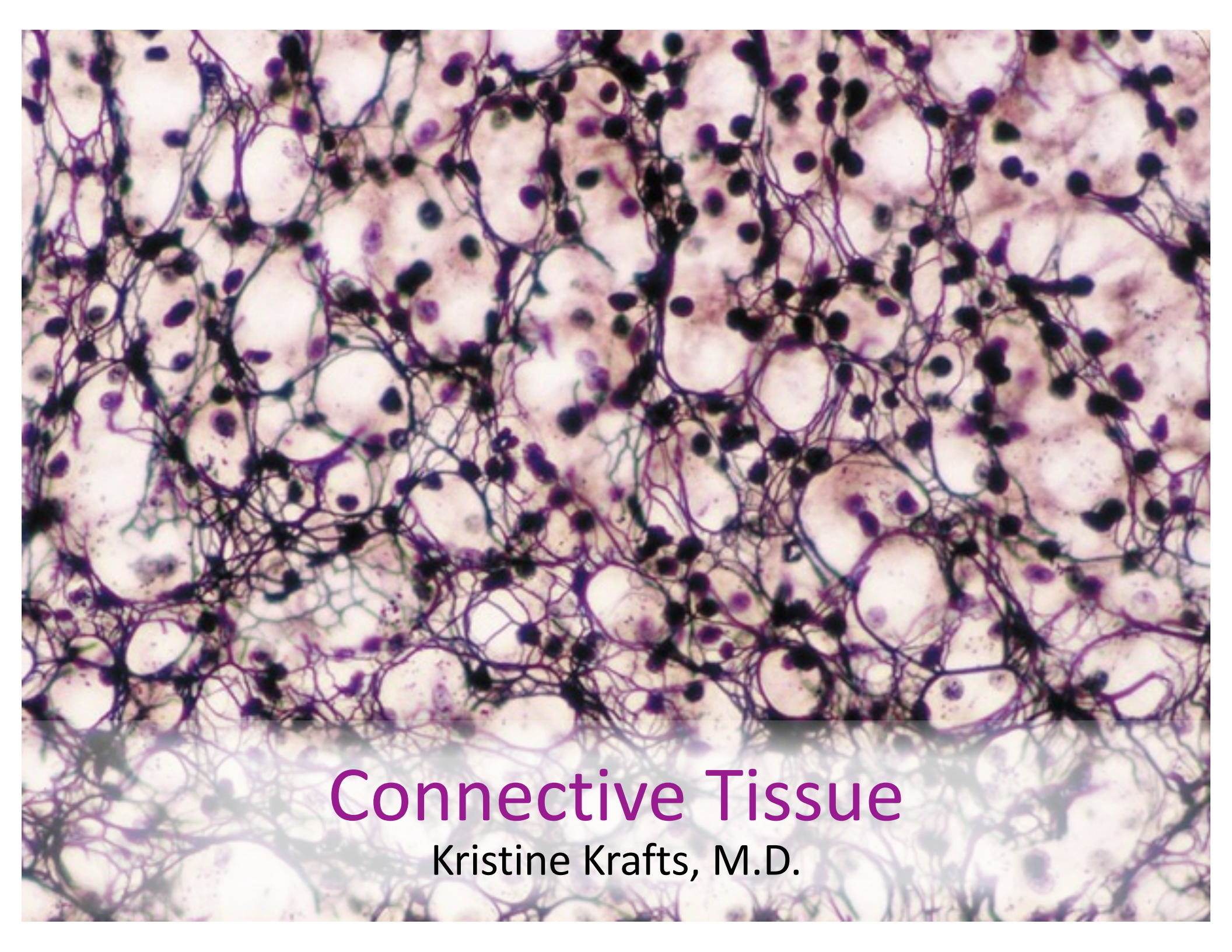


A high-magnification light micrograph of connective tissue. The image shows a dense, intricate network of purple-stained fibers, likely collagen, which form a mesh-like structure. Interspersed among these fibers are numerous small, dark purple, rounded cells, possibly fibroblasts or other stromal cells. The overall appearance is that of a highly organized, fibrous tissue matrix.

Connective Tissue

Kristine Krafts, M.D.

