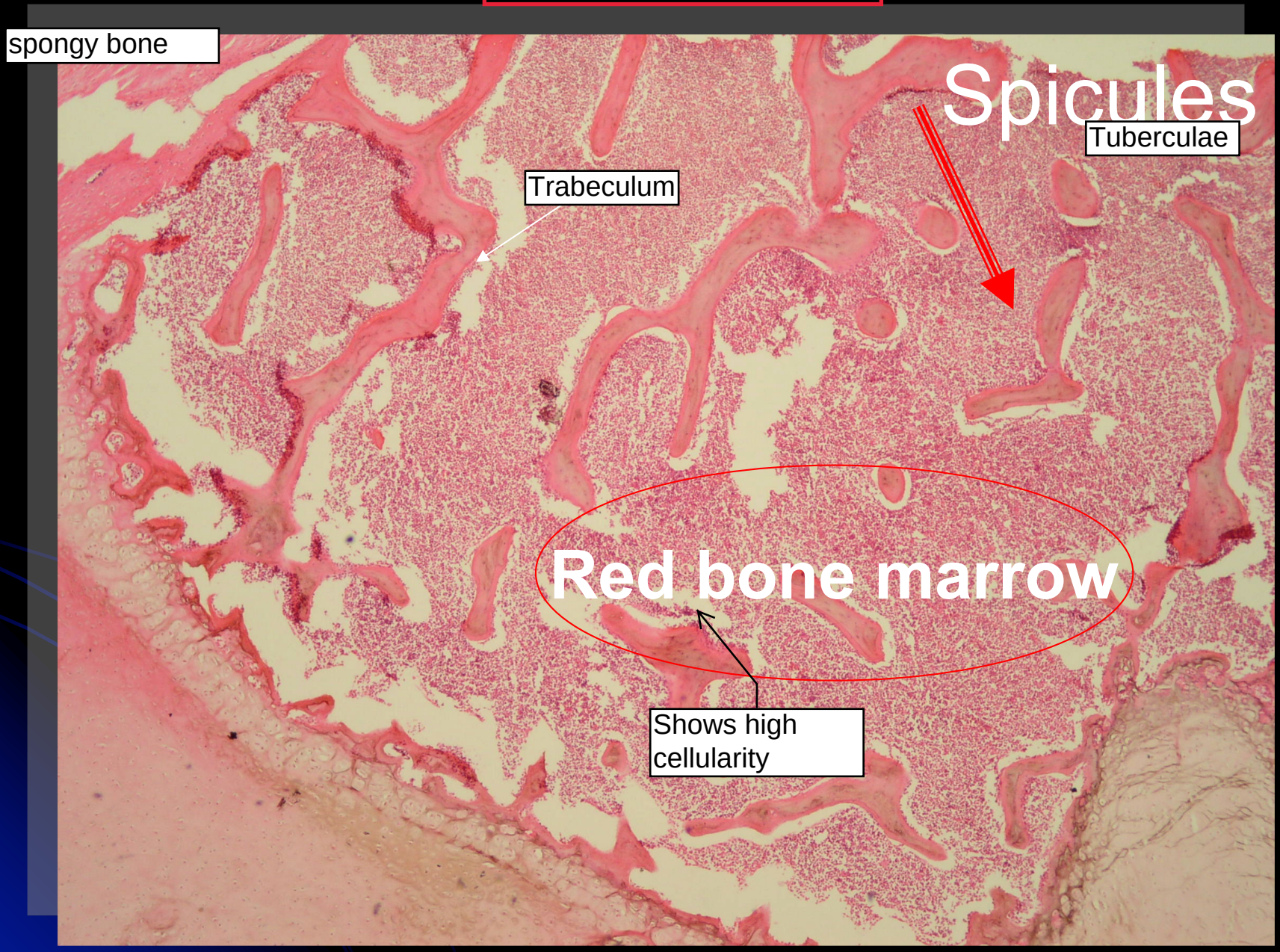


Spongy bone= cancellous bone

Spongy Bone(articular surface)

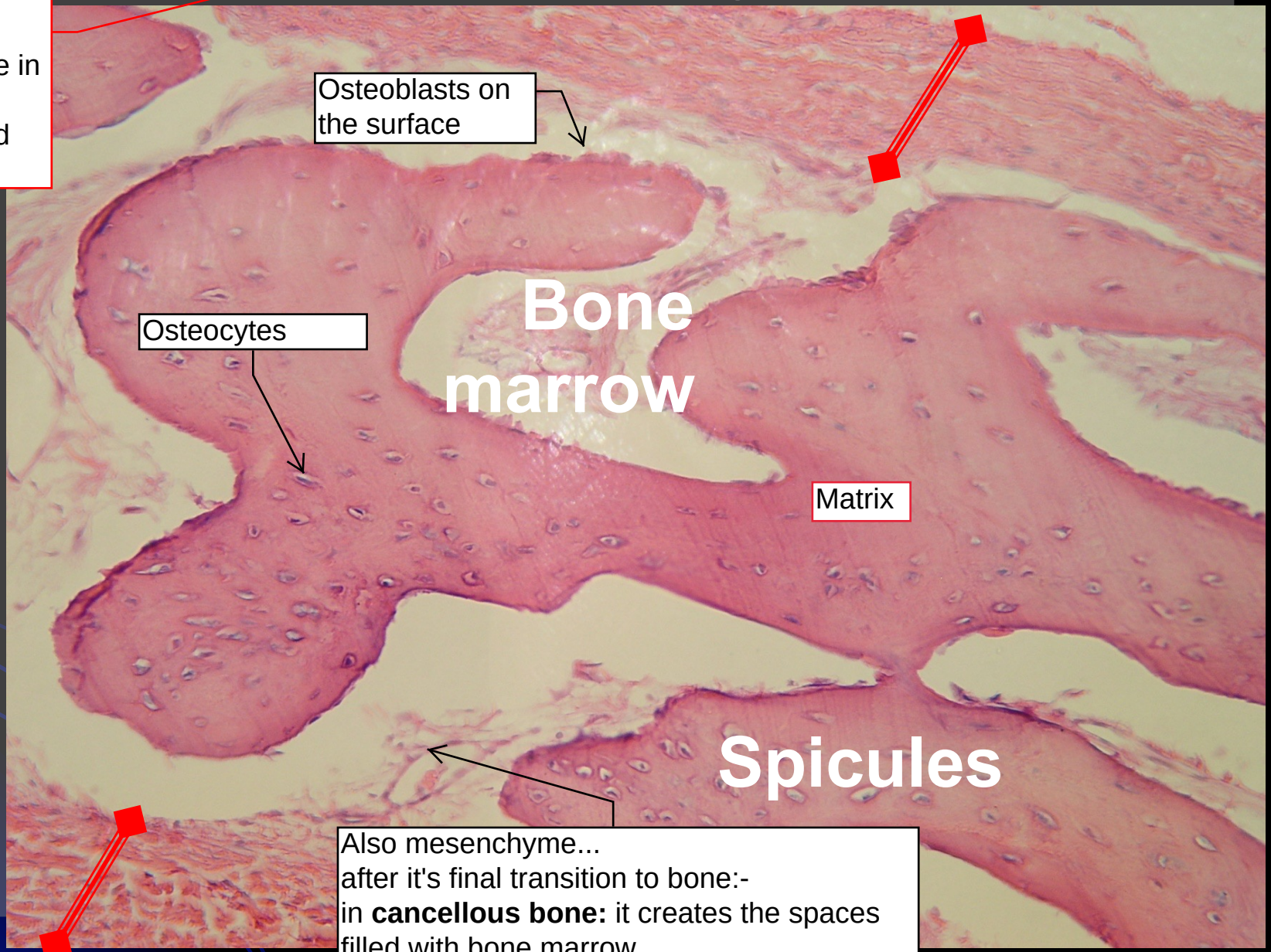


vertebrae


spongy bone
Spicules
Tuberculae
Trabeculum
Red bone marrow
Shows high cellularity

