Соединительные ткани - Connective tissues

(consist of cells and intercellular substance)

Собственно соединительные ткани
Actually connective tissues

Волокнистая
Collagenic

- Плотная - **Dense collagen**
  - оформленная - **regular type**
  - неоформленная - **irregular type**
- Рыхлая неоформленная
  Loose collagen

Со специальными свойствами
With special properties

- Ретикулярная - **reticular**
- Жировая - **adipose**
- Слизистая - **mucous**

Скелетные ткани
Skeletal tissues

Хрящевая
Cartilage

- Гиалиновый - **hyaline**
- Эластический - **elastic**
- Волокнистый - **fibrous**

Костная
Bone

- Ретикулофиброзная
  reticulofibrosus
- Пластинчатая
  lamellaris

Функции соединительных тканей

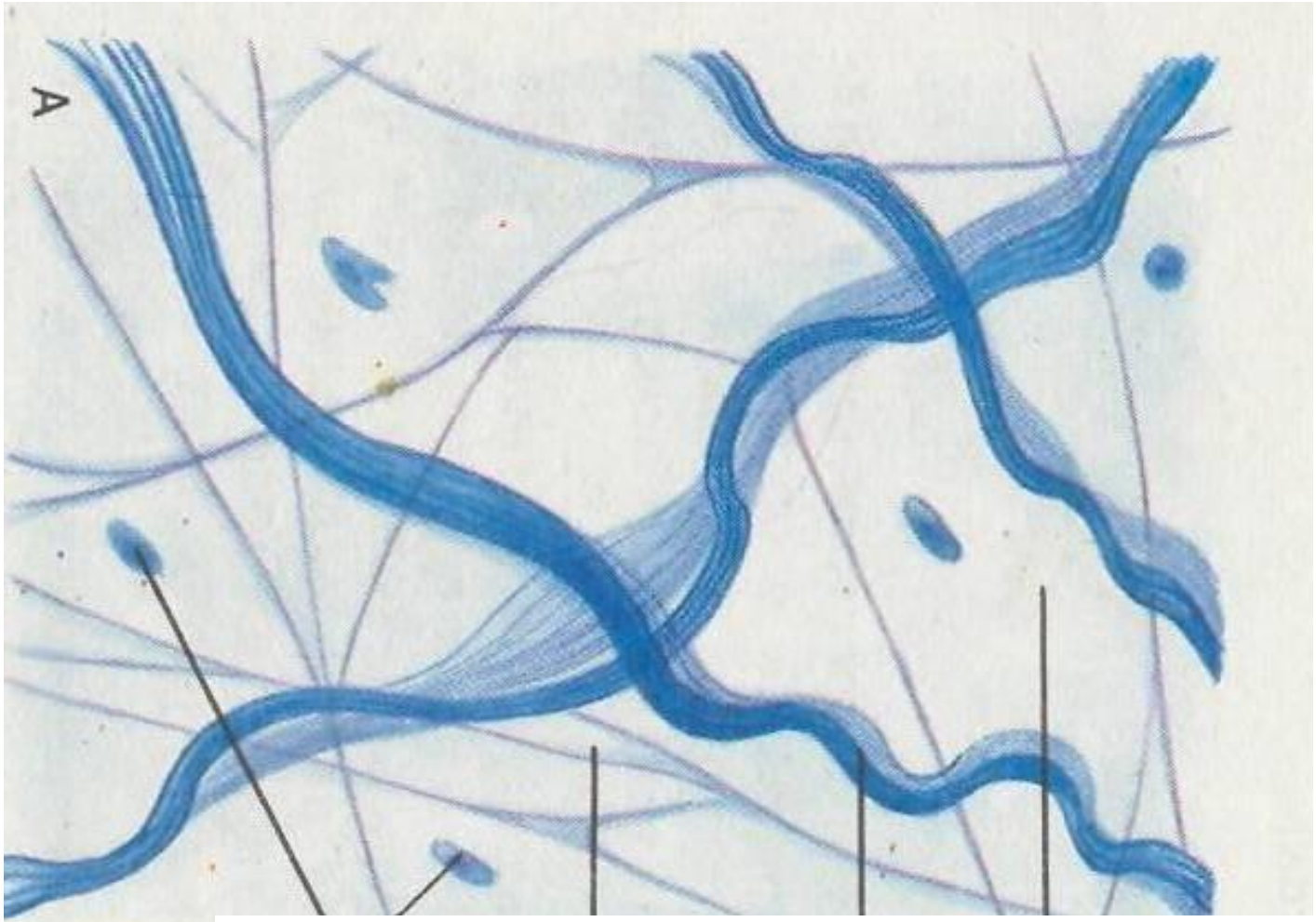
1. **Опорная** (капсулы органов, сухожилии, фасции, скелет)
2. **Трофическая** (обмен веществ между кровью и клетками)
3. **Защитная** (механич. защита, прочность органов, фагоцитоз макрофагами, участие в воспалении и иммунном ответе)
4. **Кроветворная** (микроокруже-ние для клеток гемопоэза)
5. **Пластическая** (адаптирует к изменяющимся условиям за счёт изменения обмена веществ)

Functions of connective tissues

1. **Basic** - make capsules of organs, tendons, fascia, skeleton.
2. **Trophic** - metabolism between blood and cells.
3. **Protective** - mechanical protection, durability of organs, phagosytosis by macrophages, participates in an inflammation and immunity.
4. **Hemopoietic** - a microenvironment for hemopoiesis cells.
5. **Plastic** - adapts organs at change of conditions due to change of a metabolism, participates in regeneration.

Рыхлая волокнистая соединительная ткань (РВСТ)

Loose collagen connective tissue (LCCT)



Клетки **Cells**

Эластические волокна **Elastic fibers**

Коллагеновые волокна **Collagen fibers**

Основное вещество **Fundamental (amorphous) substance**

The fundamental (amorphous) substance – a gel colloid system from water, salts and organic substances: glycoproteins, glycosaminoglycans (GAG) and proteoglycans.

Glycoproteins are the proteins connected with oligosaccharines, connect cells with fibres, happen soluble and insoluble structural, species-specific.

Proteoglycans are the proteins connected with GAG.

Glycosaminoglycans *(GAG)* are sour high-polymer combinations, synthesized by fibroblasts. Distinguish 5 groups of GAG.