Connective Tissue Lecture Objectives

- List the functions of connective tissue.
- Describe the structure, function, and appearance of collagen types I – IV and elastic fibers.
- Explain what ground substance is and what it looks like.
- Compare and contrast the structure of glycosaminoglycans, proteoglycans, and glycoproteins.
- List the four types of connective tissue proper, describe what each looks like, and explain how and where each is used in the body.

Connective Tissue Lecture Outline

- Introduction
- Extracellular matrix of connective tissue
- Cells of connective tissue
- Classification and examples of connective tissue

Connective Tissue Lecture Outline

- Introduction

Tissue Basic Concepts

There are ONLY FOUR basic tissues!

- Epithelium
- Connective tissue
- Muscle
- Nerve

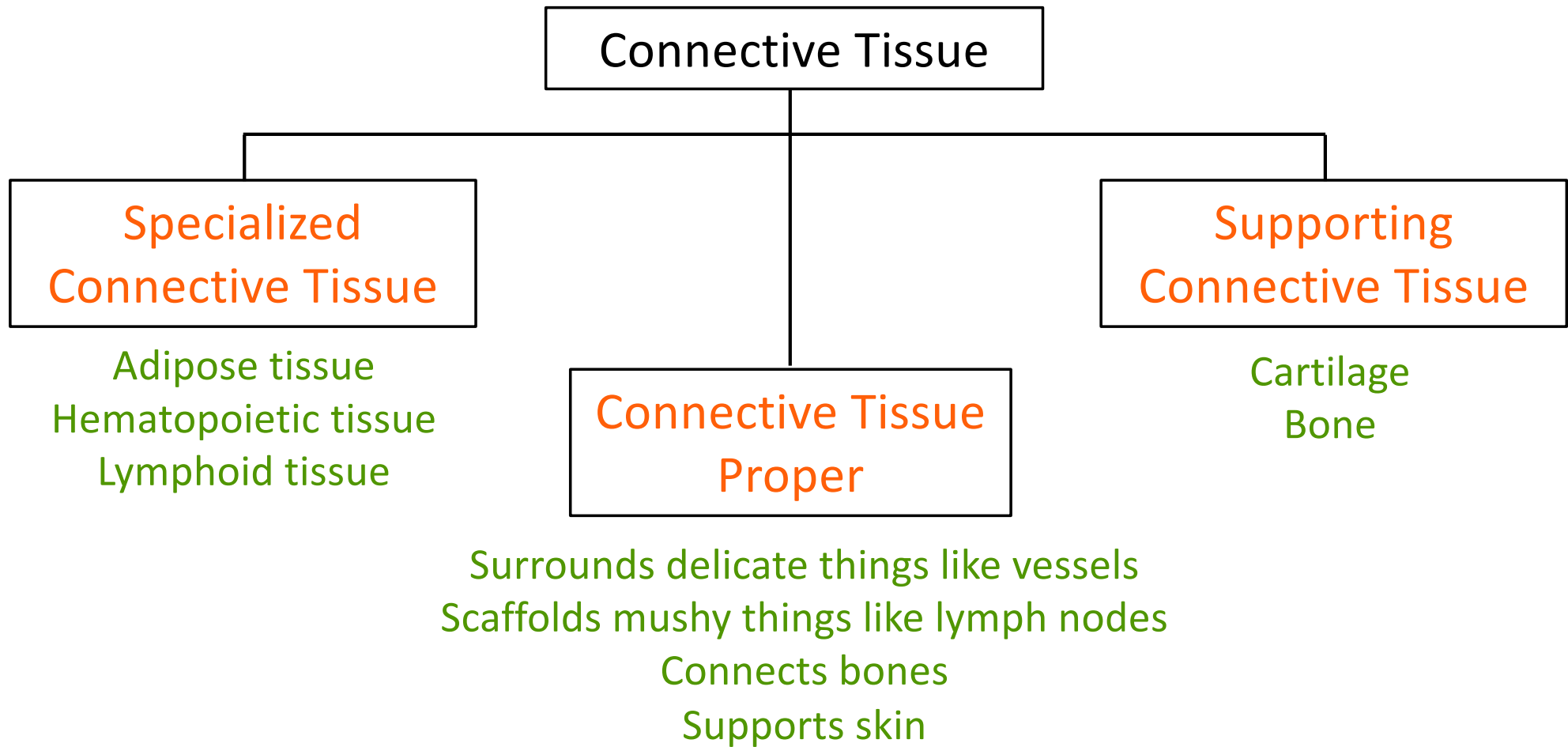
All tissues are composed of:

- Cells
- Extracellular matrix (stuff between cells)

What Makes Connective Tissue Unique?

