

Classification of Connective Tissue

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► Connective tissue proper:

- Loose (areolar)
- Dense regular
 - Dense irregular
 - Dense regular

► Special connective tissue: → Has special component

- Reticular
- Elastic → In stroma of lungs (must be elastic)
- Adipose → When we have a lot of fat cells
- Bone → Cells and ECM, ECM has calcium so it's hard
- Cartilage → ECM hardened
- Blood → Cells and ECM, ECM water (liquid)

► Embryonic connective tissue → It's special because it's found in embryo only

← Mesenchymal (mucoïd) connective tissue

It is derivative from mesoderm, but it is the origin of all connective tissue in our body

Note: the doctor used (mucoïd) to describe that it's watery (viscous)

الهدف من الحكي يلي جنب كل نوع هو إنه نفهم الآتي: inside every special type of connective tissue a special components that gives it its properties and functions

Loose Connective Tissue

- ▶ Also called areolar connective tissue
- ▶ Typically contains cells, fibers and ground substance in equal amounts
- ▶ Supports epithelium (lamina propria) Layer just below the epithelium
- ▶ Surrounds small blood vessels
- ▶ Fills spaces between muscle and nerve cells
- ▶ Mesentery
- ▶ It is flexible but not very resistant to stress

It does not have a lot of fibers

It's a mucus membrane
together we called them **mucosa**

مهم تعرف
هاد المصطلح

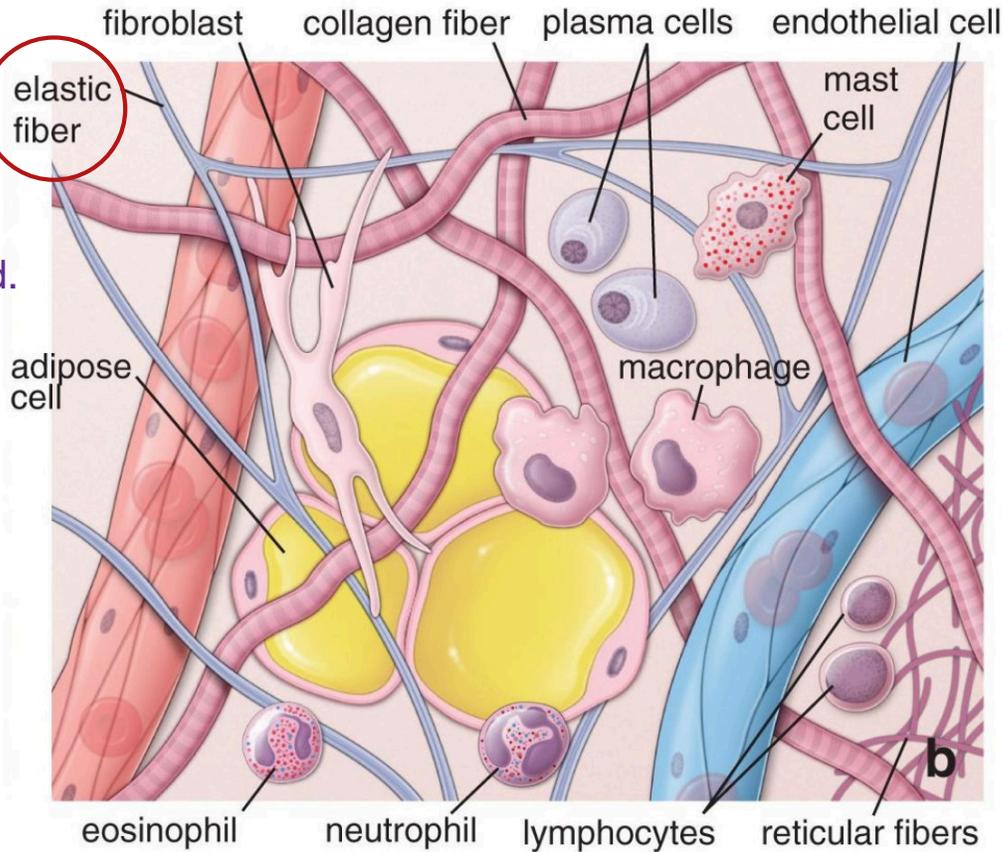
*شغلات لازم تدخل مُخنا وما تطلع منه:

*أي epithelium مسؤول عن ال absorption or secretion لازم يكون columnar وبيكون more active