Основное вещество

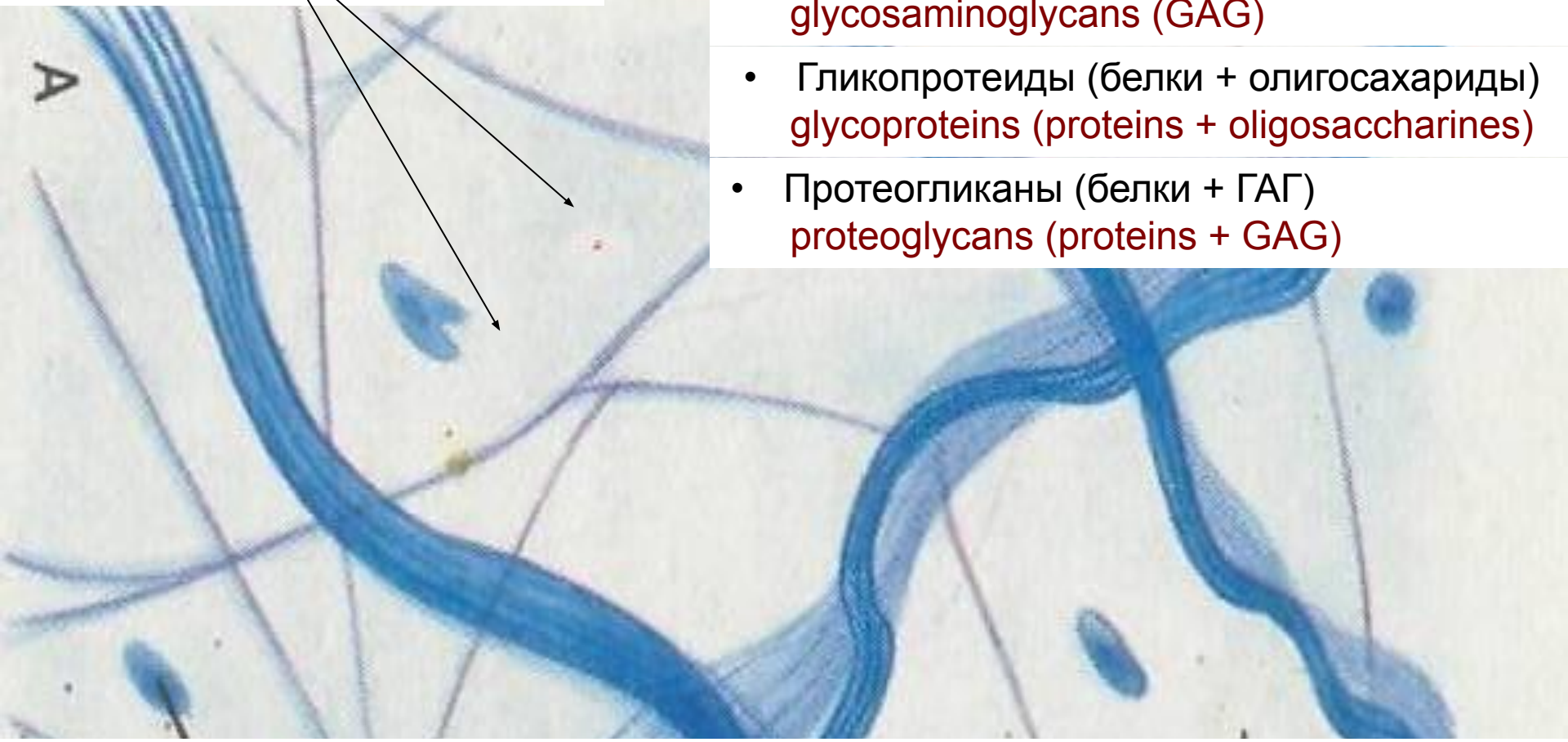
Fundamental (amorphous) substance

Вода - water

Неорганические вещества - salts

Органические вещества - organic substances :

- Гликозаминогликаны (ГАГ)
  glycosaminoglycans (GAG)
- Гликопротеиды (белки + олигосахариды)
  glycoproteins (proteins + oligosaccharines)
- Протеогликаны (белки + ГАГ)
  proteoglycans (proteins + GAG)



Гликозаминогликаны (ГАГ)

Сульфатированные, гидрофобные:

1 группа – хондроитинсульфаты A,B,C
2 группа – дерматансульфаты
3 группа – кератансульфаты
4 группа – гепарансульфаты и гепарин

Не сульфатирована, гидрофильна:
5 группа – гиалуроновая кислота

Glycosaminoglycans *(GAG)*

4 groups are sulfatated, connected with proteins, are a part of proteoglycans:

1) ***chondroitinsulfats A,B,C,***
2) ***dermatansulfats,***
3) ***keratansulfats,***
4) ***heparansulfats and heparin***.

5-th group is not sulfatated:

- ***hyaluronic acid***

It has the greatest molecular weight, can be free and connected with proteins.

GAG define permeability of a tissue for water and solutions.

- ***Hyaluronic acid*** is hydrophilic, well connects water, stimulates a metabolism, phagocytosis, duplication and mobility of cells. It is a lot of it at young organisms.
- ***Chondroitinsulfats*** are hydrophobic, brake duplication of cells and regeneration; with the years their quantity increases.
- ***Heparin*** blocks phagocytosis, the metabolism, duplication and mobility of cells, permeability of tissues, coagulability of blood, but activates disintegration of fibrin and fats. Breach of GAG parity in tissue leads to breach of fibre formation and development of collagenouses (rheumatism, scleroderma).

Коллагеновые волокна (из белка коллагена)

Collagen fibers **(from protein collagen)**

Collagenic fibers are

- very strong,
- oxiphilic,
- tape-like,
- not anastomose,
- lay freely,
- slightly twisting.

- ***Collagenic fibers*** are constructed of ***tropocollagen-protein*** which consists of triplets of amino-acids - in each triplet the first amino-acid is glycine, the second - proline or lysine, the third - anyone in different types of collagen.
- Fibroblasts synthesize ***tropocollagen*** and secrete it in the intercellular environment. Then it is polymerisated in **fibril** with participation of acidic GAG, thus the *tropocollagen* molecules are displaced rather each other on ¼ of length therefore fibrils are cross-striated.
- **Fibrils Fibrils** are combined **collagenic fibres** having thickness from 1 up to 12 microns.

Fibroblast by means of the shoots creeps along of a fibre and completes it at length and thickness.