Mesenchyme C.T

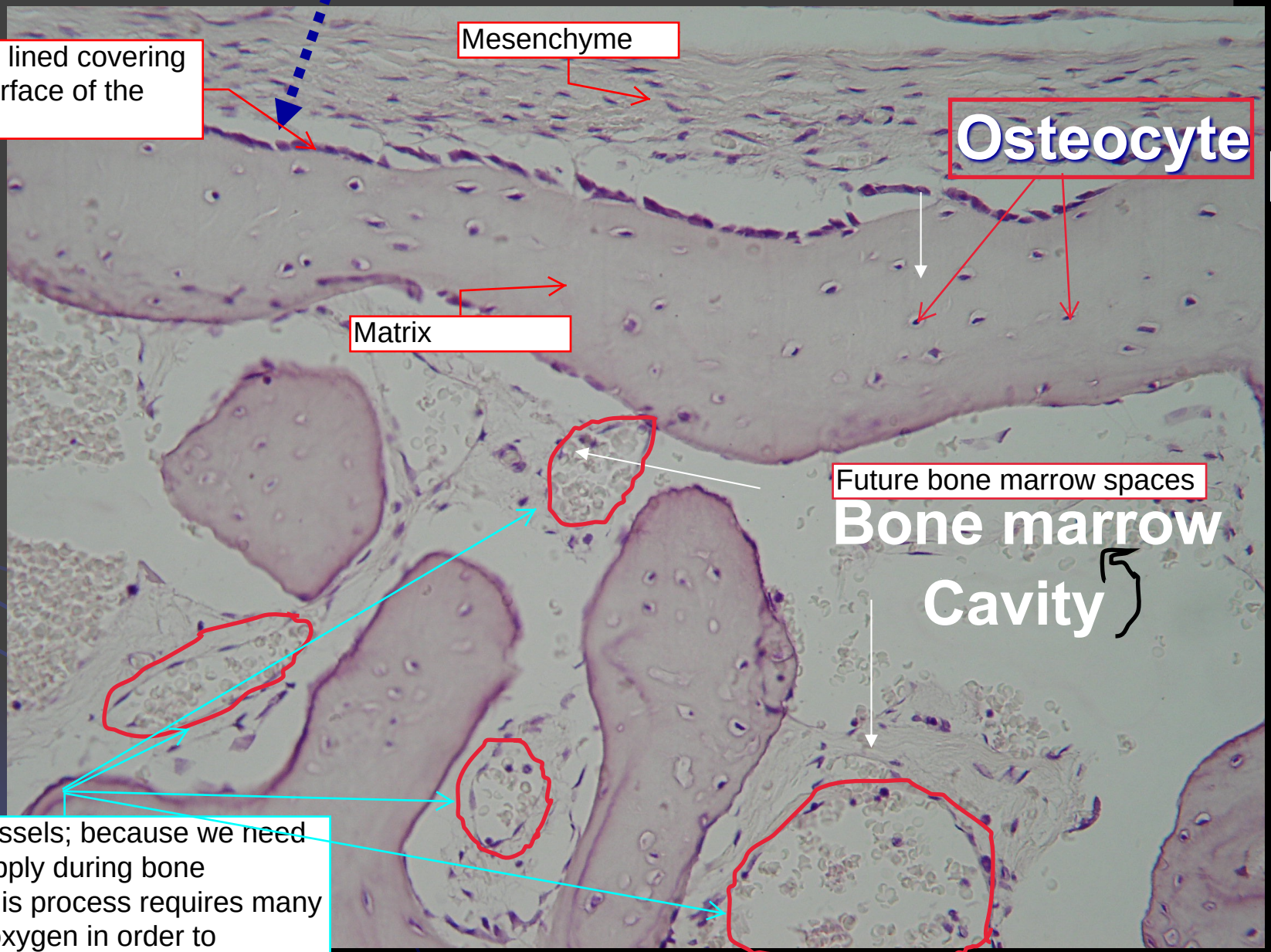
Presence of mesenchyme indicates that this is a tissue in an embryo (newly formed bone)

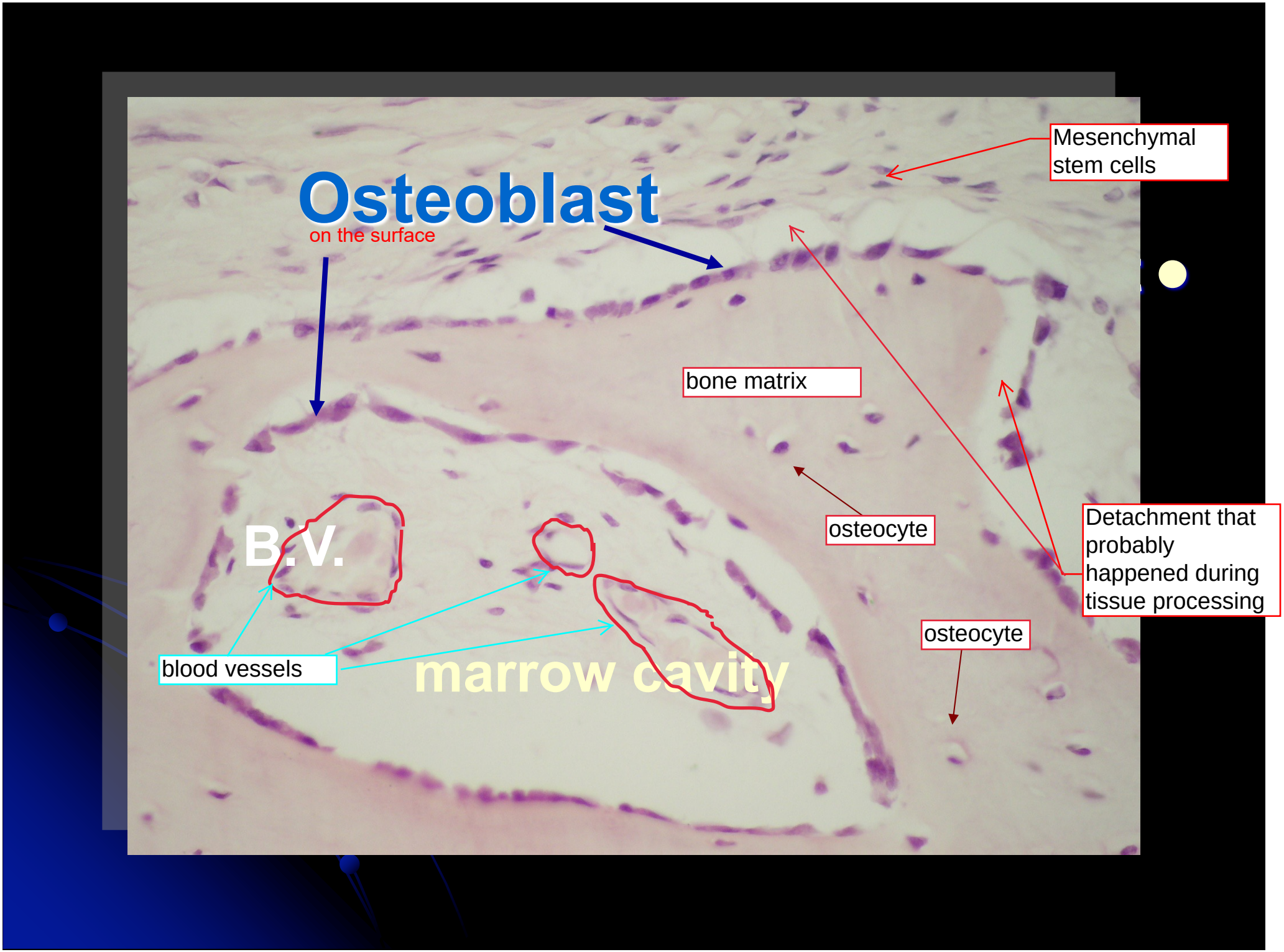


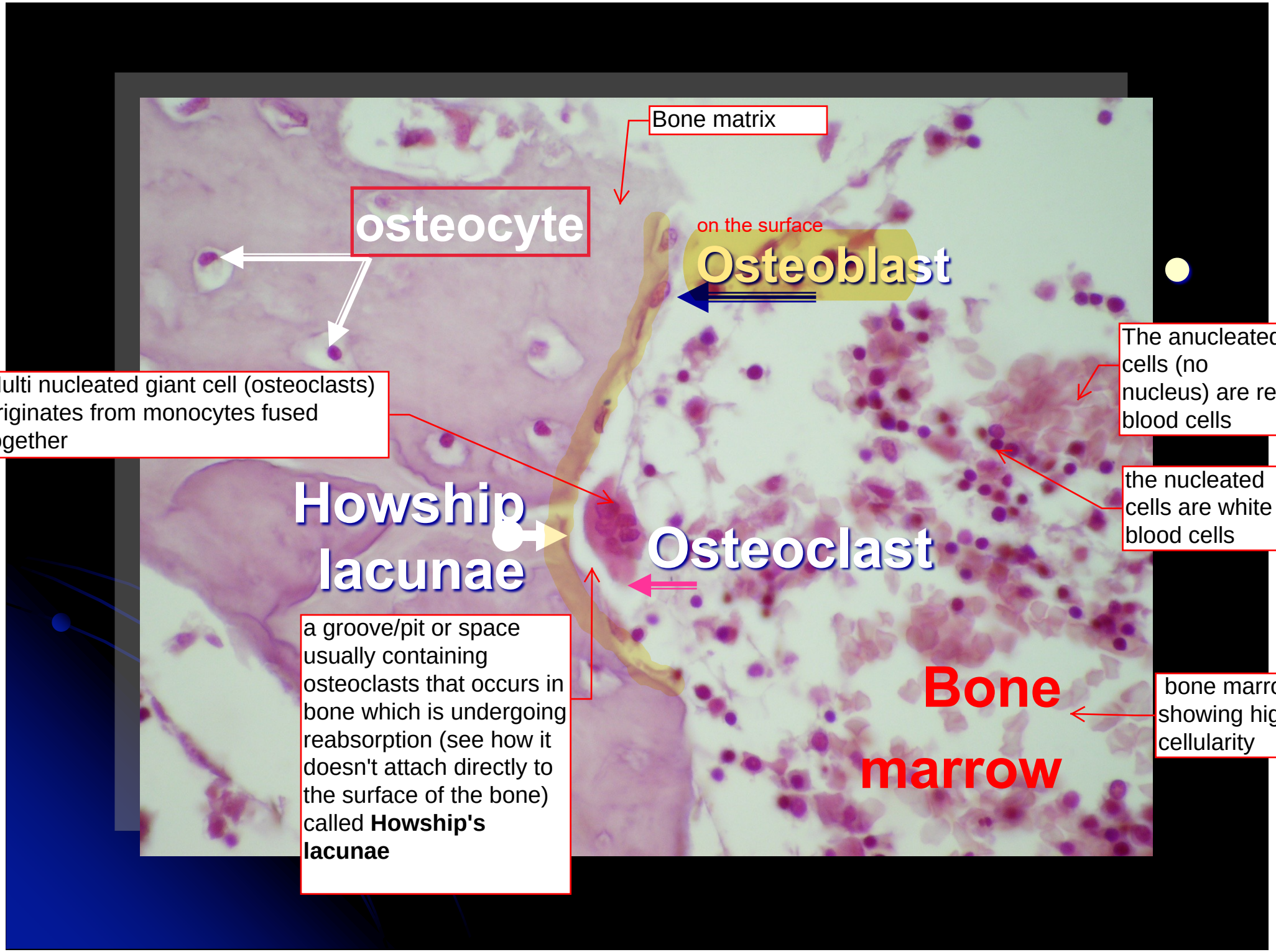
Also mesenchyme...
after it's final transition to bone:-
in **cancellous bone:** it creates the spaces filled with bone marrow
however in **compact bone:** you will see very little of those spaces only in central and perforating canals