*بينما لو كان مسؤول عن التجدد والانقسام وغيره does a lot of mitosis لازم يكون

cuboidal *غصب عنك *

There are many type of cells

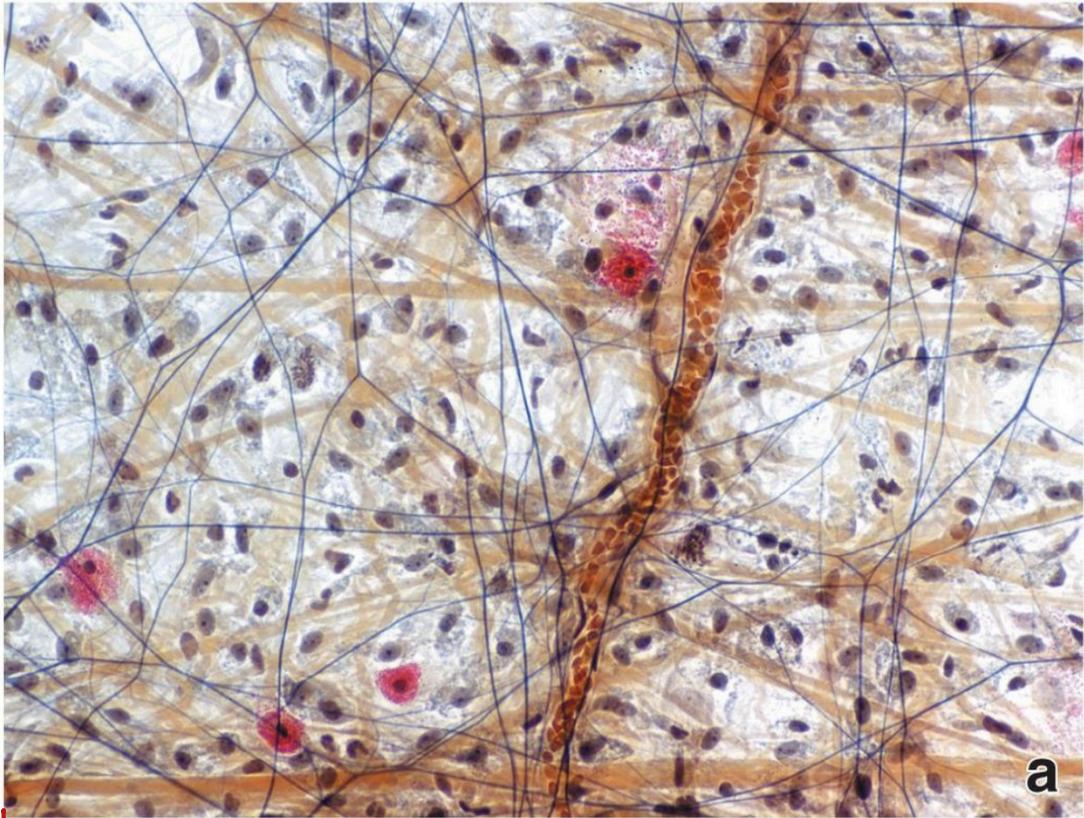


elastic fiber

It has branching to be recognized.
*It is thinner than collagen

حسي
Function
تissue

Usually collagen appears pink
but here we have a special
stain.



↳ Loose connective tissue.

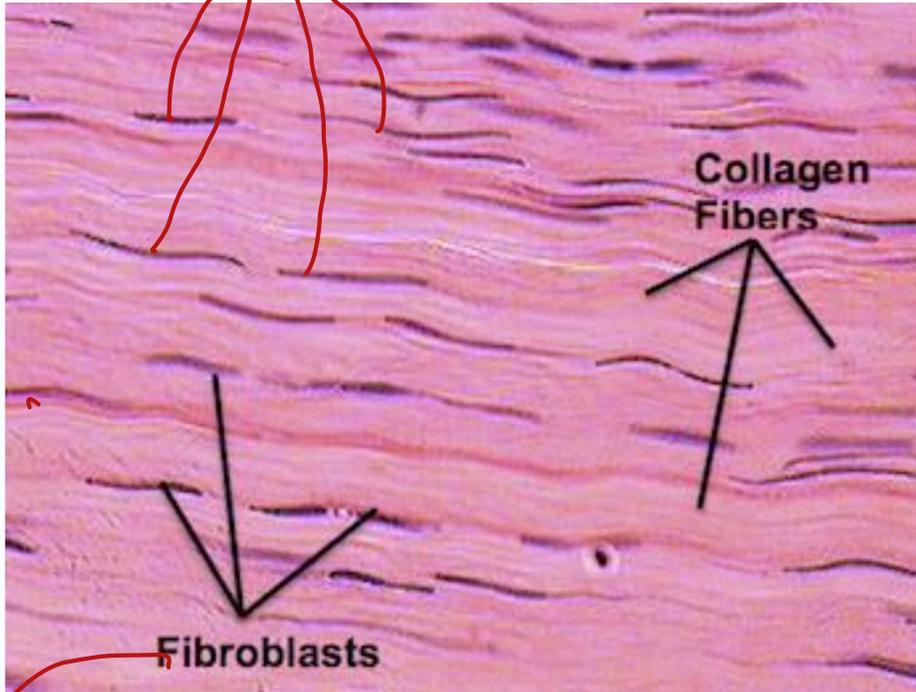
Dense Regular Connective Tissue

↳ In one direction

- ▶ Parallel bundles of collagen fibers with few fibrocytes aligned with collagen and separated by very little ground substance
- ▶ Provides resistance to prolonged or repeated stresses exerted in the same direction
- ▶ Ligaments and tendons