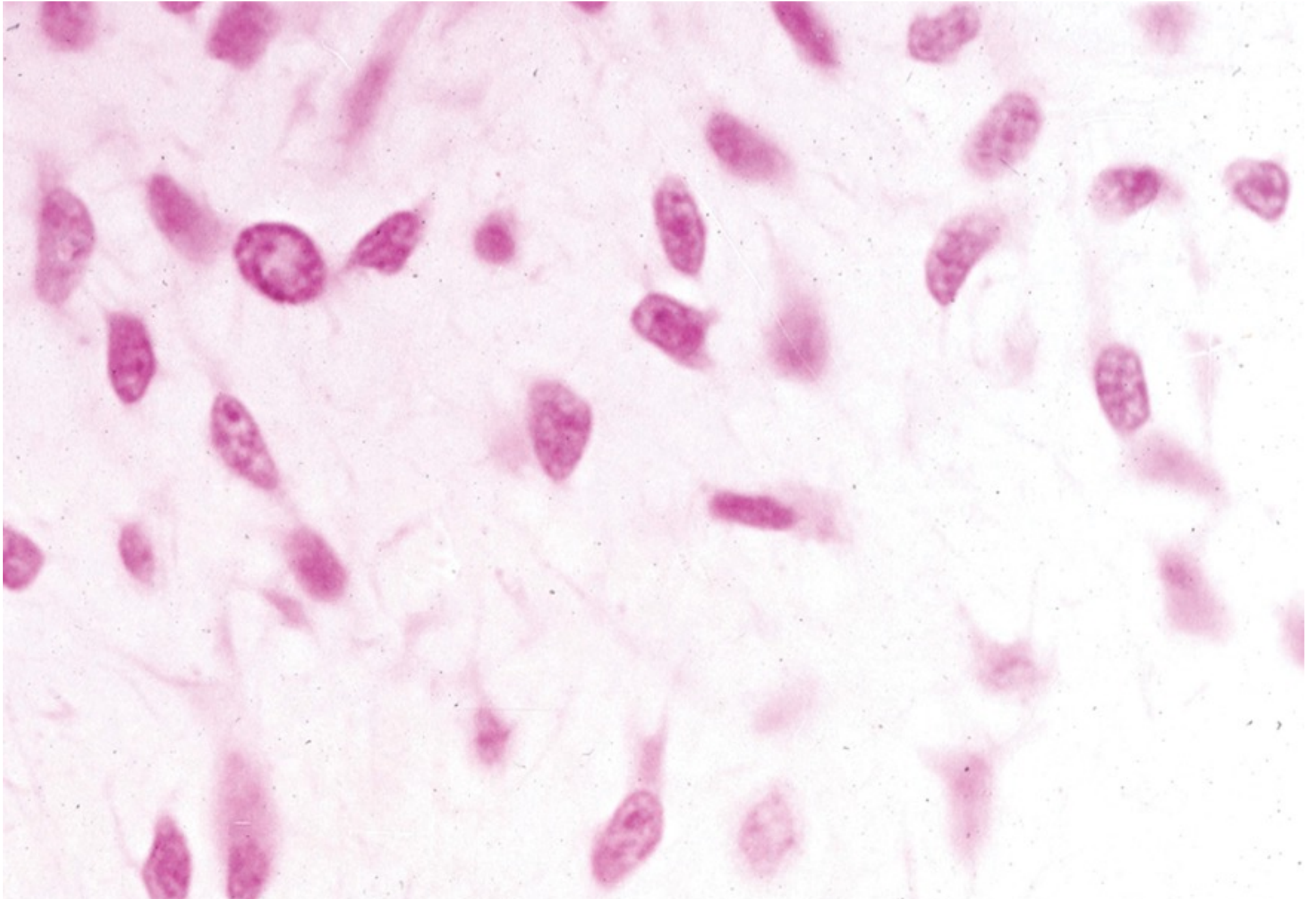
- Extracellular matrix (ECM) is the major component of most types of connective tissue.
- Cells are a minor component.
- The other basic tissues (epithelium, muscle, nerve) are fundamentally different in that they are composed mainly of cells.