Newly formed bone

Osteoblast cell




Osteoblast
on the surface
Mesenchymal stem cells
bone matrix
osteocyte
Detachment that probably happened during tissue processing
B.V.
blood vessels
marrow cavity
osteocyte


Bone matrix
osteocyte
on the surface
Osteoblast
Multi nucleated giant cell (osteoclasts) originates from monocytes fused together
The anucleated cells (no nucleus) are red blood cells
the nucleated cells are white blood cells
Howship lacunae
Osteoclast
a groove/pit or space usually containing osteoclasts that occurs in bone which is undergoing reabsorption (see how it doesn't attach directly to the surface of the bone) called **Howship's lacunae**
Bone marrow
bone marrow showing high cellularity

Hyaline Cartilage(e.g :Trachea)

Those white colored structures are goblet cells

lumen

Epithelium of respiratory tract:

Pseudostratified columnar Ciliated epithelium

with goblet cells

blood vessels

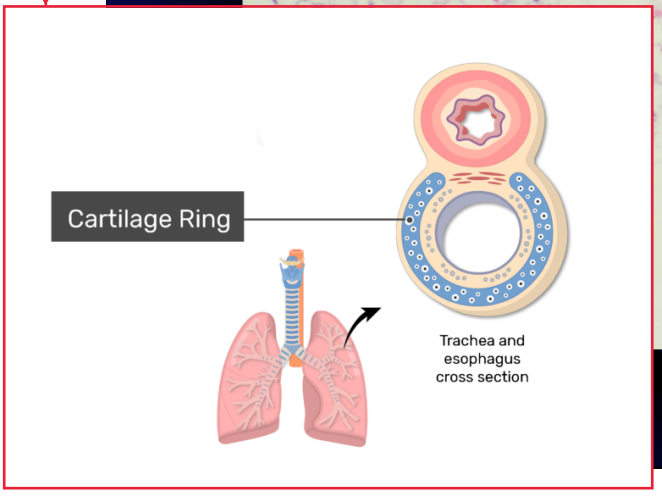
Cartilage tissue of the trachea: forms C shaped hyaline cartilages that provide support for the trachea (the tracheal rings)

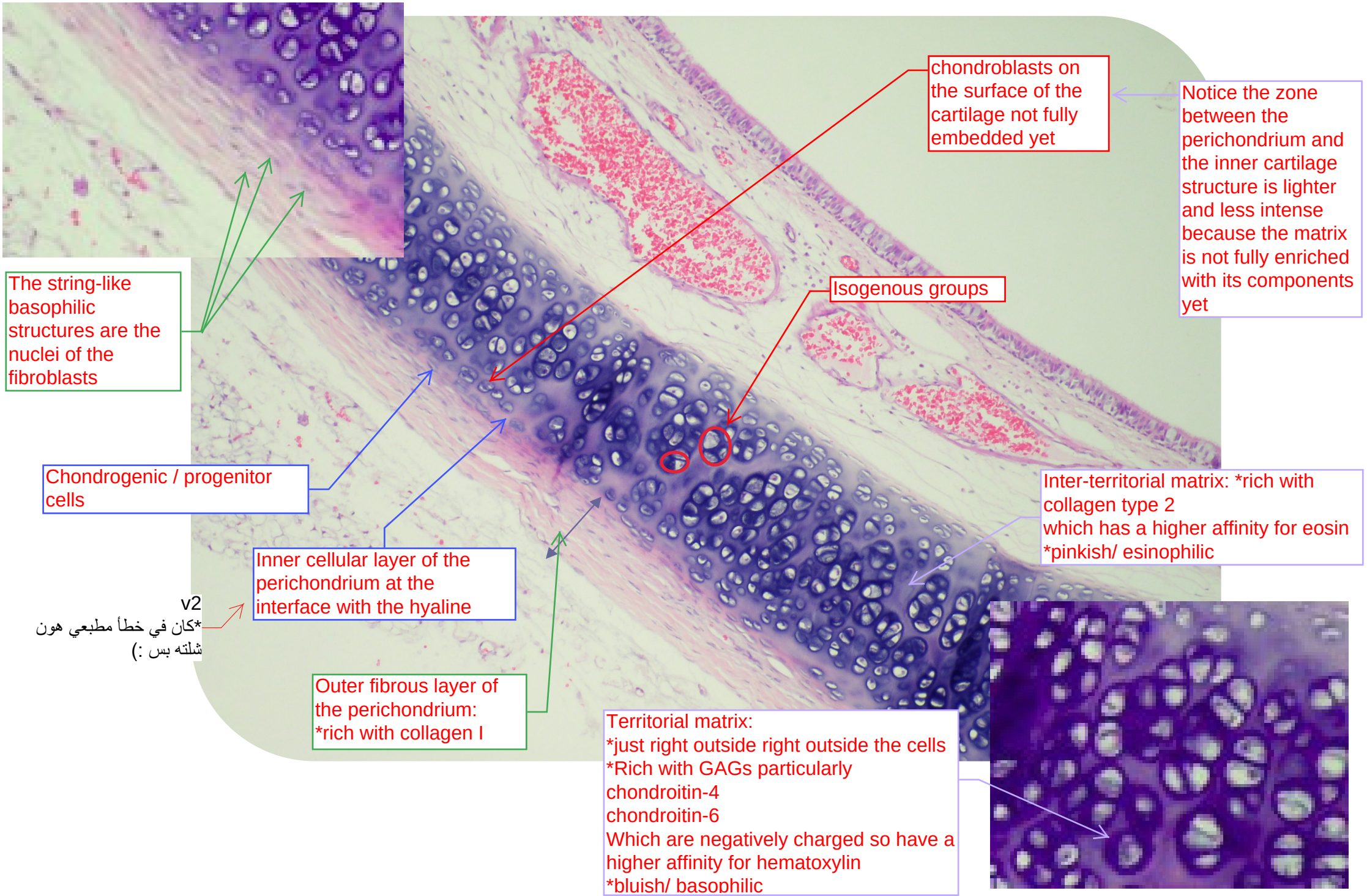
perichondrium

submucosa: under the epithelium

The structure of the hyaline look how cellular it is!