It's a fibrocyte because it looks inactive

It can be active again and produce collagen



Usually it is a large and sbundle shape

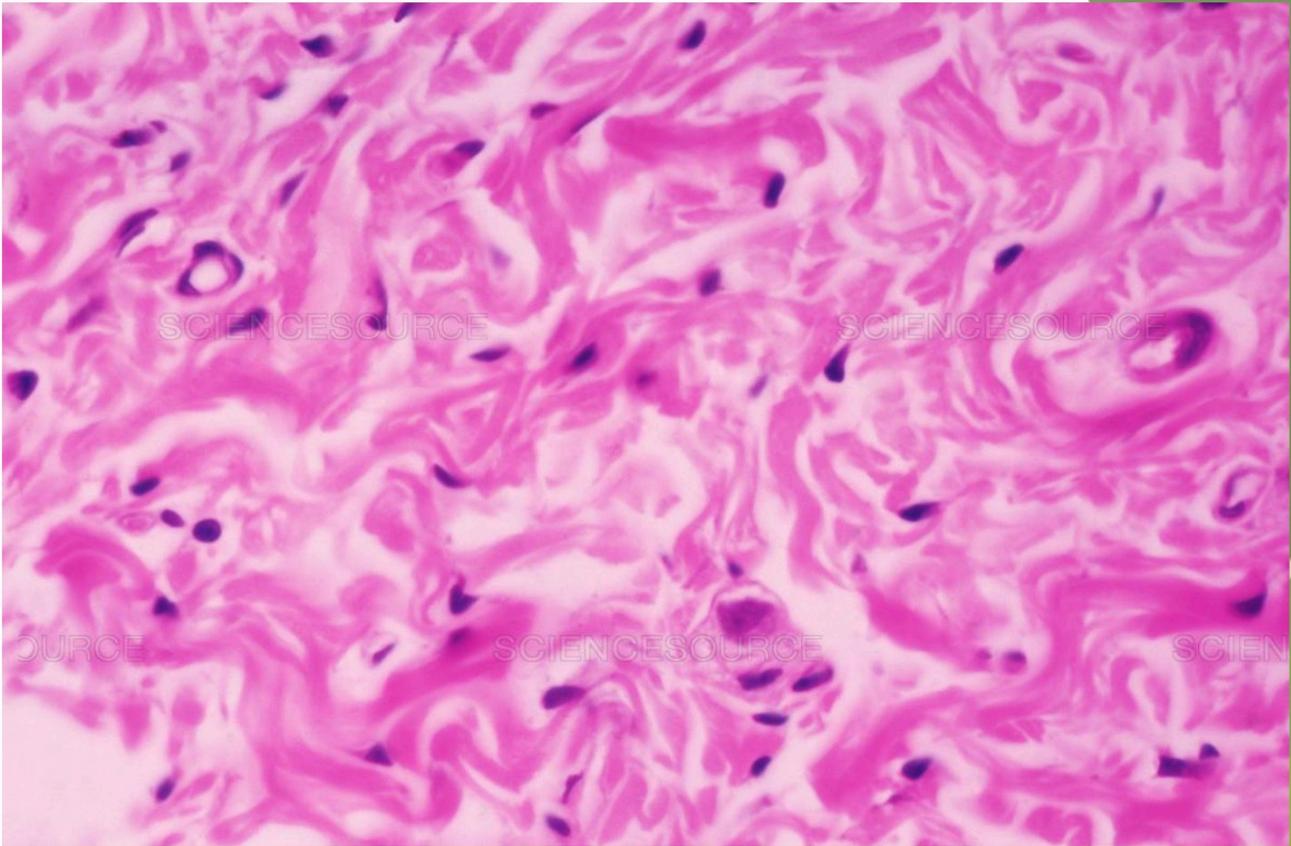
لهيكه بنحوي في نهم fibrocyte

Dense **Irregular** Connective Tissue

↳ In multiple direction

- ▶ Bundles of collagen fibers are randomly interwoven with no definite orientation
- ▶ Provides resistance to stress from all directions
- ▶ Dermis of skin, organ capsules, submucosa

↳ May be joint capsule or organ capsule

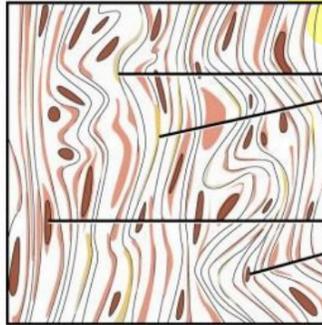


The fibroblasts distributed between bundle of collagen

-Parallel bundles of collagen

-Fibroblasts you can find them in rows

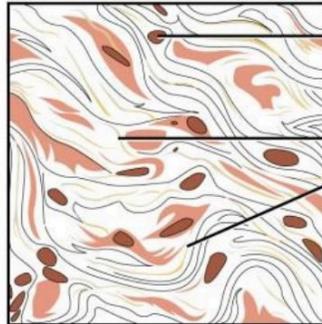
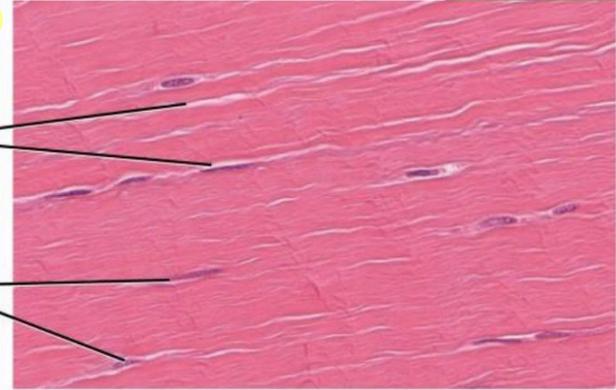
-Highly packdesly