Types of connective tissue



Connective Tissue Development

- Connective tissue develops from a precursor tissue called mesenchyme (which arises from mesoderm).
- Mesenchyme is an undifferentiated tissue present only in early embryonic life.
- Mesenchyme gives rise to all connective tissues plus vessels and smooth muscle cells.



Mesenchyme: bland cells in lots of ground substance

Connective Tissue Lecture Outline

- Introduction
- Extracellular matrix of connective tissue

Composition of Extracellular Matrix (ECM)

Protein fibers

- Collagen fibers
- Elastic fibers

Ground substance

- Glycosaminoglycans
- Proteoglycans
- Glycoproteins

Two Main Protein Fibers in ECM

Collagen fibers

- Flexible, non-extensible
- Over 20 types!
- Made of polypeptide chains

Elastic fibers

- Thinner and stretchier than collagen
- Made of elastin and fibrillin

Main Types of Collagen in the Body

Type	Microscopic Appearance	Main Function	Main Locations
I	Thick fibers and bundles	Resistance to tension	Skin, tendons, bone, organ capsules
II	Thin fibrils (very hard to see)	Resistance to pressure	Cartilage
III	Also called reticular fibers. Need silver stain to see.	Delicate, flexible structural support	Lymph nodes, spleen, bone marrow, basement membrane
IV	Invisible	Support, filtration	Basement membrane