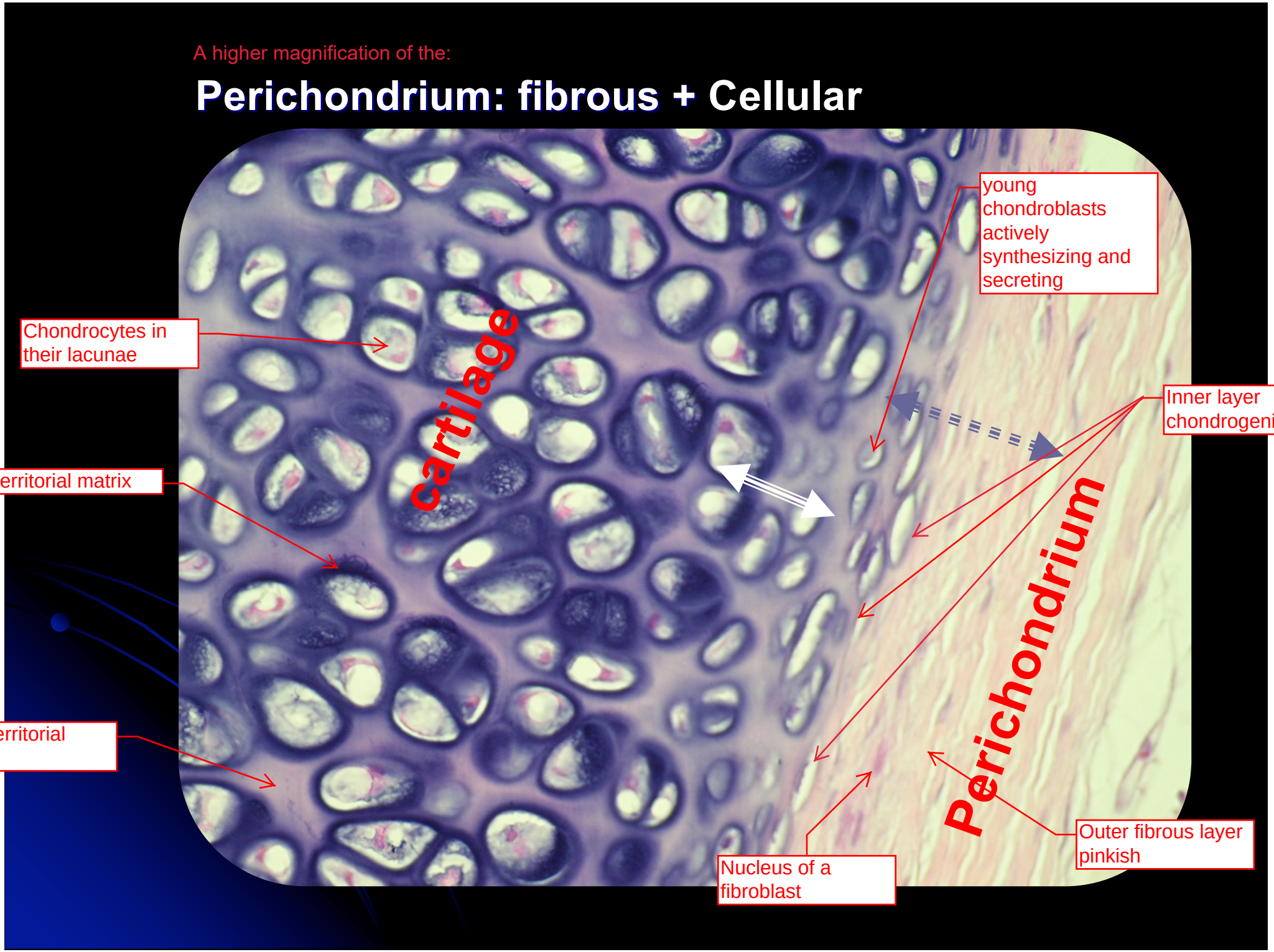
perichondrium: wraping the cartilage

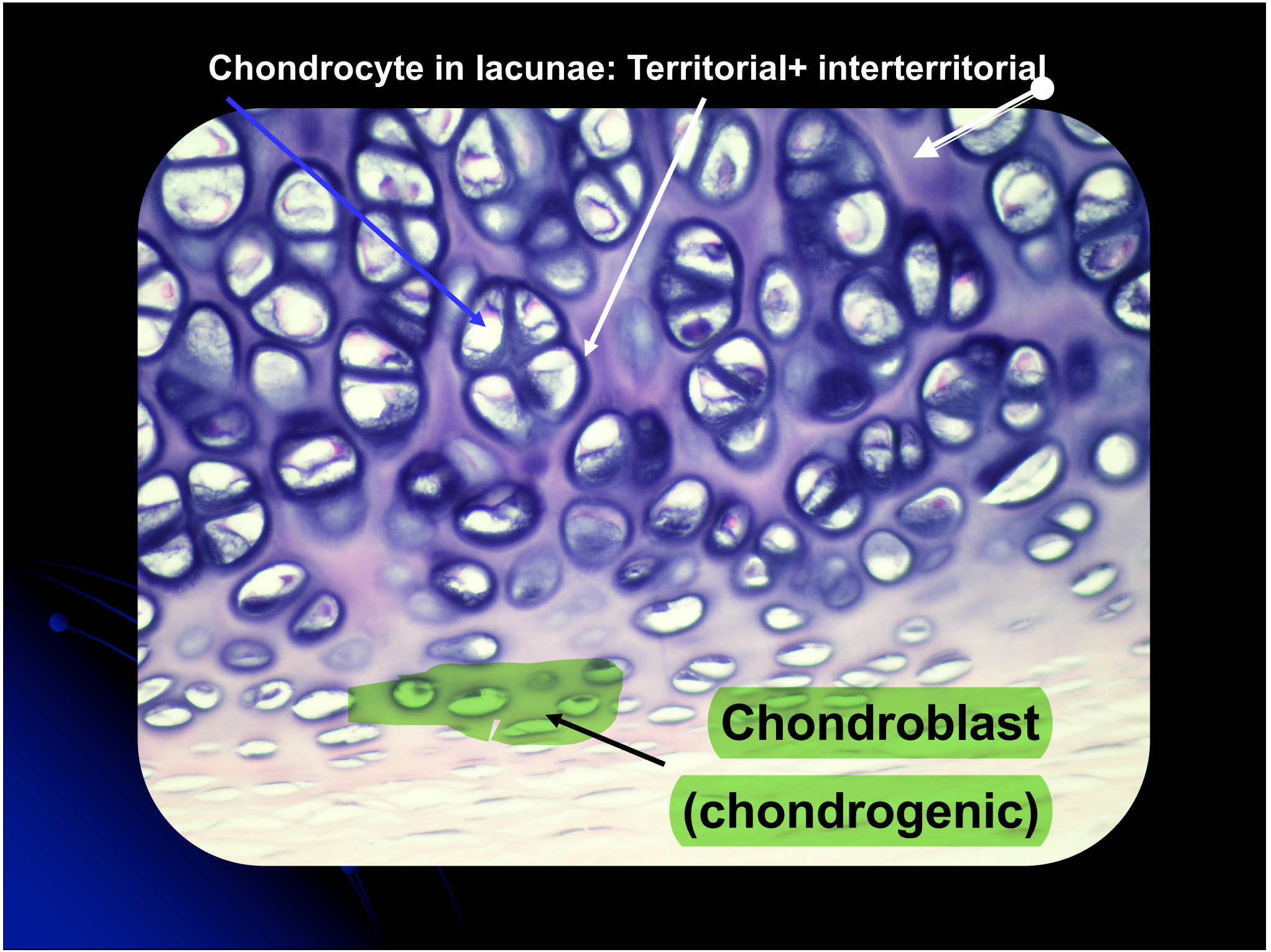


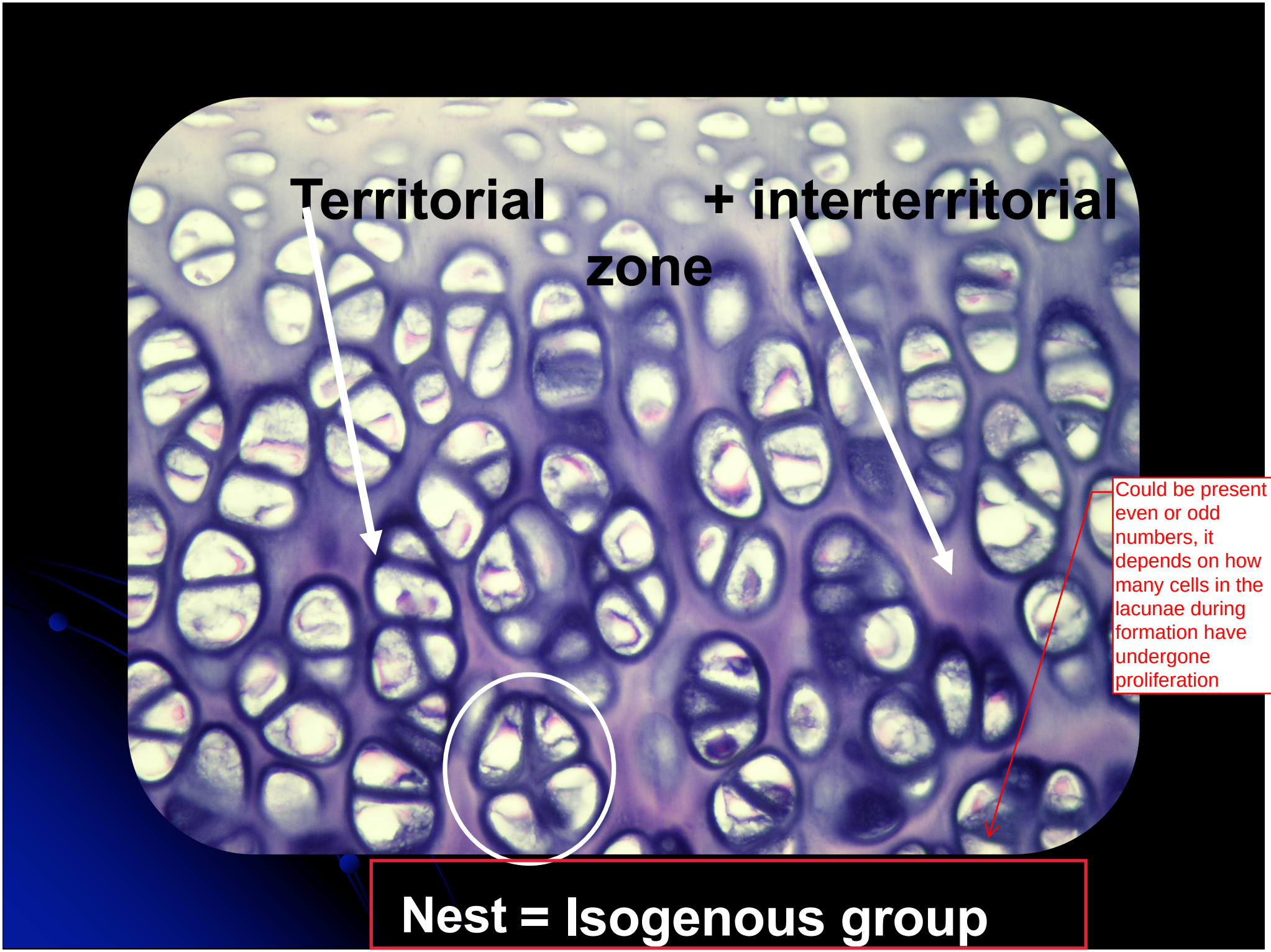

chondroblasts on the surface of the cartilage not fully embedded yet
Notice the zone between the perichondrium and the inner cartilage structure is lighter and less intense because the matrix is not fully enriched with its components yet
The string-like basophilic structures are the nuclei of the fibroblasts
Isogenous groups
Chondrogenic / progenitor cells
Inter-territorial matrix: *rich with collagen type 2
which has a higher affinity for eosin
*pinkish/ esinophilic
Inner cellular layer of the perichondrium at the interface with the hyaline
v2
*كان في خطأ مطبعي هون
شلته بس :)
Outer fibrous layer of the perichondrium:
*rich with collagen I
Territorial matrix:
*just right outside right outside the cells
*Rich with GAGs particularly
chondroitin-4
chondroitin-6
Which are negatively charged so have a higher affinity for hematoxylin
*bluish/ basophilic

A higher magnification of the:

Perichondrium: fibrous + Cellular

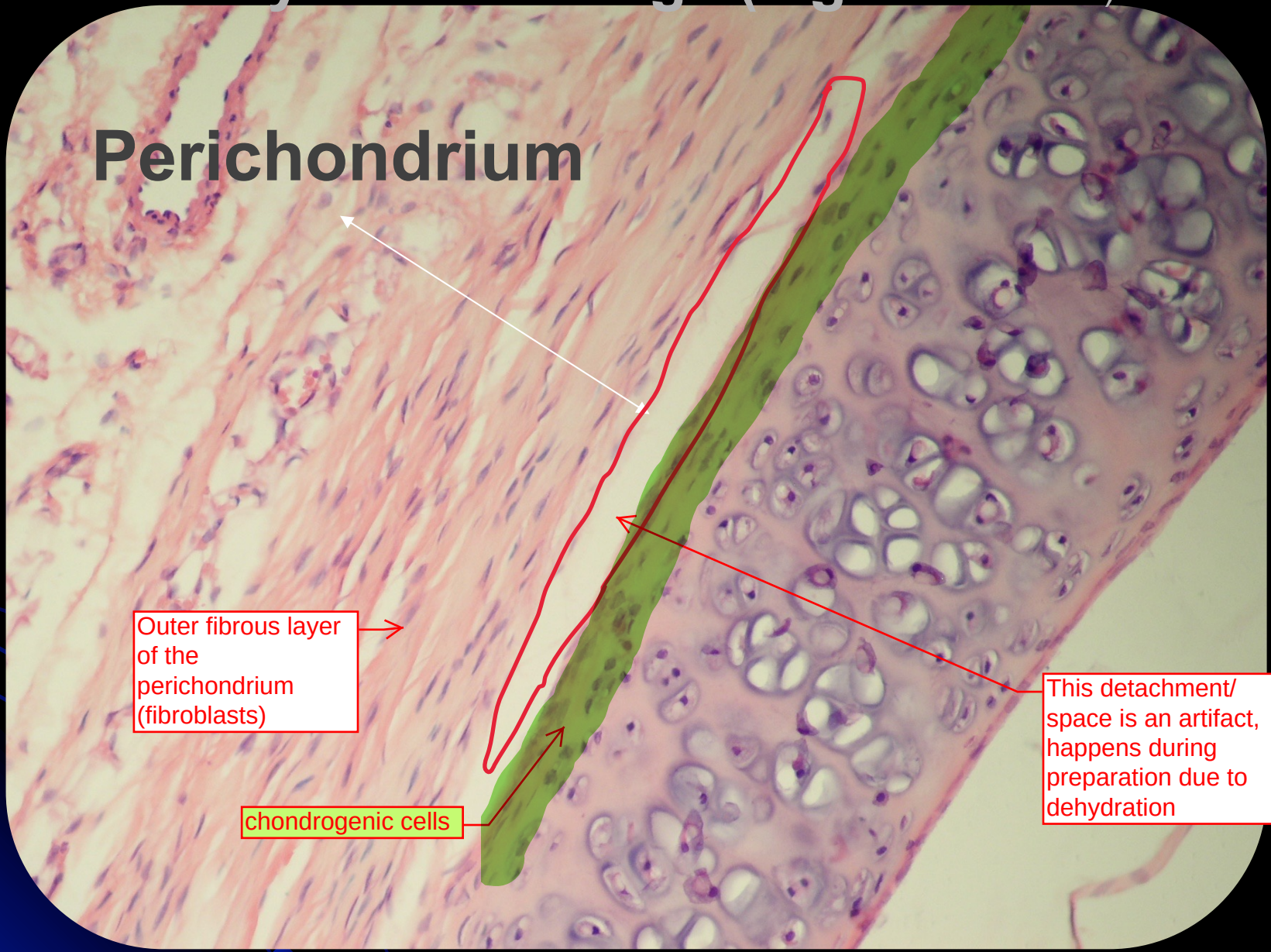


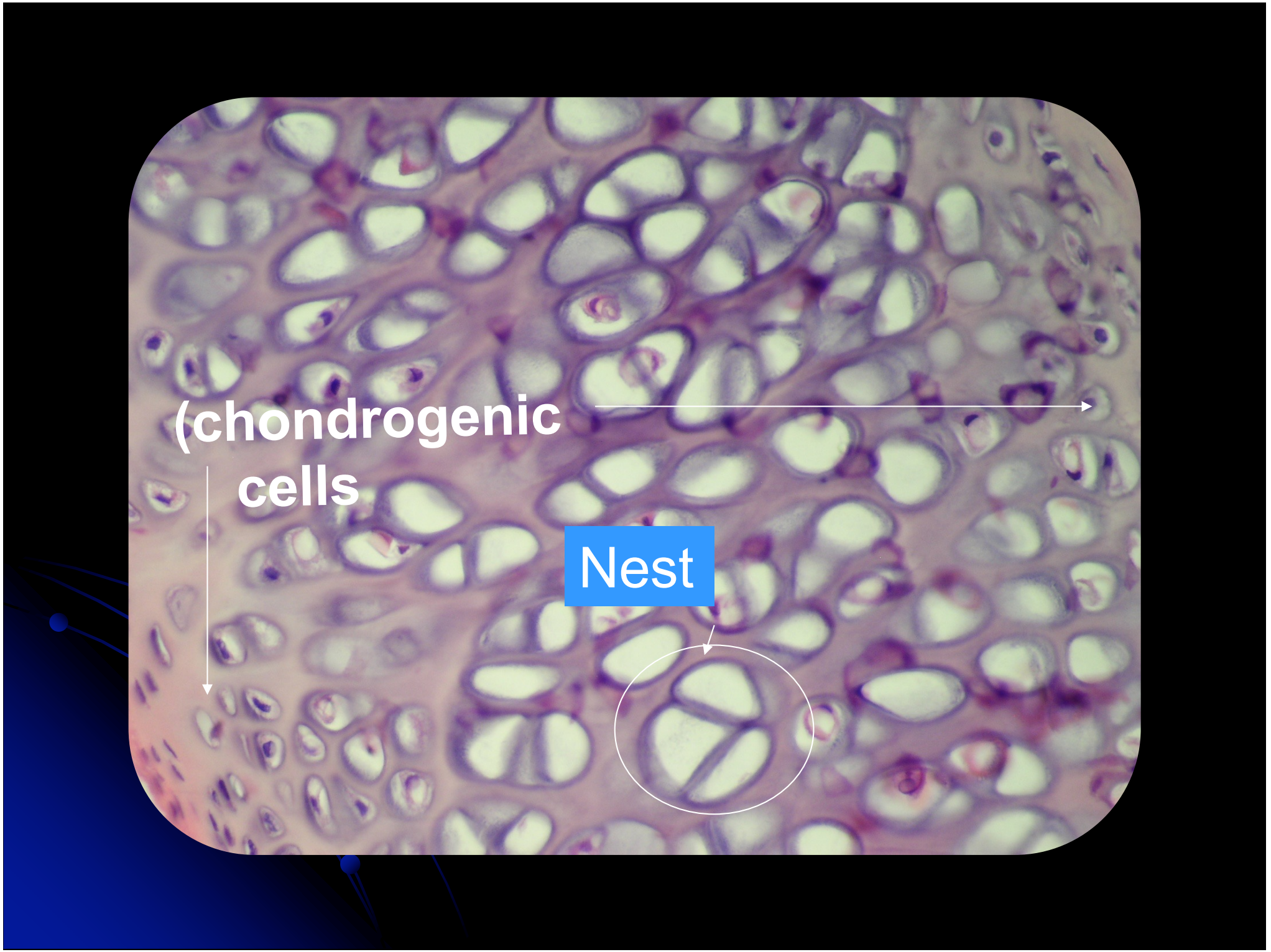

Chondrocyte in lacunae: Territorial+ interterritorial
Chondroblast
(chondrogenic)


Territorial zone
+ interterritorial
Could be present in even or odd numbers, it depends on how many cells in the lacunae during formation have undergone proliferation
Nest = Isogenous group