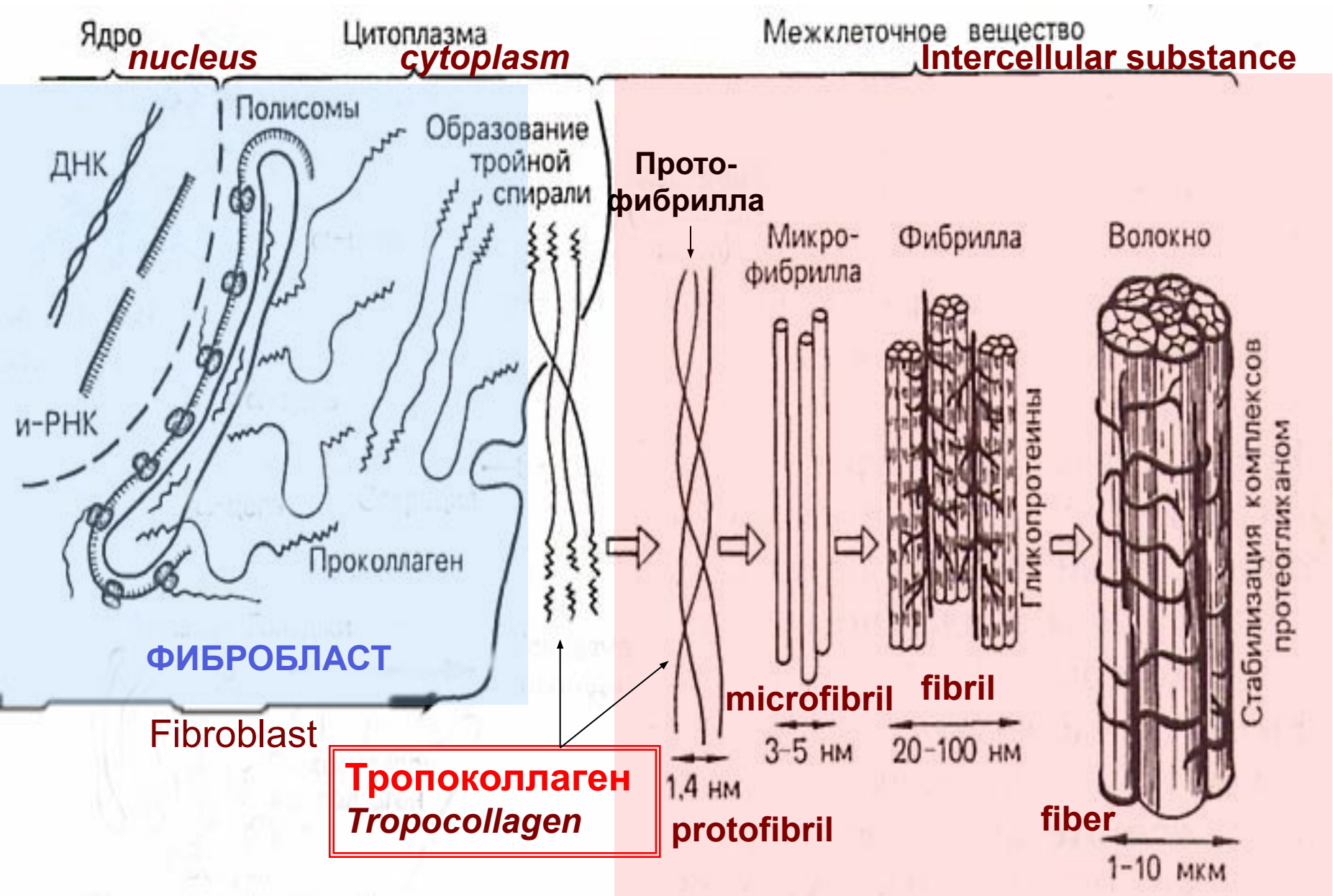
Young organism has a lot of ***hyaluronic acid***, therefore a fibre thin and long.

Old organism has a lot of ***heparin***, therefore fibres short and thick.

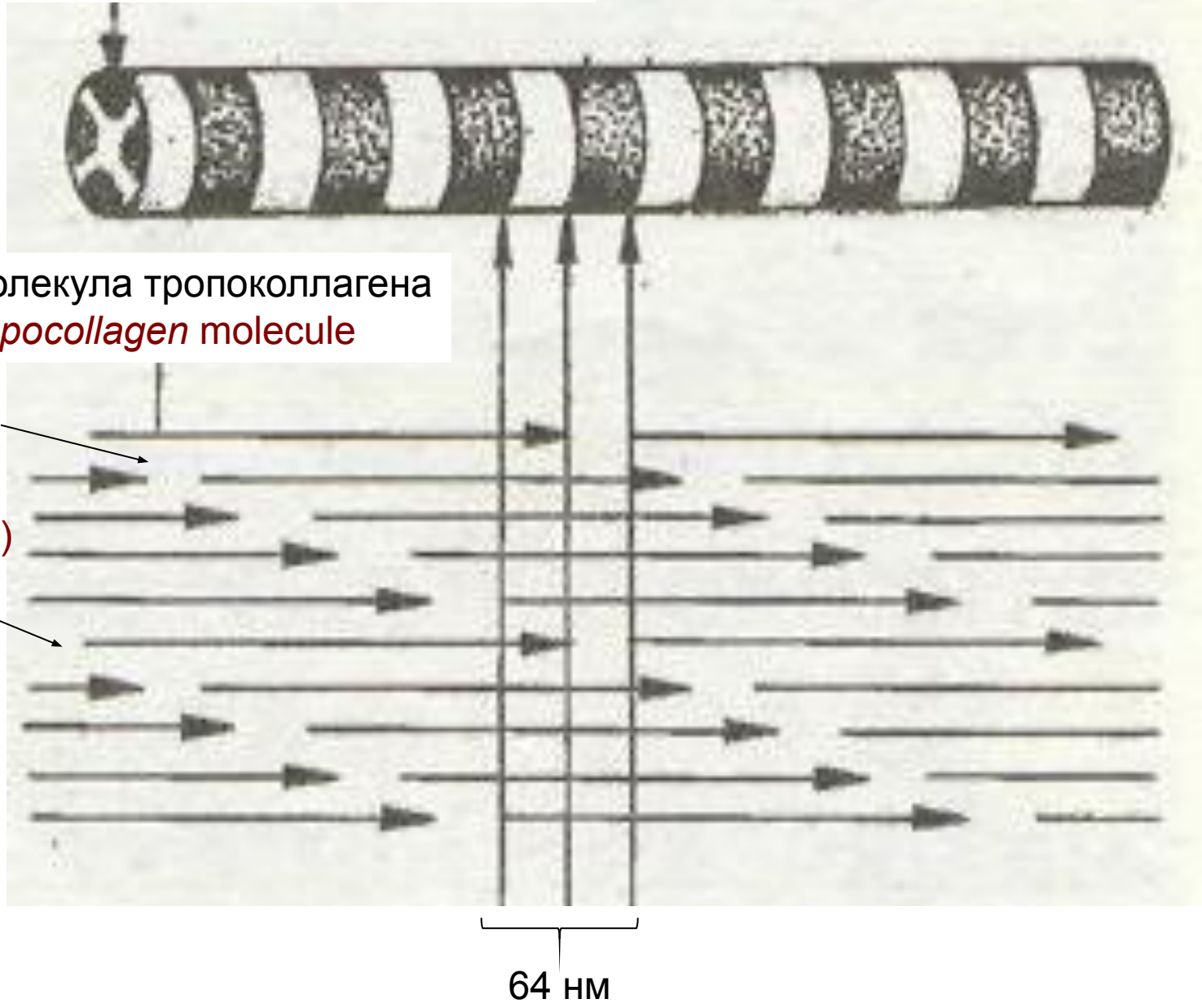
Deficiency of vit.C blockages a *tropocollagen* formation, there are defects of bones, a teeth, healing of wounds, crises of bones.