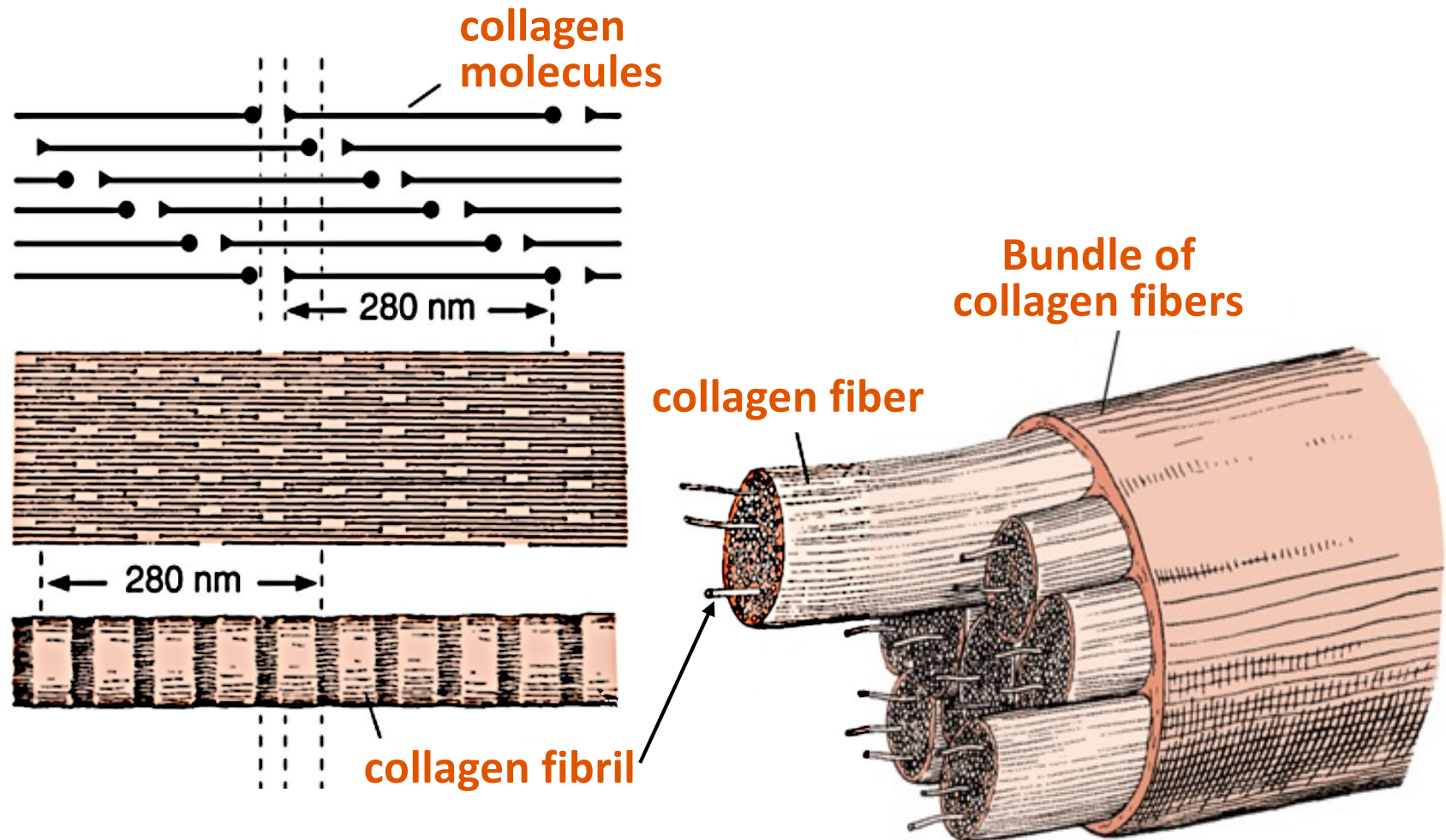
Main Types of Collagen in the Body