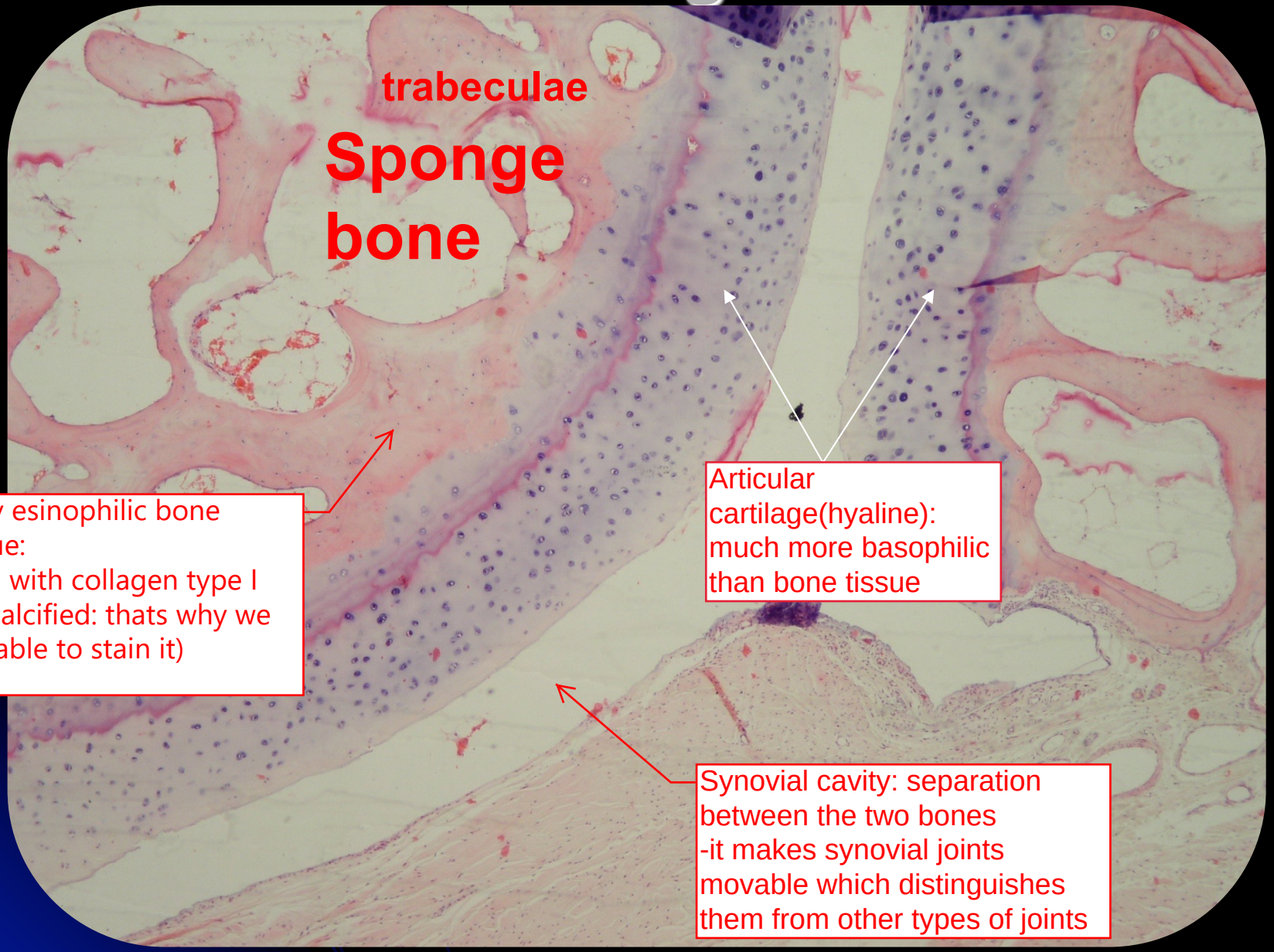
Hyaline Cartilage (e.g :Trachea)

Same cartilage tissue but the difference in color is due to the different processing:
-Different stain
-Stain was applied for a longer/shorter time
this gives us different results less or more intense



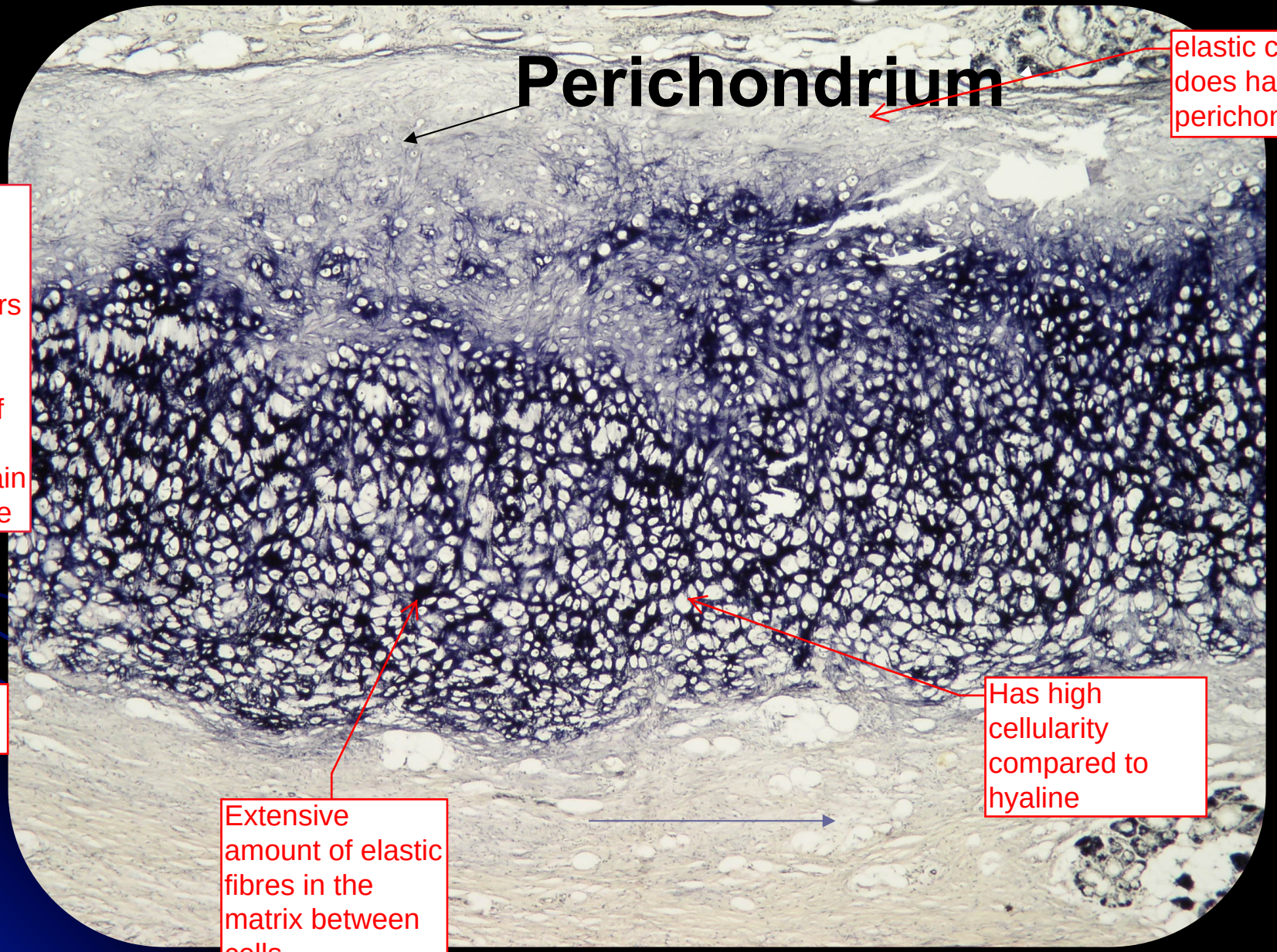

(chondrogenic
cells
Nest

Articular cartilage On surfaces of joi



On surfaces of joint

Elastic Cartilage:



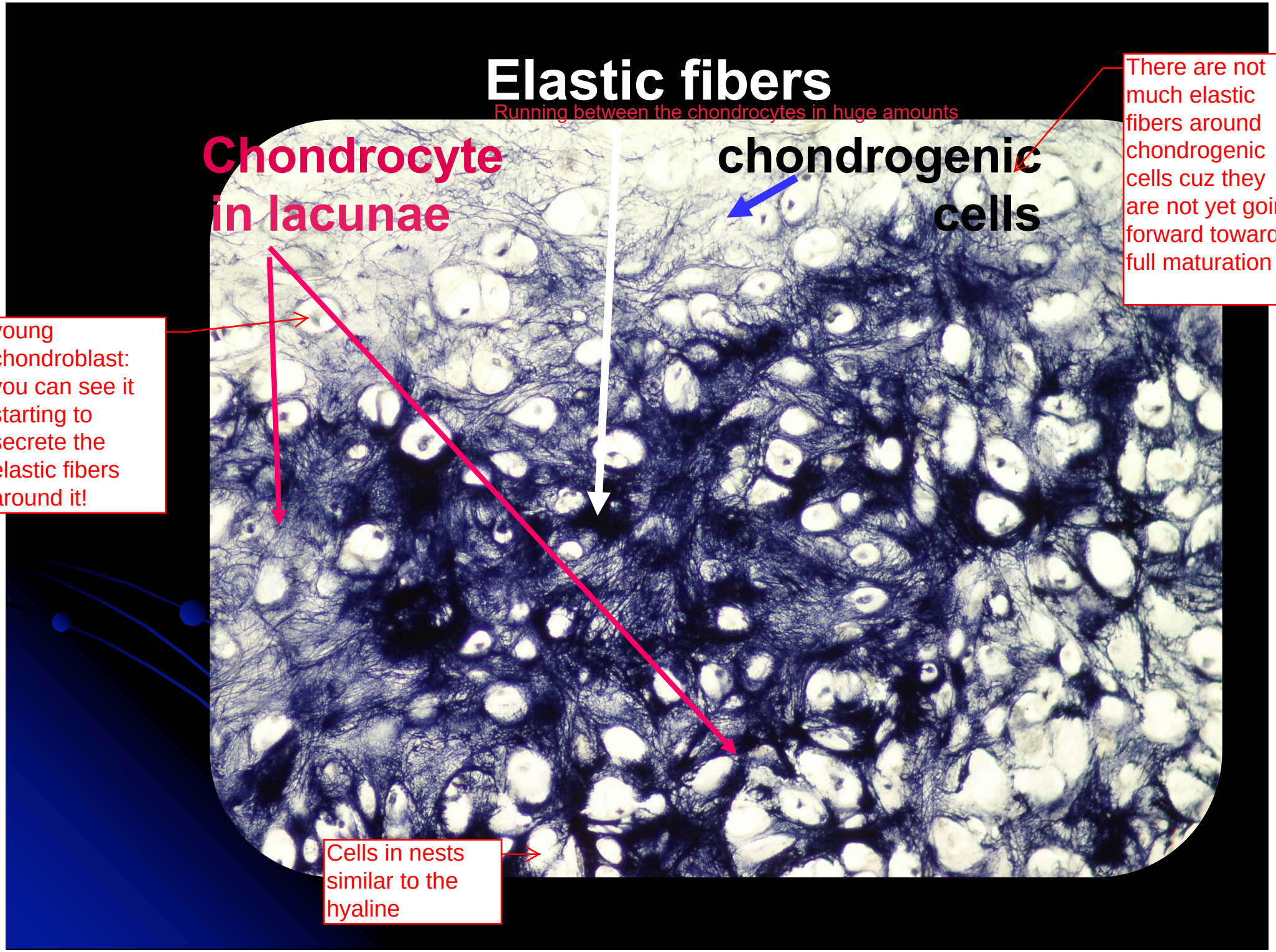
elastic cartilage does have perichondrium ✓