Образование коллагеновых волокон

Collagen fibers formation



Фибрилла (тропоколлаген)
Fibril (*tropocollagen)*



Типы коллагена Types of collagen

Толстые волокна

1 тип – в соединительной ткани, в костях, зубах

1 type - in a connective tissue, bones and a teeth

Thick fibers

Тонкие волокна

2 тип – в хрящах, в стекловидном теле глаза

2 type - in cartilages and vitreous body of an eye

3 тип – в ретикулярной и рыхлой соед. ткани

3 type - in reticular and loose collagen tissue

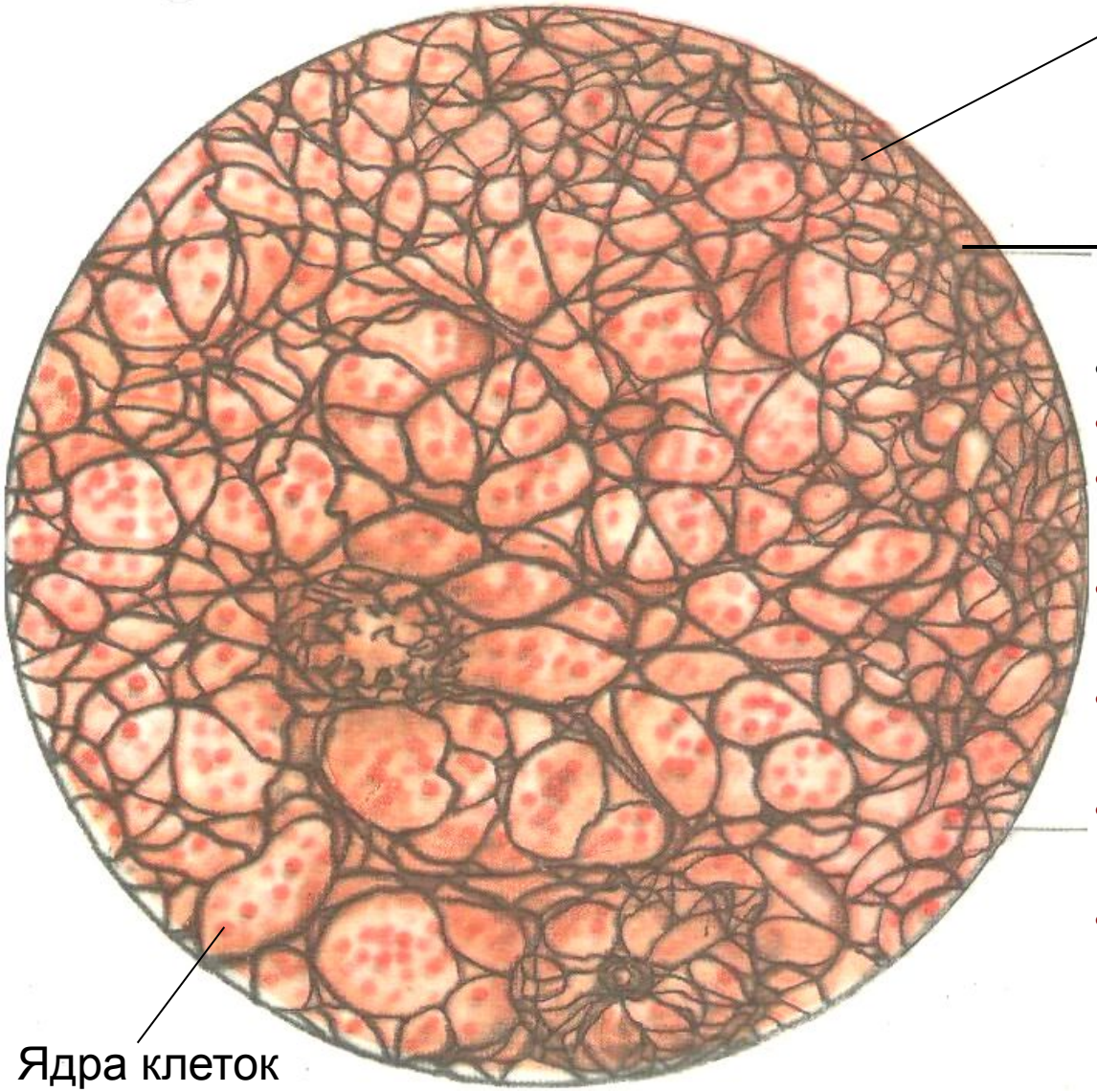
4 тип – в базальных мембранах эпителия

4 type - in basal membrane of epithelium

5 тип – в базальных мембранах эндотелия

5 type - in basal membrane of endothelium

Thin fibers



Ретикулярные волокна

(коллаген 3 типа)

Reticular fibers

(collagen 3 type)

- thickness 1 micron,
- bunches of collagen 3-rd type,
- "dressed" in a cover from neutral glycoproteins,
- not painted by eosin, but impregnate by silver.
- are steady against acids, alkalis and enzymes,
- strong branched, anastomosed, braid cells,
- it is a lot of in stroma of hemopoetic organs, in smooth muscle tissue, mucous layes, basal membranes.

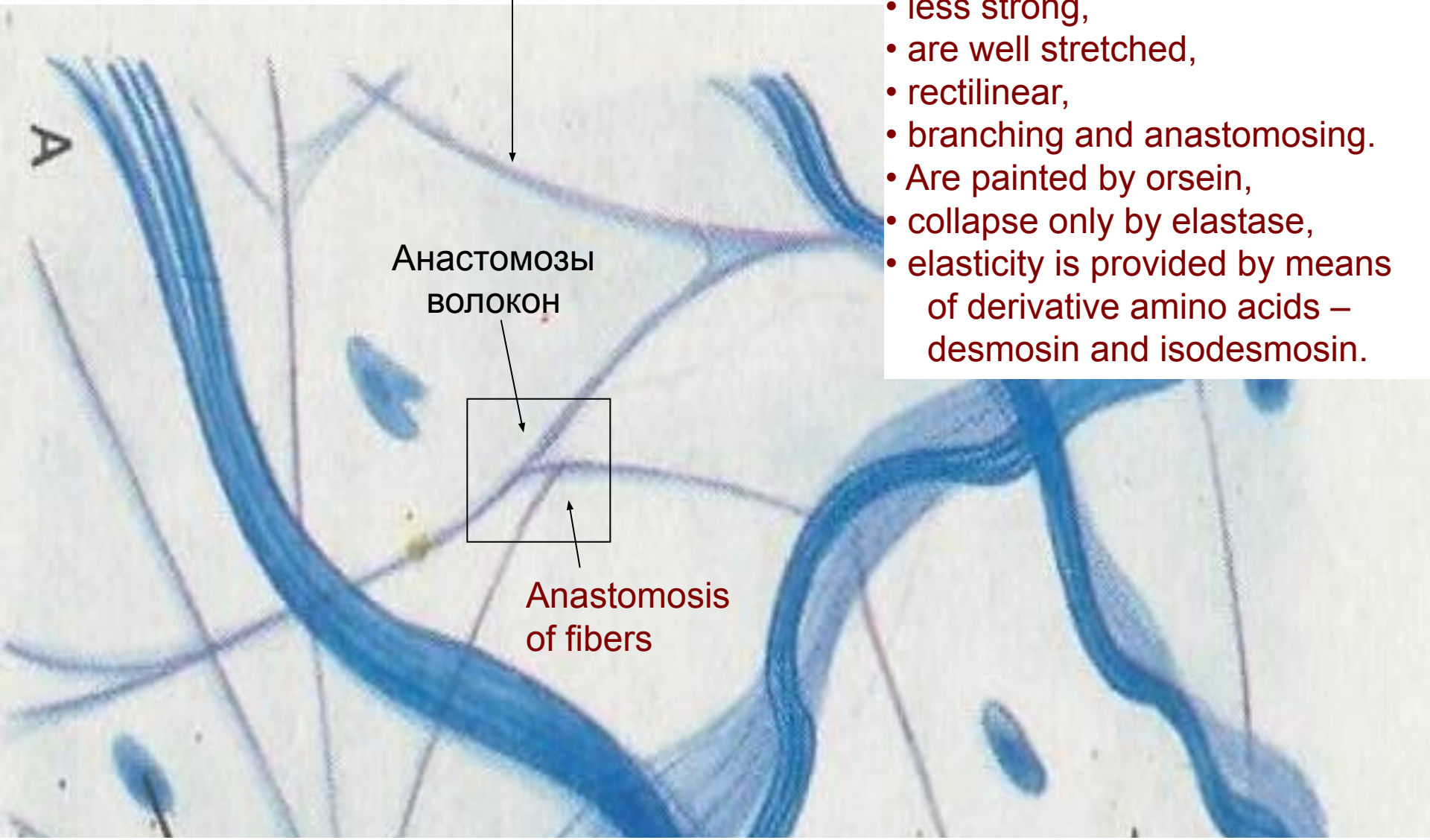
Ядра клеток
(nucleous of cells)