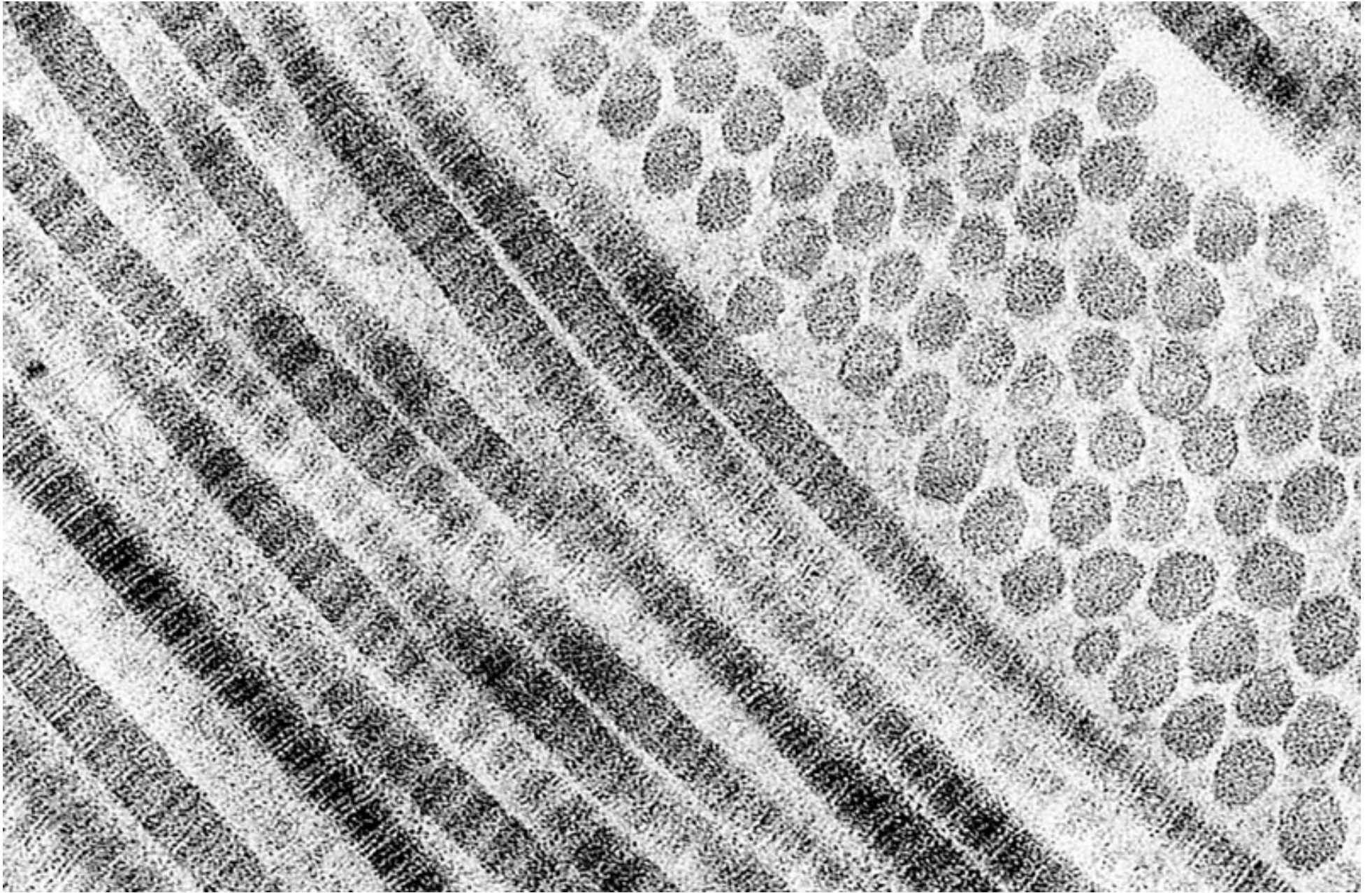
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