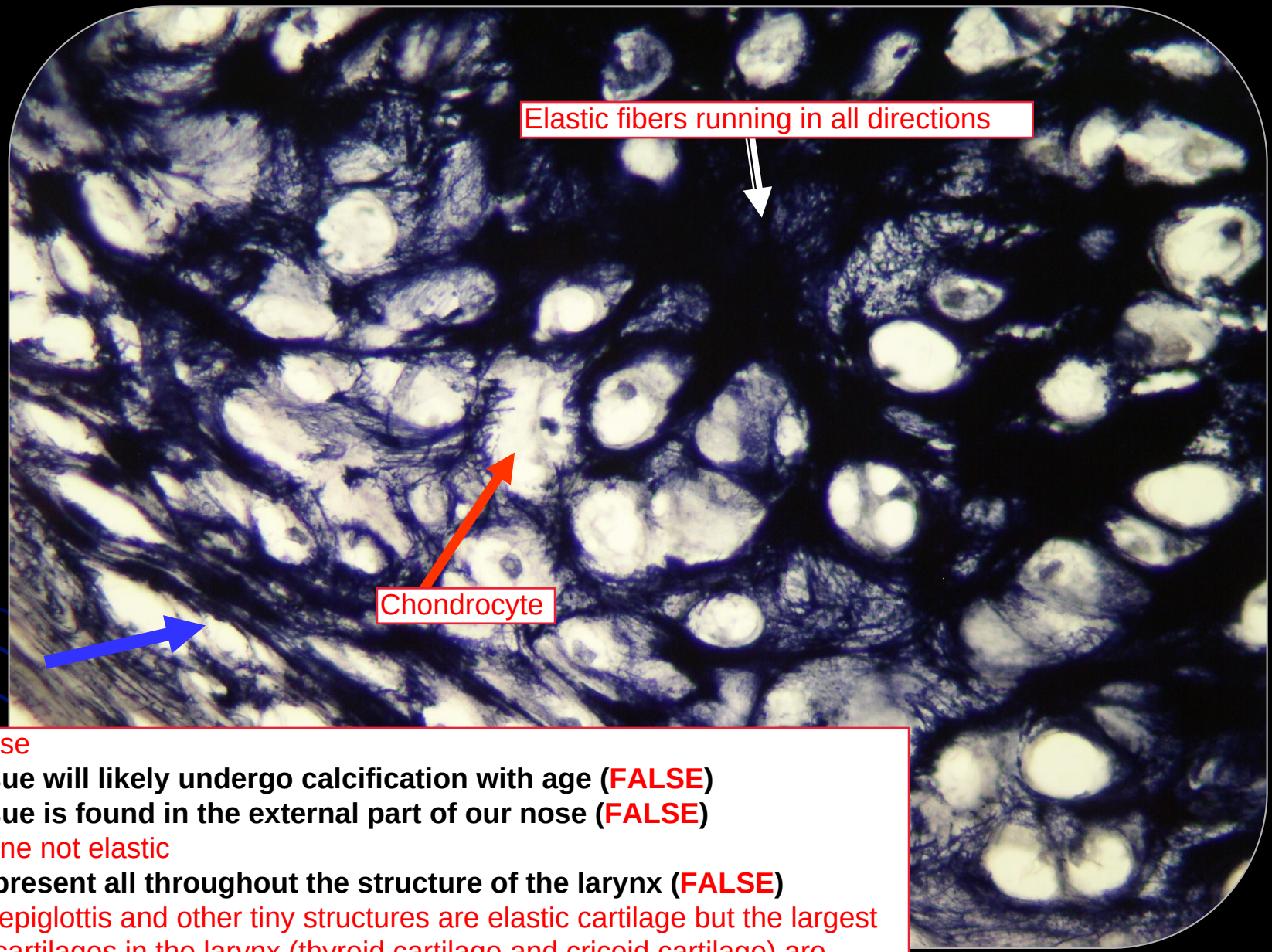
both **Verhoeff** van Geison stains (giving the elastic fibers a black color) and **orcein** (giving more of a purple color) are used to stain elastic cartilage

This one is probably orcein

Extensive amount of elastic fibres in the matrix between cells

Has high cellularity compared to hyaline


Elastic fibers
Running between the chondrocytes in huge amounts
Chondrocyte in lacunae
chondrogenic cells
There are not much elastic fibers around chondrogenic cells cuz they are not yet going forward toward full maturation
young chondroblast: you can see it starting to secrete the elastic fibers around it!
Cells in nests similar to the hyaline



True or false

1.this tissue will likely undergo calcification with age (FALSE)

2.this tissue is found in the external part of our nose (FALSE)

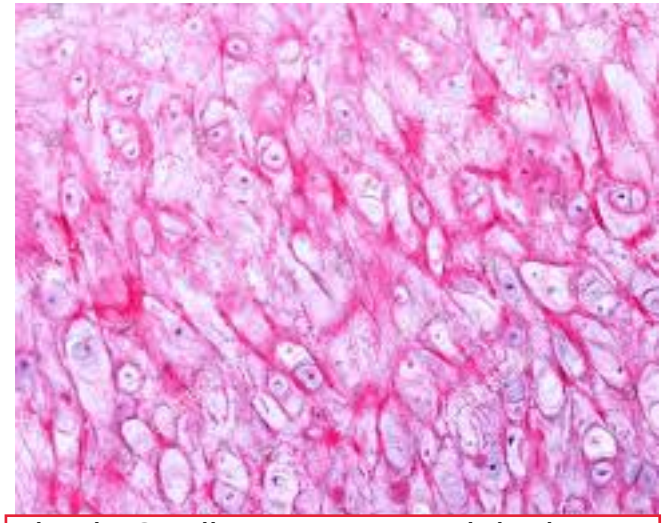
;hyaline not elastic

3.This is present all throughout the structure of the larynx (FALSE)

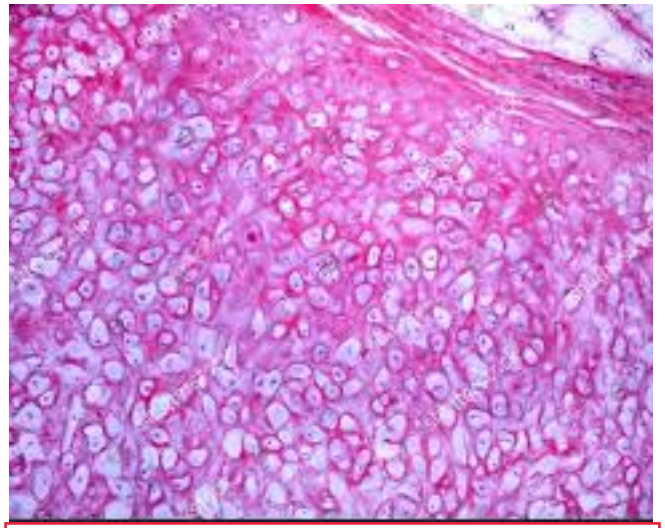
;The epiglottis and other tiny structures are elastic cartilage but the largest two cartilages in the larynx (thyroid cartilage and cricoid cartilage) are hyaline cartilage

4.We need the special stain to visualize this type of elastic cartilage (TRUE)

Dr. Ghada said that she did not provide pics of elastic cartilage with H&E stain but we are supposed to look them up ourselves and will probably be asked about them in the exam, so here are some pictures i found helpful:)