Collagen fibers

Fibroblast nuclei

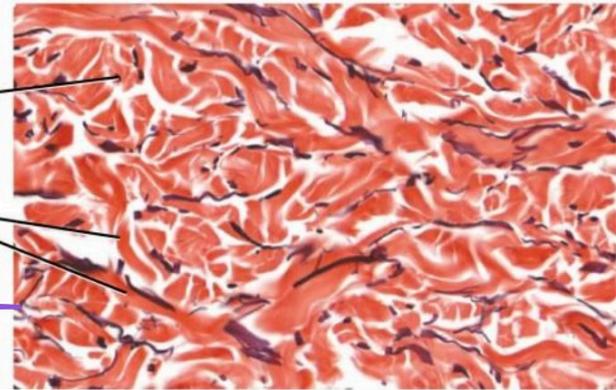
(a) Regular dense



Fibroblast nuclei

Collagen fiber bundles

(b) Irregular dense



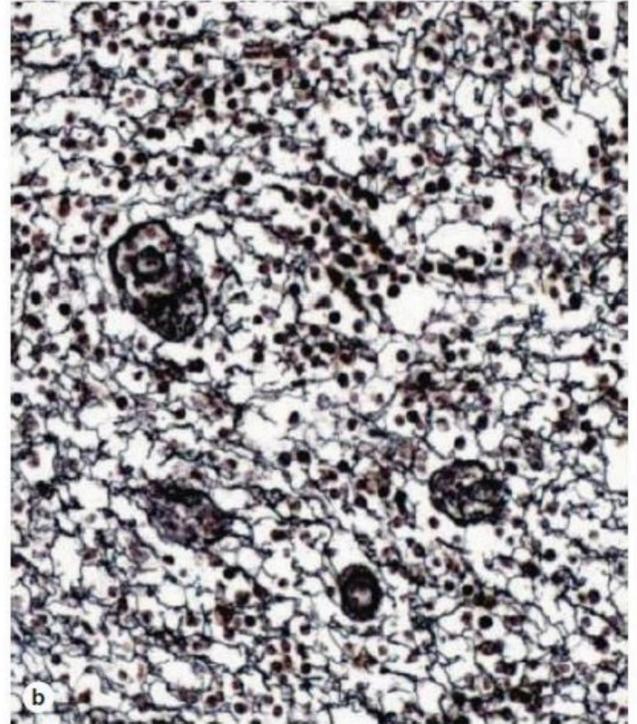
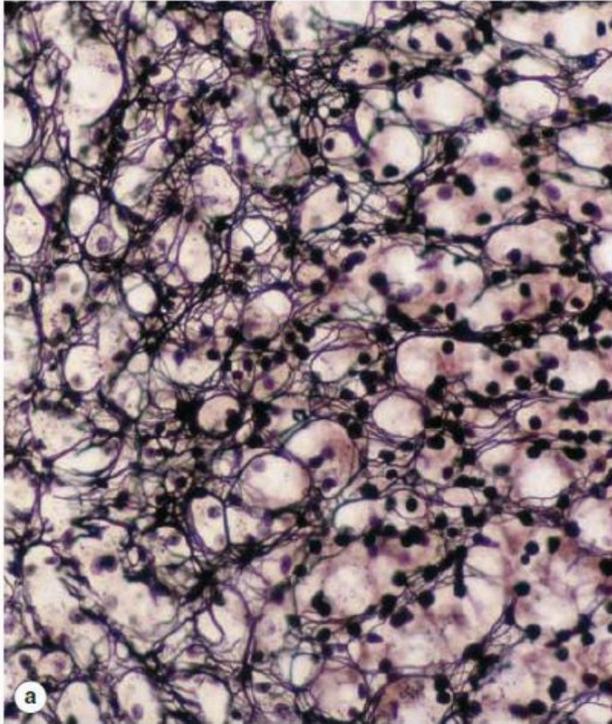
. -bundles going to every directions
-cells are not distributed in rows
-distributed among the collagen bundles

Reticular Connective Tissue

↳ collagen III

- ▶ Consists of reticular cells (modified fibroblasts) and the network of reticular fibers formed by them
- ▶ Forms the structural framework in which the cells of the organ are suspended
- ▶ In the liver, bone marrow, lymph nodes and the spleen

✘ We can find this tissue in the framework of organs



Mesenchymal Connective Tissue

- ▶ Mesenchyme forms the undifferentiated "filling" of the early embryo.
- ▶ It consists of mesenchymal cells, which interconnect by slender cell processes.
- ▶ Mesenchymal cells have stem cell properties, i.e. they are able give rise to other cell and tissues types.
- ▶ The wide extracellular space between the mesenchymal cells is occupied by ground substance