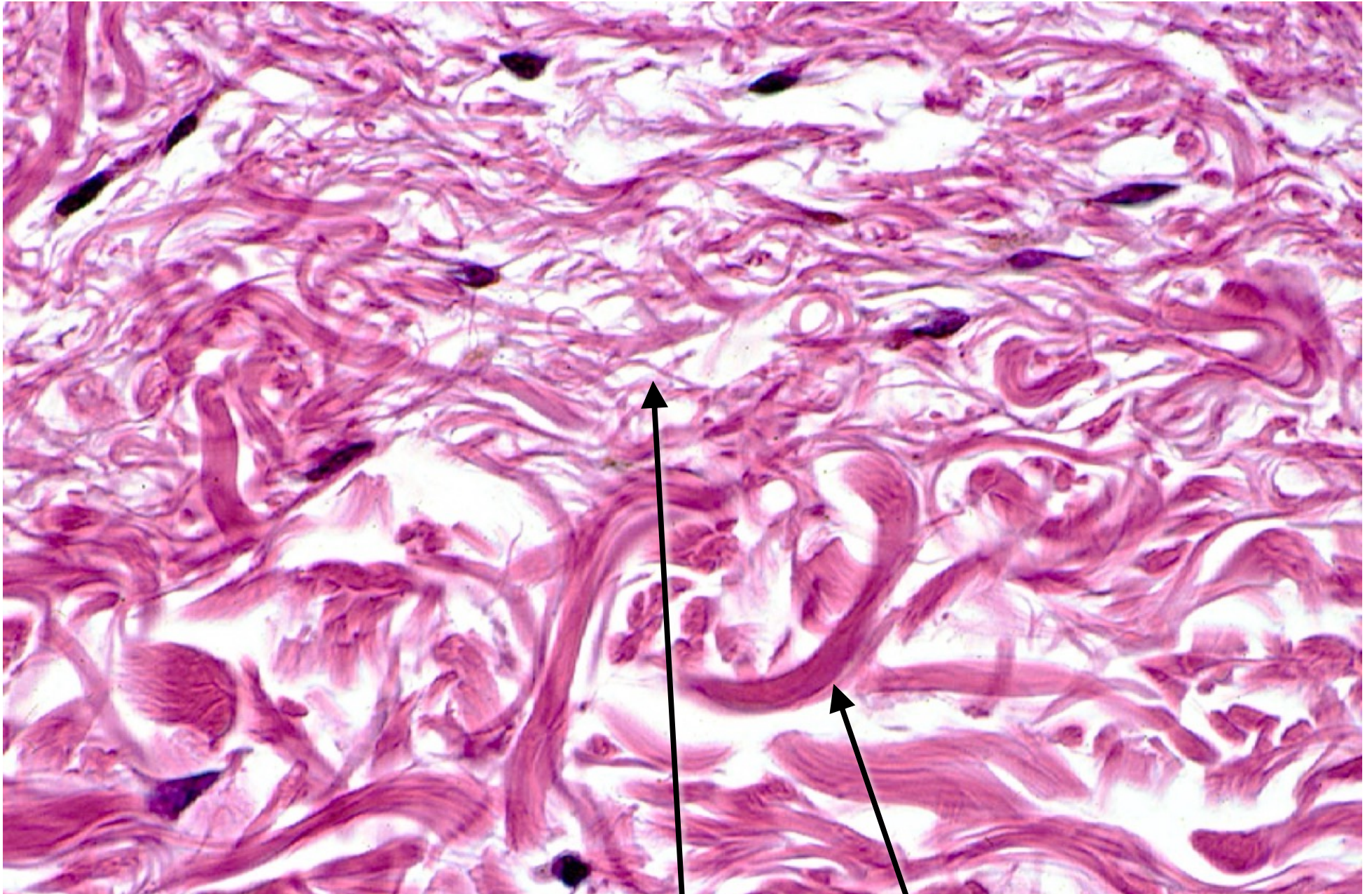
“Fibrillar” collagen