Elastic Cartilage Human Epiglottis

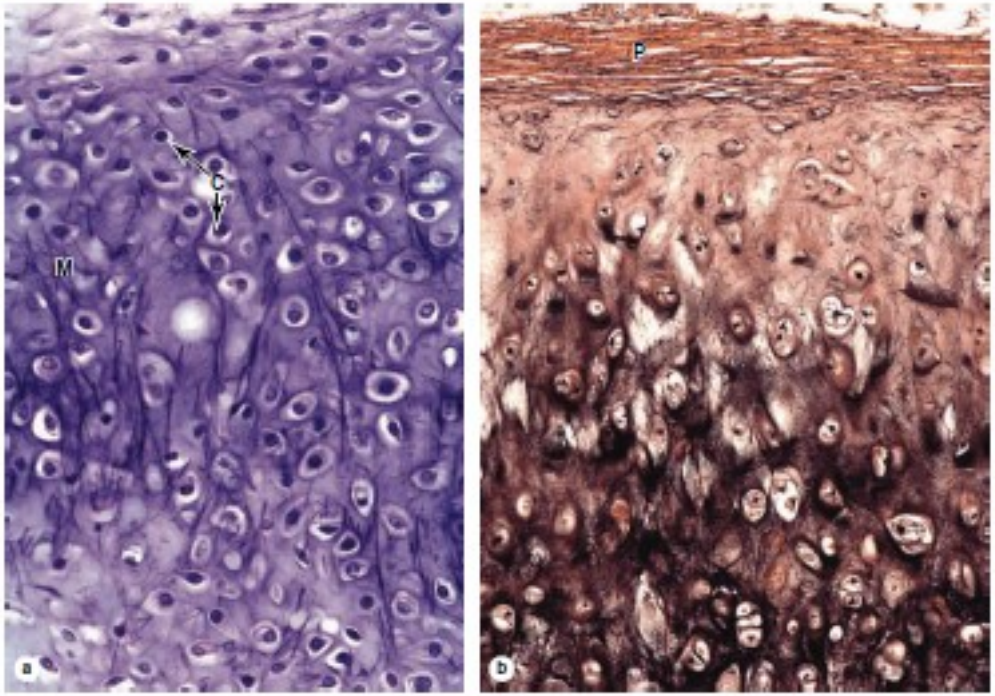


Elastic Cartilage Human Epiglottis

Elastic Cartilage Of Human Outer Ear

Elastic Cartilage Of Human Outer Ear

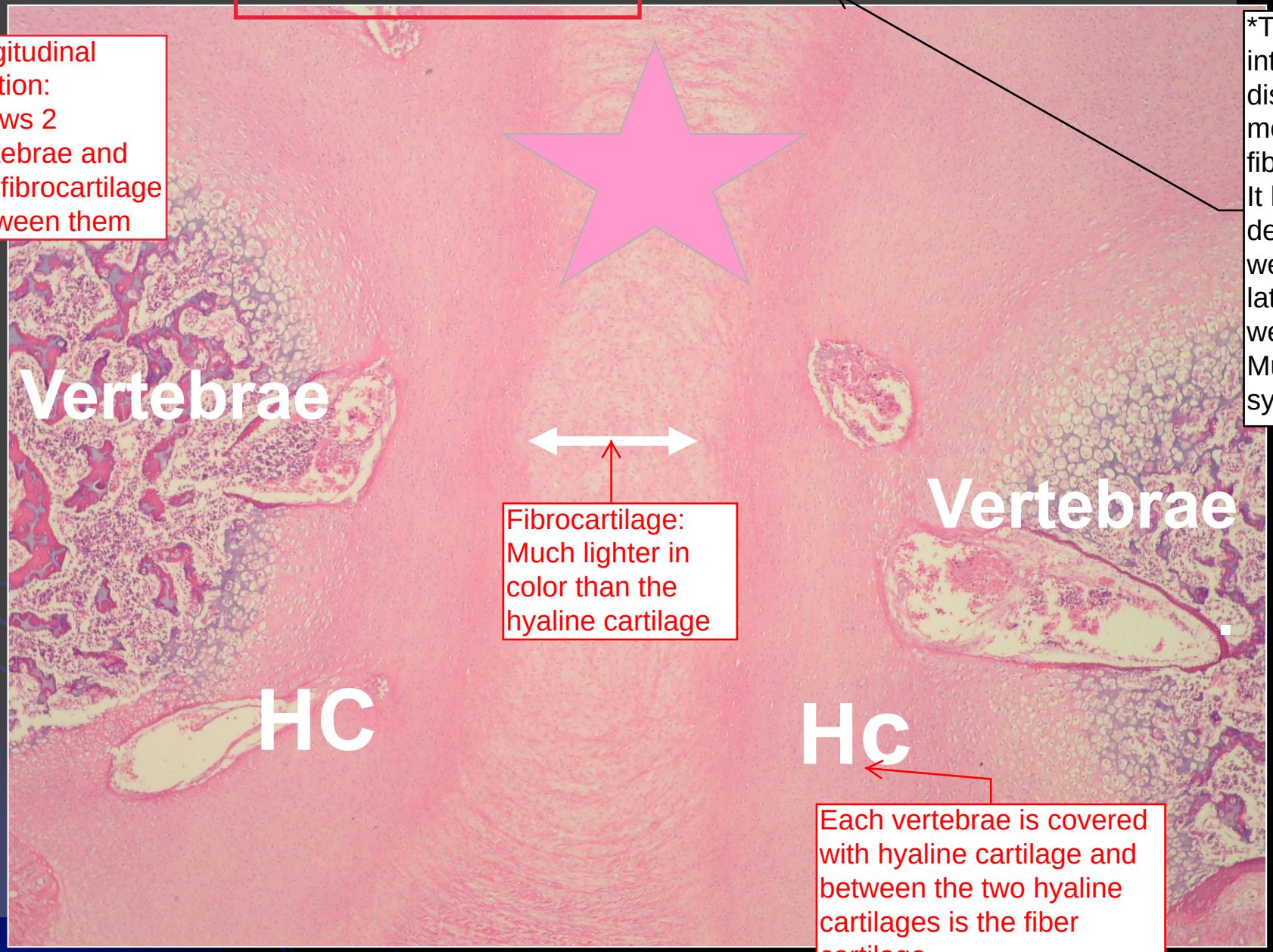
FIGURE 7–4 Elastic cartilage.



The chondrocytes (**C**) and overall organization of elastic cartilage are similar to those of hyaline cartilage, but the matrix (**M**) also contains elastic fibers that can be seen as darker components with proper staining. The abundant elastic fibers provide greater flexibility to this type of cartilage. The section in part **b** includes perichondrium (**P**) that is also similar to that of hyaline cartilage. **(a)** X160; Hematoxylin and orcein. **(b)** X180; Weigert resorcin and van Gieson.

pics from our book:

Fibrocartilage:intervertibral disc



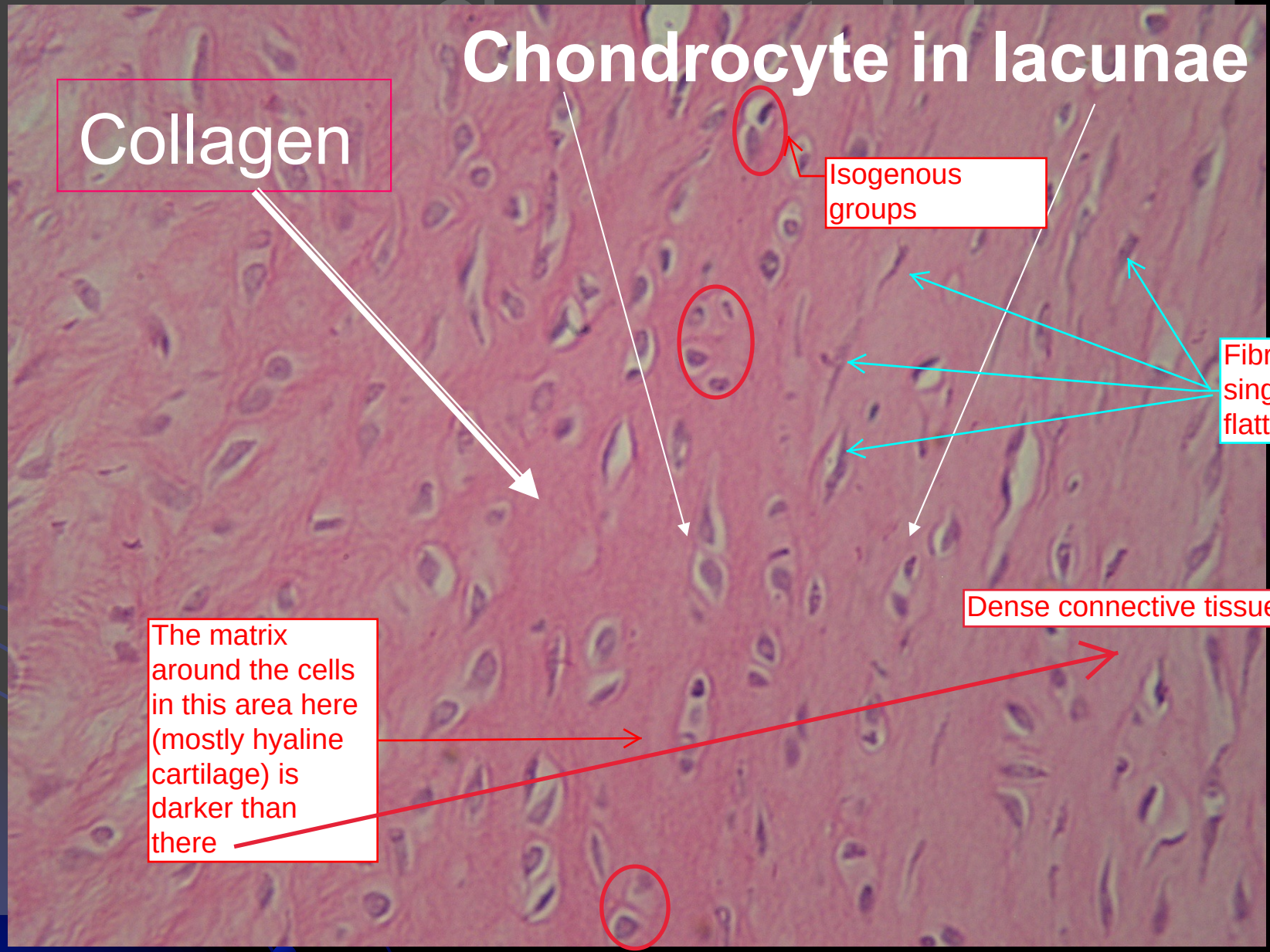
longitudinal section: shows 2 vertebrae and the fibrocartilage between them

The intervertebral disc consists of more than just fibrocartilage It has more details to it that we'll get into later on when we study the Musculoskeletal system

Fibrocartilage: Much lighter in color than the hyaline cartilage

Each vertebrae is covered with hyaline cartilage and between the two hyaline cartilages is the fiber cartilage

Higher magnification



True or false questions:

1.You can find collagen I, collagen II, and the elastic fibres in this tissue (FALSE)

;only collagen I and collagen II

2.This type of cartilage is found in the knee (TRUE)

;and its called meniscus

3.We see articular and hyaline cartilage in the knee (TRUE)

4.This type of cartilage is usually found side by side with hyaline (TRUE)

;the bones where u find FC are covered with hyaline and between the hyaline at the ends of the bones is the aforementioned fibrocartilage