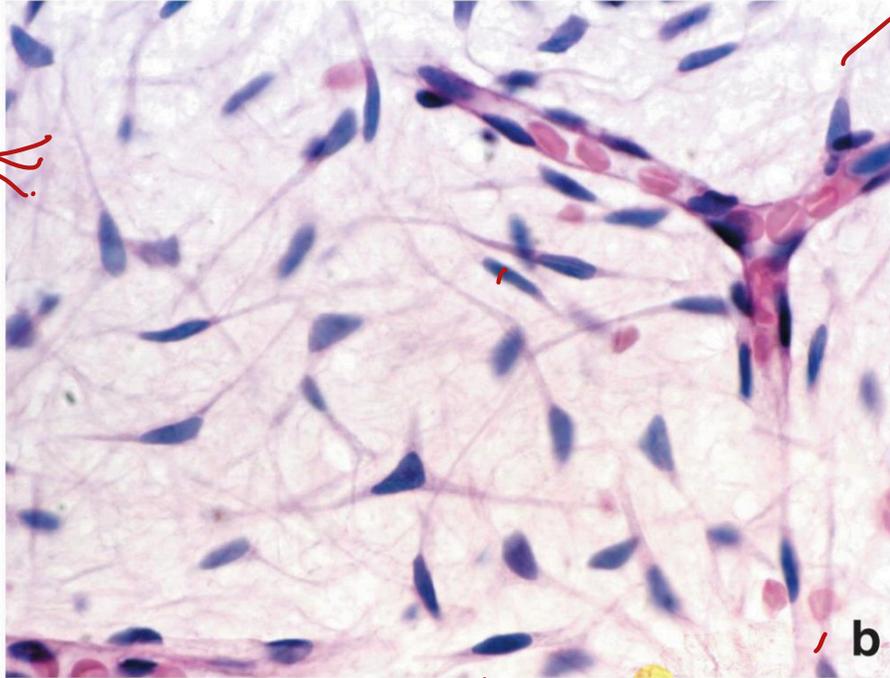
- It has a lot of cells
- these cells are highly active but they are undifferentiated
- Its cells are a triangular nuclei
- cytoplasmic extension processes
- highly acidophilic cytoplasm

Line
fibrous



الخلفية
الليفية

background



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→ a lot
of blood
vessels

Don't have collagen bundles, just we have some collagen fibers in the background

↳ It is a loose connective tissue

Adipose Tissue

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Adipose tissue & adipocytes

→ A special type of connective tissue

- ▶ Connective tissue in which fat-storing cells or **adipocytes** predominate is called **adipose tissue**
 - ▶ Adipocytes are **metabolically** active cells that specialize in storing triglycerides *↳ that means that it's active in metabolism or storage...*
 - ▶ There are two major types of adipose tissue with different locations, structures, colors, and functions.
 - ▶ **White adipose tissue**
 - ▶ **Brown adipose tissue**
- A special type, only found in new babies distributed in specific areas around some organs.

White Adipose Tissue

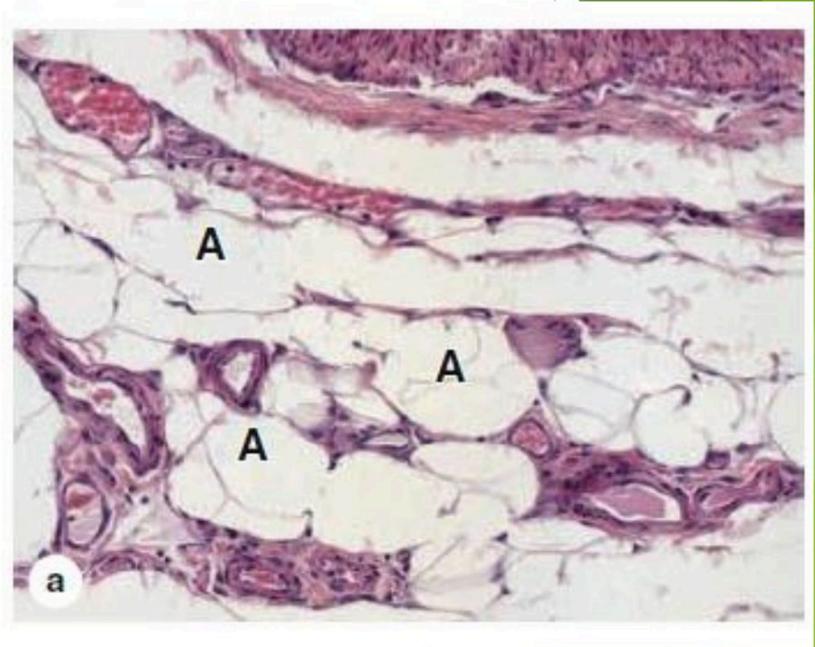
- ▶ The more common type
- ▶ Specialized for fat storage
- ▶ Consists of cells each containing one large cytoplasmic droplet of whitish-yellow fat (white adipocytes)
- ▶ Subdivided into incomplete lobules by partitions of connective tissue containing a vascular bed and nerve network
- ▶ Reticular fibers form a fine network that supports individual fat cells and binds them together