(импрегнация азотнокислым серебром) (Impregnation $AgNO_3$)

Эластические волокна (из белка эластина)

Elastic fibers (protein elastin)

- are more thin and light then collagenic fibers,
- less strong,
- are well stretched,
- rectilinear,
- branching and anastomosing.
- Are painted by orsein,
- collapse only by elastase,
- elasticity is provided by means of derivative amino acids – desmosin and isodesmosin.



Клетки соединительной ткани:

1. Фибробласты
2. Тканевые макрофаги
3. Тучные клетки

Основные резидентные

4. Малодиффе-ренцированные клетки
5. Липоциты
6. Меланоциты

Малочисленные резидентные

7. Эндотелиоциты

В сосудах

8. Плазмоциты
9. Лейкоциты

Приносятся кровью

Cells of connective tissue:

1. Fibroblasts
2. Histiocyte
3. Labrocyte

Main residental cells

4. Little differentiated cells
5. Lipocytes
6. Melanocytes

Not numerous residental cells

7. Endotheliocytes

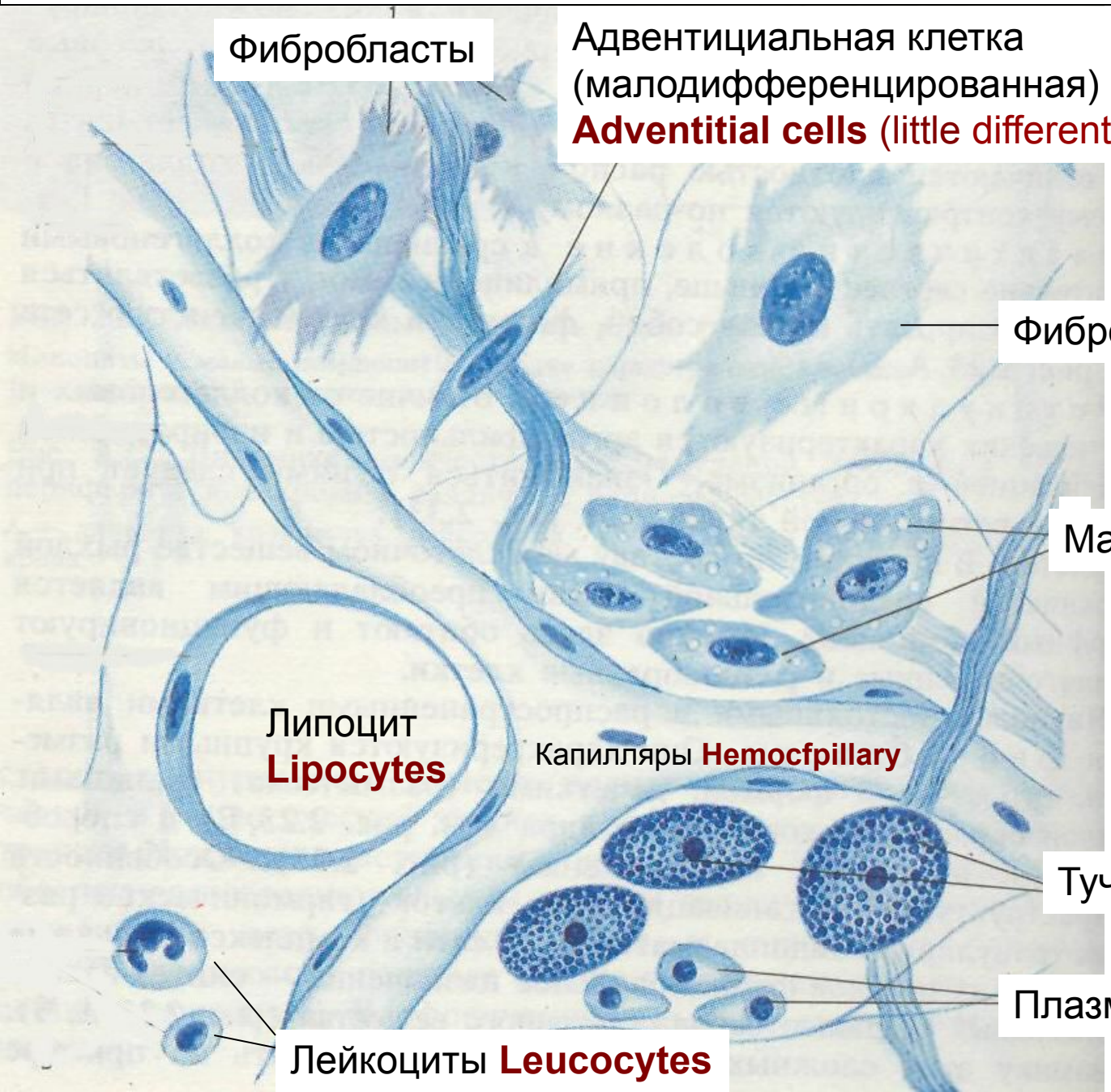
In vessels

8. Plasmocytes
9. Leucocytes

Are brought by blood

Рыхлая волокнистая соединительная ткань

Loose collagen connective tissue



Lymphocytes, eosinophis, basophils prevalence at the immune answer, **neutrophils -** at a acute inflammation. **Plasmocytes** happens much at a chronic inflammation, at an allergy.

Plasmocytes have:

- a dense nucleus with arrangement of dense chromatin in the form of spokes in a wheel,
- basophilic cytoplasm,
- well developed a rough endoplasmic reticulum,
- a light court yard about a nucleus (a site where KG is located).