White adipocyte

- ▶ A white adipocyte is very large
- ▶ It contains a single huge droplet of lipid filling almost the entire cell
- ▶ White adipocytes are also called **unilocular**
- ▶ They often appear empty in standard light microscopy
- ▶ They are said to have a signet-ring appearance

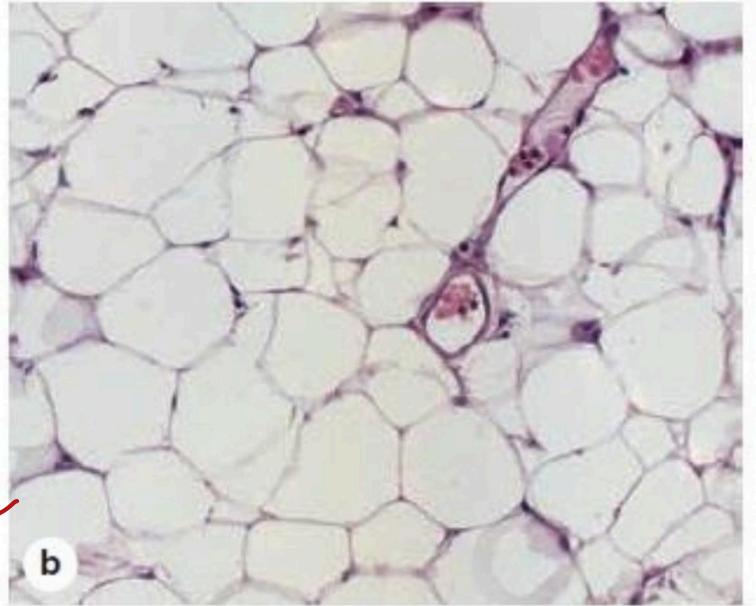
- ▶ Large white adipocytes (A) are seen in the connective tissue associated with small blood vessels.
- ▶ The fat cells are empty because lipid was dissolved away in slide preparation.
- ▶ Nuclei at the cell membranes are visible in some of the fat cells

✳ Nuclei pushed to the side



- ▶ Large (empty) adipocytes predominate in this typical white adipose tissue, which shows only a small portion of microvasculature.

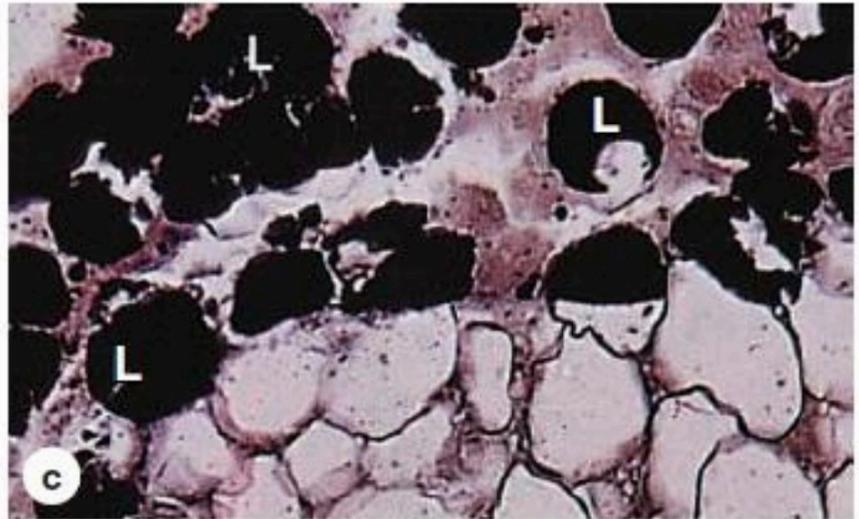
It's filled with fats, so it is an adipose connective tissue



- ▶ Tissue was fixed here with **osmium tetroxide**, which preserves lipid (L) and stains it black.

An example.

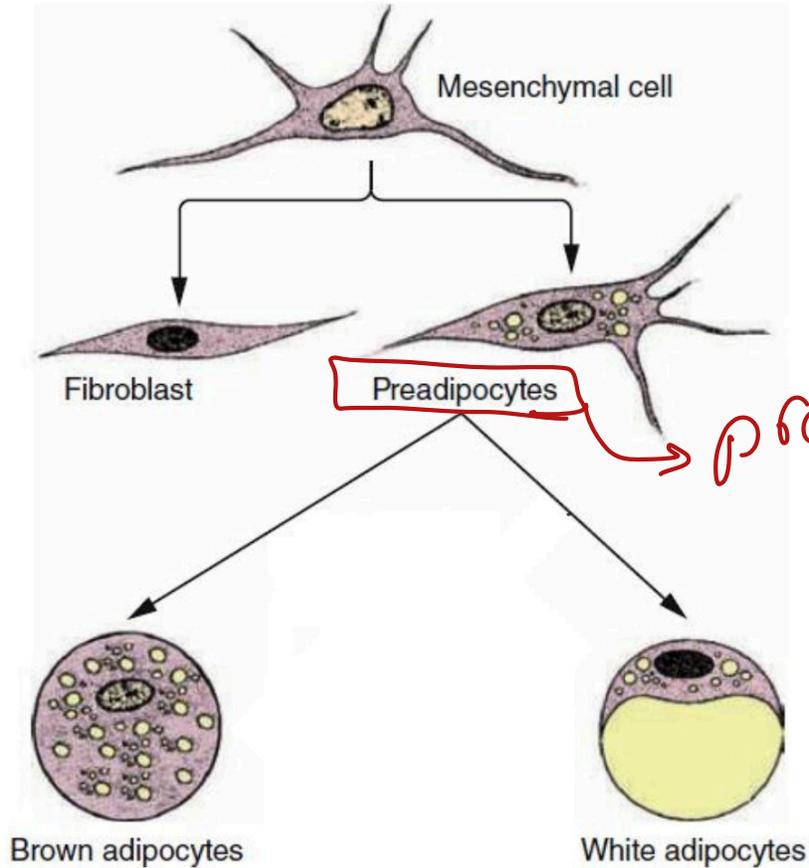
It is a heavy metal, used as a fixative and staining material



Histogenesis of White Adipose Tissue

↳ means creation (development)

- ▶ Adipocytes develop from mesenchymal stem cells
- ▶ Adipose development first produces **preadipocytes**, which look rather like larger fibroblasts with cytoplasmic lipid droplets
- ▶ Initially the droplets of white adipocytes are isolated from one another but soon fuse to form the single large droplet



progenitor

Development of White Adipose Tissue

- ▶ Humans are born with stores of white adipose tissue which begin to accumulate by the 14th week of gestation.
- ▶ **Proliferation** of progenitor cells stops by late gestation
- ▶ After that, adipose tissue increases mainly by the filling of existing adipocytes until around age 10.
- ▶ This is followed by a period of new fat cell differentiation which lasts through adolescence.
- ▶ New adipocyte formation occurs around small blood vessels, where undifferentiated mesenchymal cells are most abundant.

▶ means mitosis or increasing in number

Adult Vs Childhood Obesity

- ▶ Excessive adipose tissue accumulation, or obesity, occurs when nutritional intake exceeds energy expenditure.
- ▶ Adult-onset obesity mainly involves increasing the size of existing adipocytes (**hypertrophy**).
- ▶ Childhood obesity often involves increases in both adipocyte size and numbers due to the differentiation of more preadipocytes from mesenchymal cells (**hyperplasia**).
- ▶ Weight loss after dietary changes is due to reductions in adipocyte volume, but not their overall number.

Brown Adipose Tissue

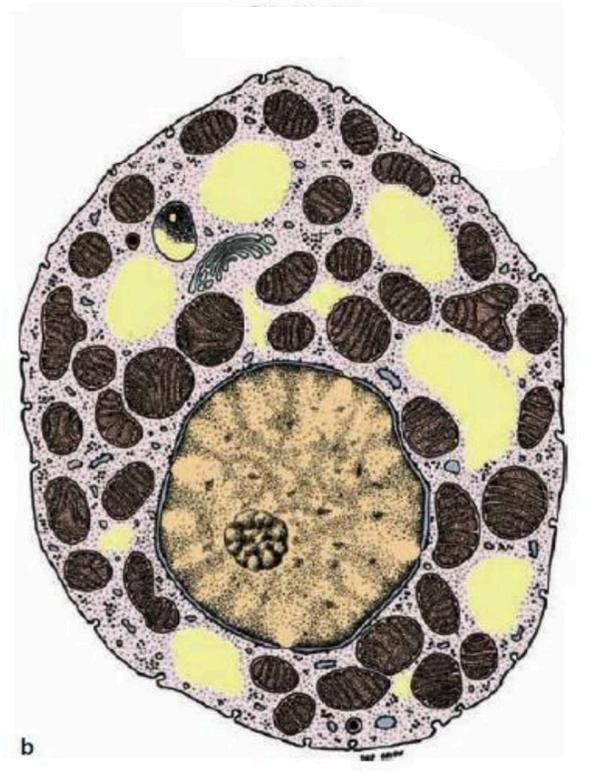
- ▶ Brown adipose tissue constitutes 2%-5% of the newborn body weight
- ▶ It is located mainly in the back, neck, and shoulders
- ▶ It is greatly reduced during childhood and adolescence.
- ▶ Cells have multiple lipid droplets interspersed among abundant mitochondria
- ▶ Its color is due to the very abundant mitochondria and the large number of blood capillaries in this tissue.
- ▶ Brown adipocytes release heat and function to warm the blood.