Плазмоциты

Plasmocytes

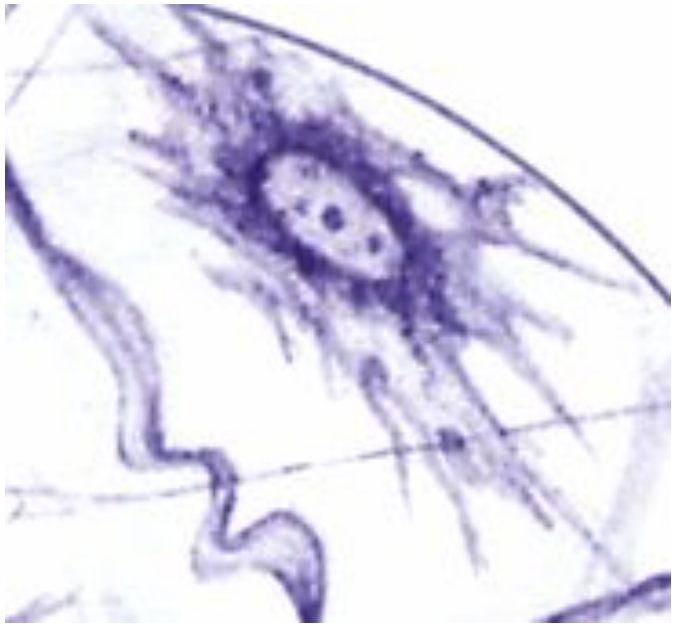
Светлый дворик

light court yard

Виды фибробластов: Types of fibroblasts:

1. Малодифференцированные
   Little differentiated ***(divide and differentiate)***

2. Зрелые
   Mature *(40-50 мкм)*
   (builders of a connective tissue)

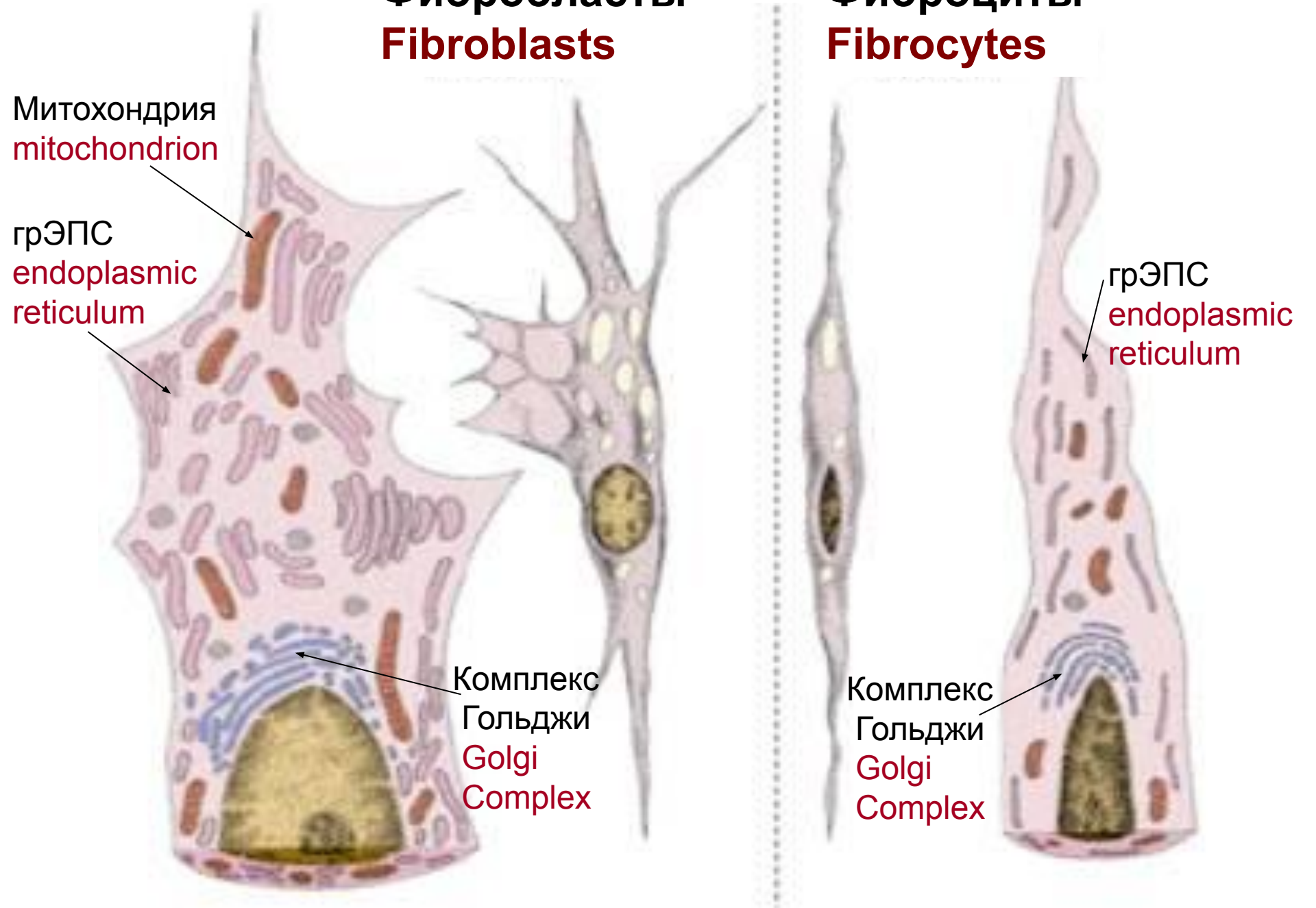


3. Фиброкласты
   Fibroclasts
   (destructors of tissue)

4. Миофибробласты
   Myofibroblasts ***(can shorten)***
5. Фиброциты
   Fibrocytes ***(final form)***

Фибробласты
Fibroblasts

Фиброциты
Fibrocytes



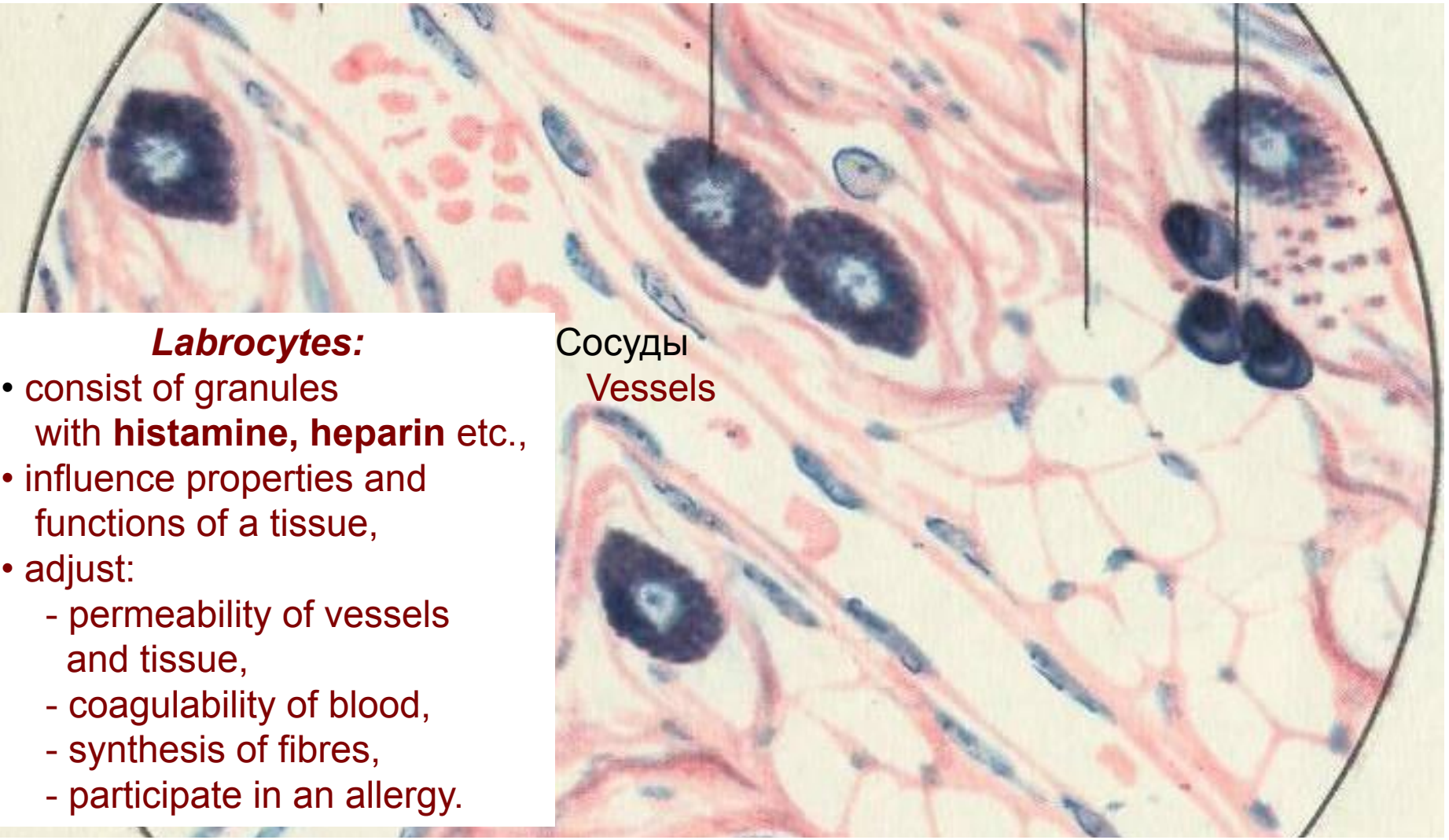
Тучные клетки *– тканевые базофилы (лаброциты)*

Labrocytes **–** basophilic granulocytes

Тучные клетки **Labrocytes**

Адипоциты **Lipocytes**

Дегрануляция **Degranulation**



Сосуды
Vessels

Labrocytes:

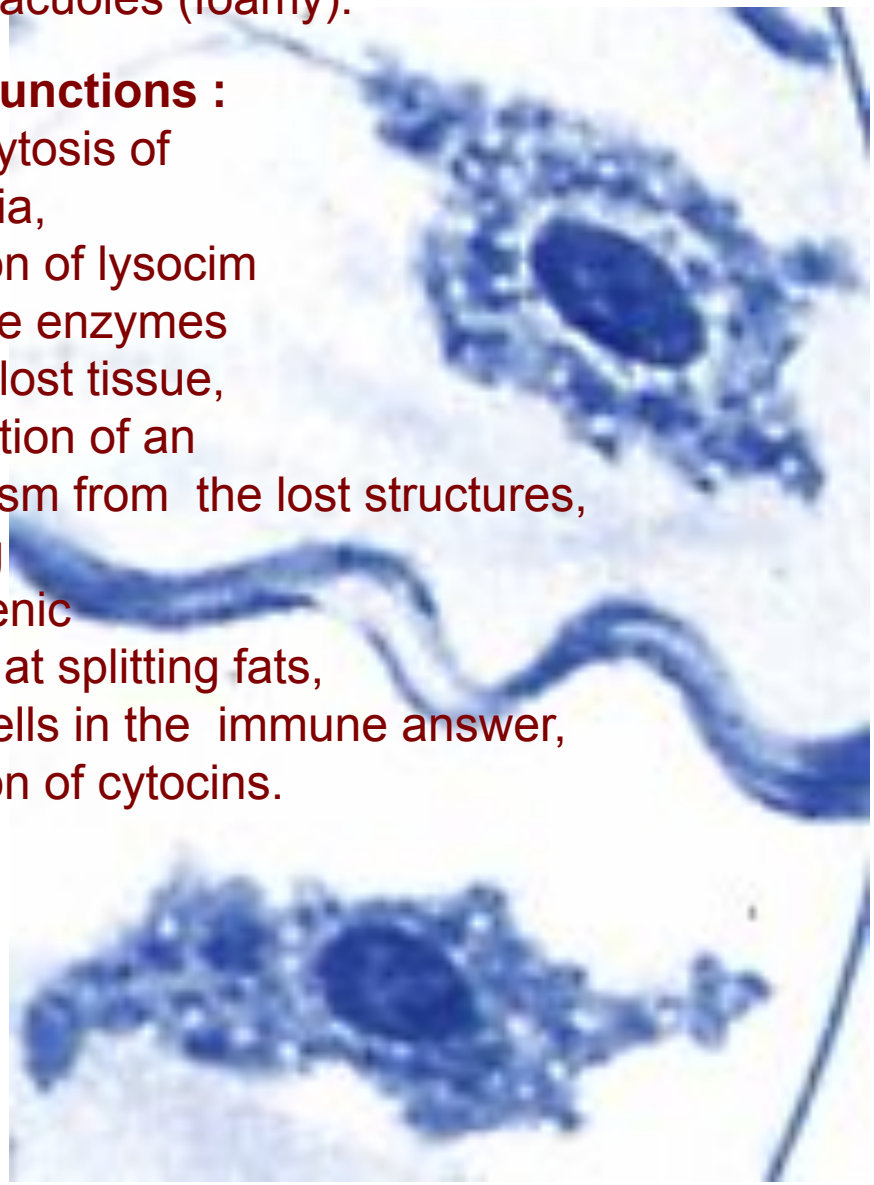
- consist of granules with **histamine, heparin** etc.,
- influence properties and functions of a tissue,
- adjust:
  - permeability of vessels and tissue,
  - coagulability of blood,
  - synthesis of fibres,
  - participate in an allergy.