Brown Adipocytes

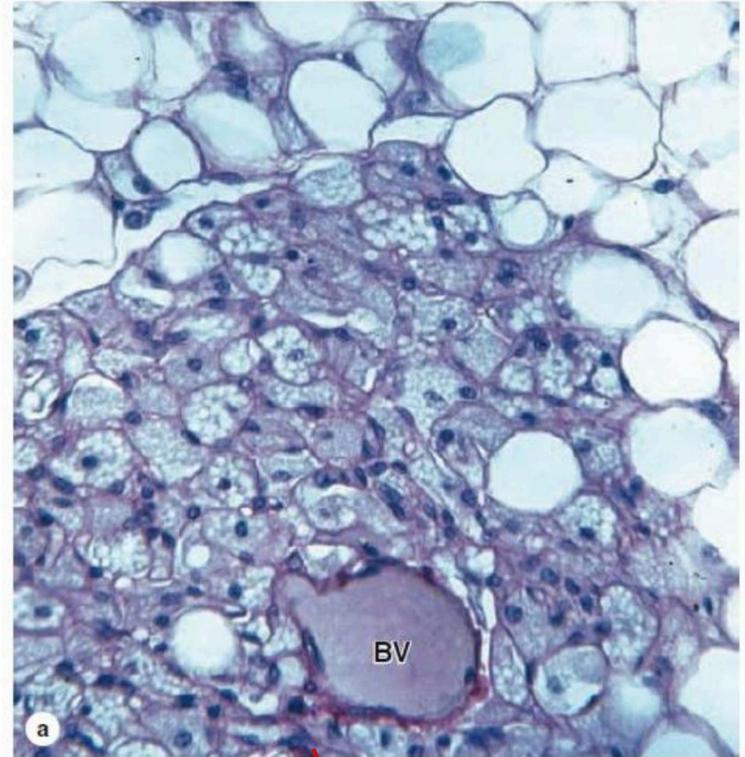
- ▶ Brown adipocytes contain many small lipid inclusions
- ▶ They are called **multilocular**
- ▶ The small lipid droplets, abundant mitochondria, and rich vasculature all help mediate this tissue's principal function of **heat production** and warming the blood.
- ▶ Cells of brown fat are polygonal and generally smaller than white adipocytes
- ▶ The nucleus is centrally located
- ▶ Brown adipocytes are often closely packed around large capillaries
- ▶ The tissue is subdivided by connective tissue partitions into lobules

why? multiple droplets of fat between them a cytoplasm filled with mitochondria

- ▶ A diagram of a single multilocular adipocyte showing the central nucleus, numerous small lipid droplets (yellow), and many mitochondria.



- ▶ Brown adipose tissue is shown here around a small blood vessel (BV) and adjacent white adipose tissue at the top of the photo.
- ▶ Brown adipocytes are slightly smaller and characteristically contain many small lipid droplets and central spherical nuclei.
- ▶ If the lipid has been dissolved from the cells, as shown here, the many mitochondria among the lipid spaces are retained and can be easily seen



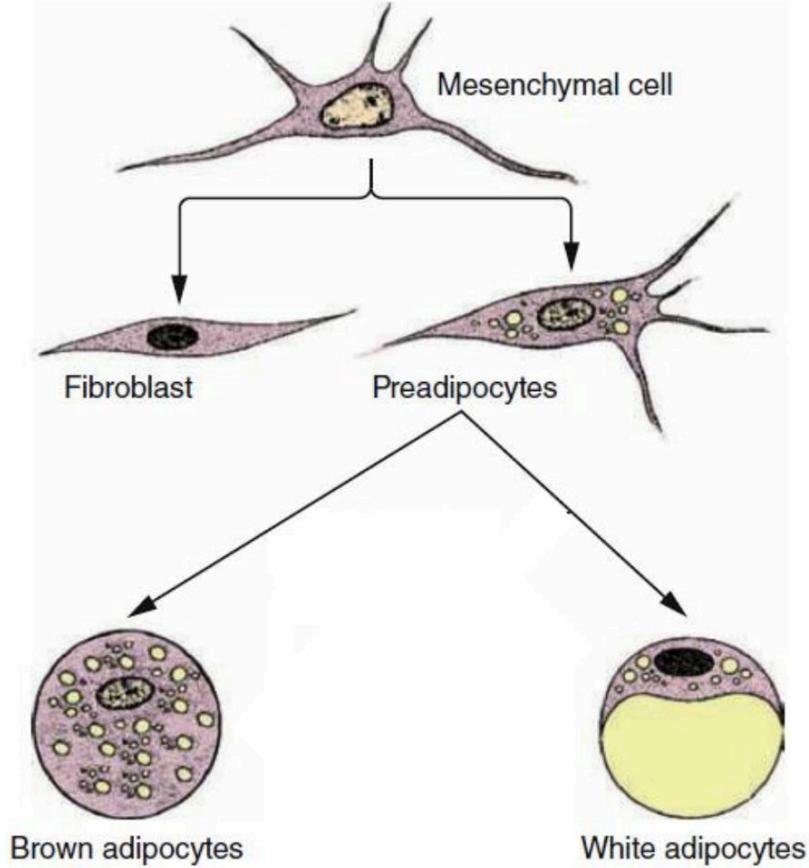
L M J

Histogenesis of Brown Adipose Tissue

- ▶ Adipocytes develop from mesenchymal stem cells
- ▶ Adipose development first produces **preadipocytes**
- ▶ In humans the amount of brown fat is maximal relative to body weight at birth, and partially disappears by involution and apoptosis during childhood

لا تحسب المجد تمرًا أنت أكله

لن تبلغ المجد حتى تلحق الصبرا



Good luck 💜

لن ينتهي البؤس أبدًا 😊