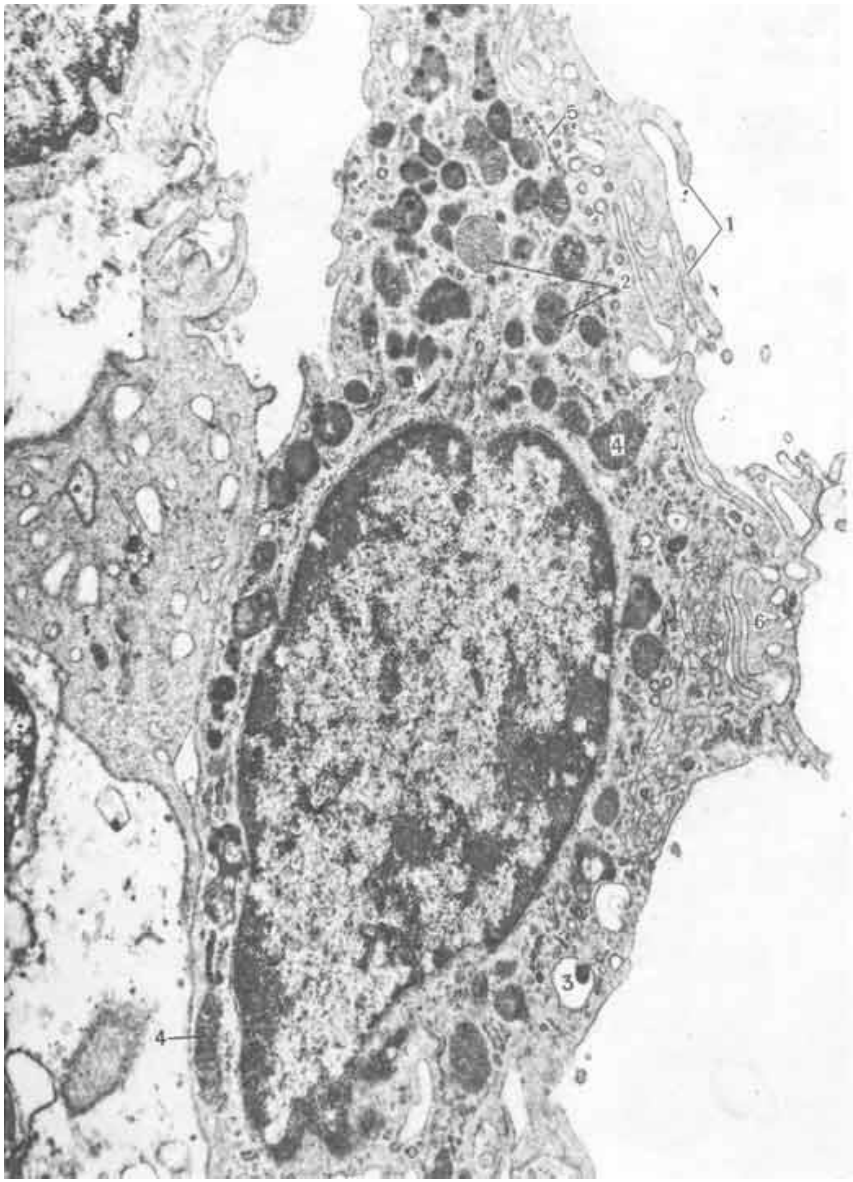
Макрофаги – гистиоциты
***Macrophages -** histiocytes*

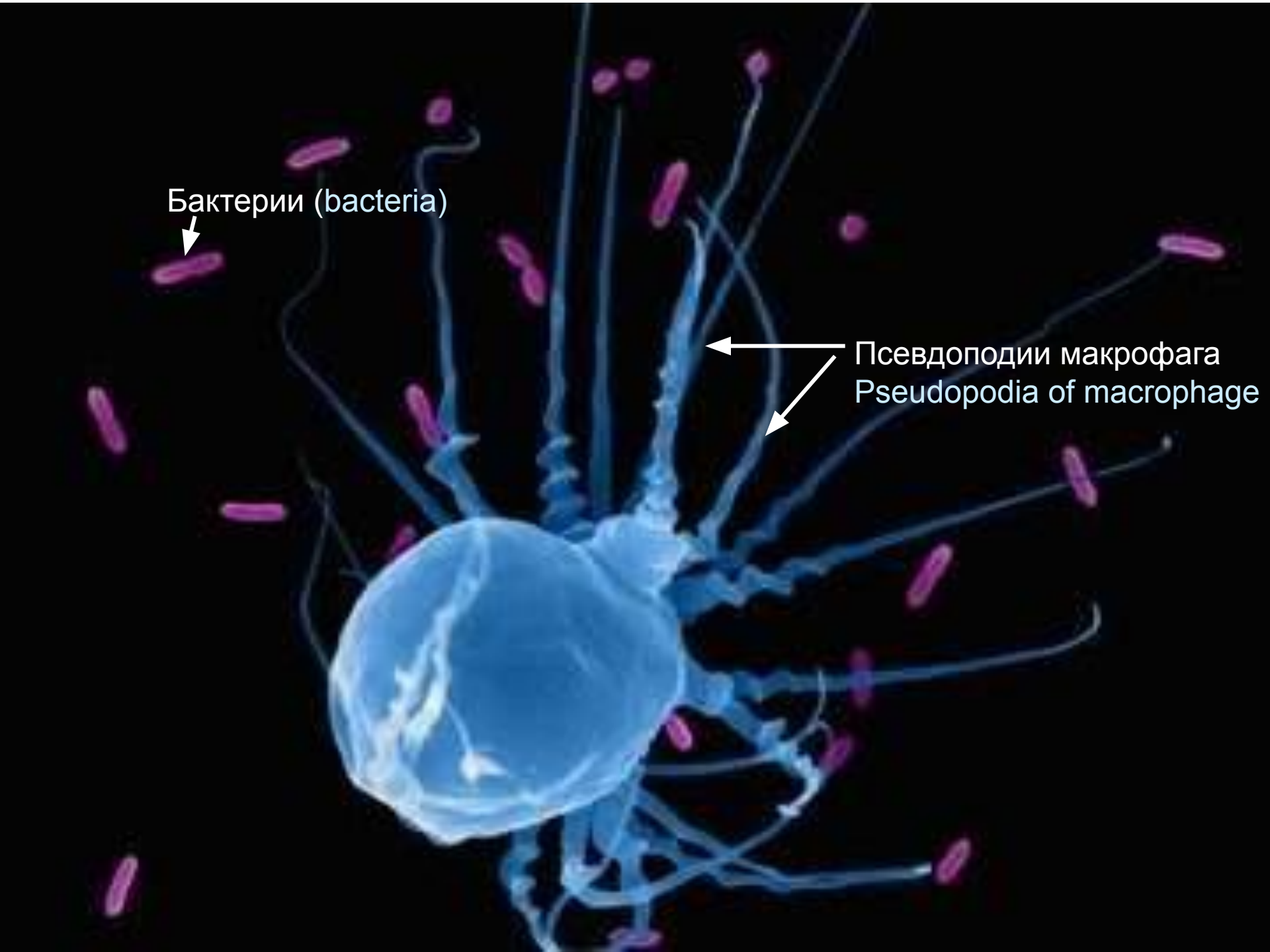
- dense oval nucleus,
- cytoplasm is foamy,
- a lot of lysosomes and small vacuoles (foamy).

Functions :

- phagocytosis of bacteria,
- secretion of lysocim and the enzymes lyzing lost tissue,
- clarification of an organism from the lost structures,
- clearing endogenic waters at splitting fats,
- are A-cells in the immune answer,
- secretion of cytocins.






Бактерии (bacteria)
Псевдоподии макрофага
Pseudopodia of macrophage

Мононуклеарная фагоцитарная система

- Гистиоциты
- Альвеолярные макрофаги лёгких
- Звёздчатые клетки Купфера печени
- Береговые клетки лимфоузлов
- Макрофаги ретикулярной ткани
- Перитониальные макрофаги
- Гигантские клетки инородных тел
- Остеокласты
- Микроглия нервной ткани
- Клетки мезангиума почек
- Клетки Лангерганса в эпидермисе

Mononuclear phagocytic system

- *Histiocytes*
- Alveolar lung macrophages
- Stellate Kupffer's cells of a liver
- Reticular cells of lymphatic node sinus
- Macrophages of reticular tissue
- Peritoneal macrophages
- Gigantic cells of alien bodies
- Osteoclasts
- Microglia of nerve tissue
- Renal mesangium cells
- Langergans's cells of epidermis

Фильм макрофаг гоняется за бактерией