Structure of fibrillar collagen

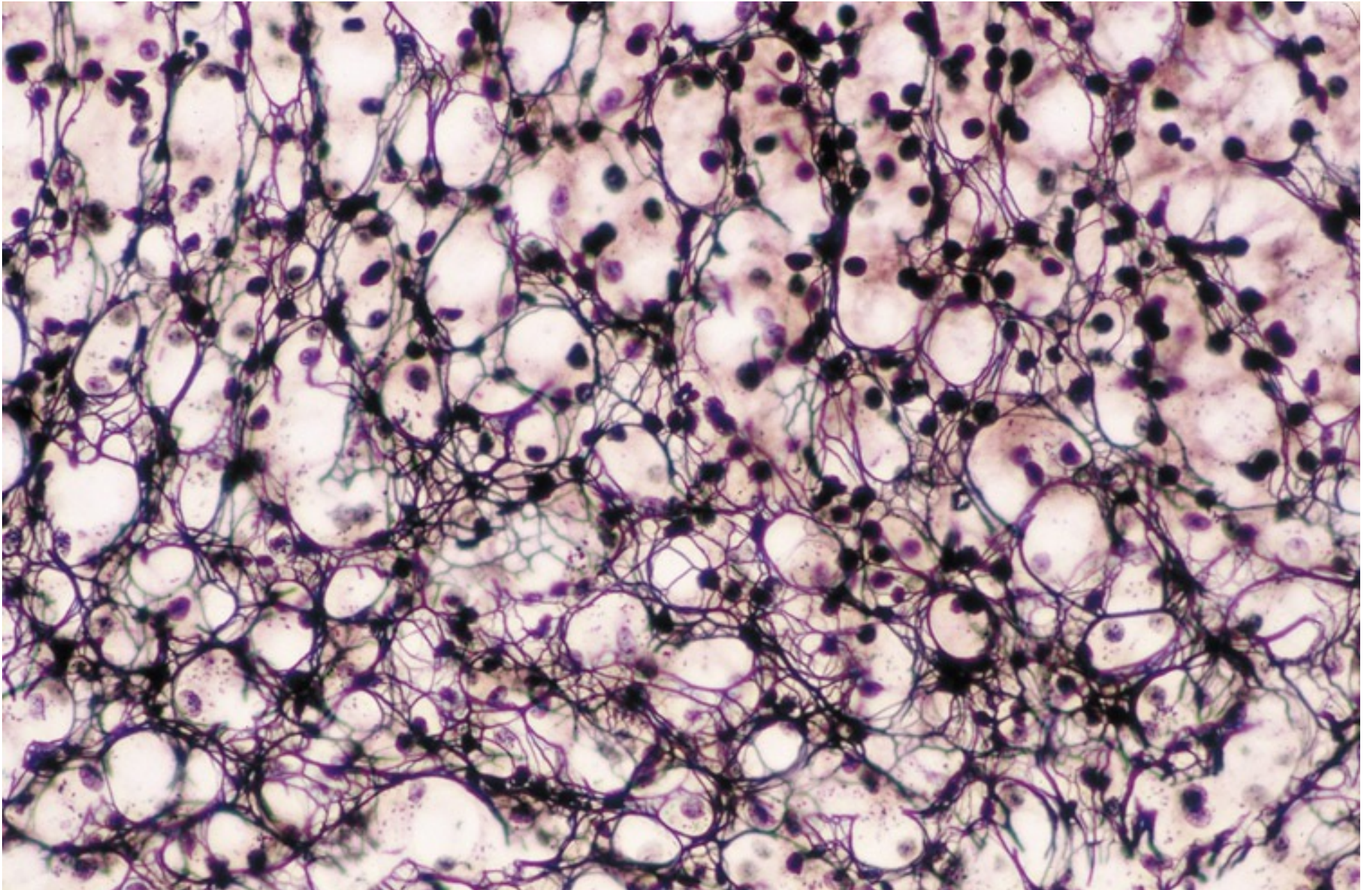




Collagen fibrils, longitudinal and in cross-section, by EM

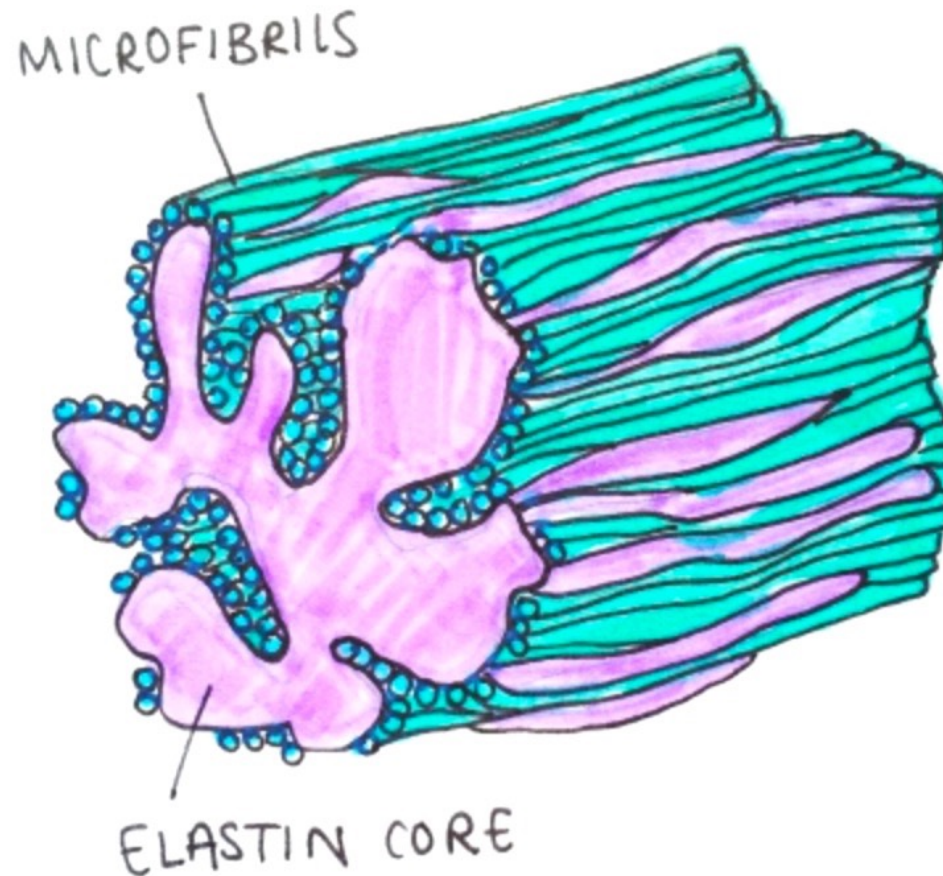


Type I collagen fibers and bundles

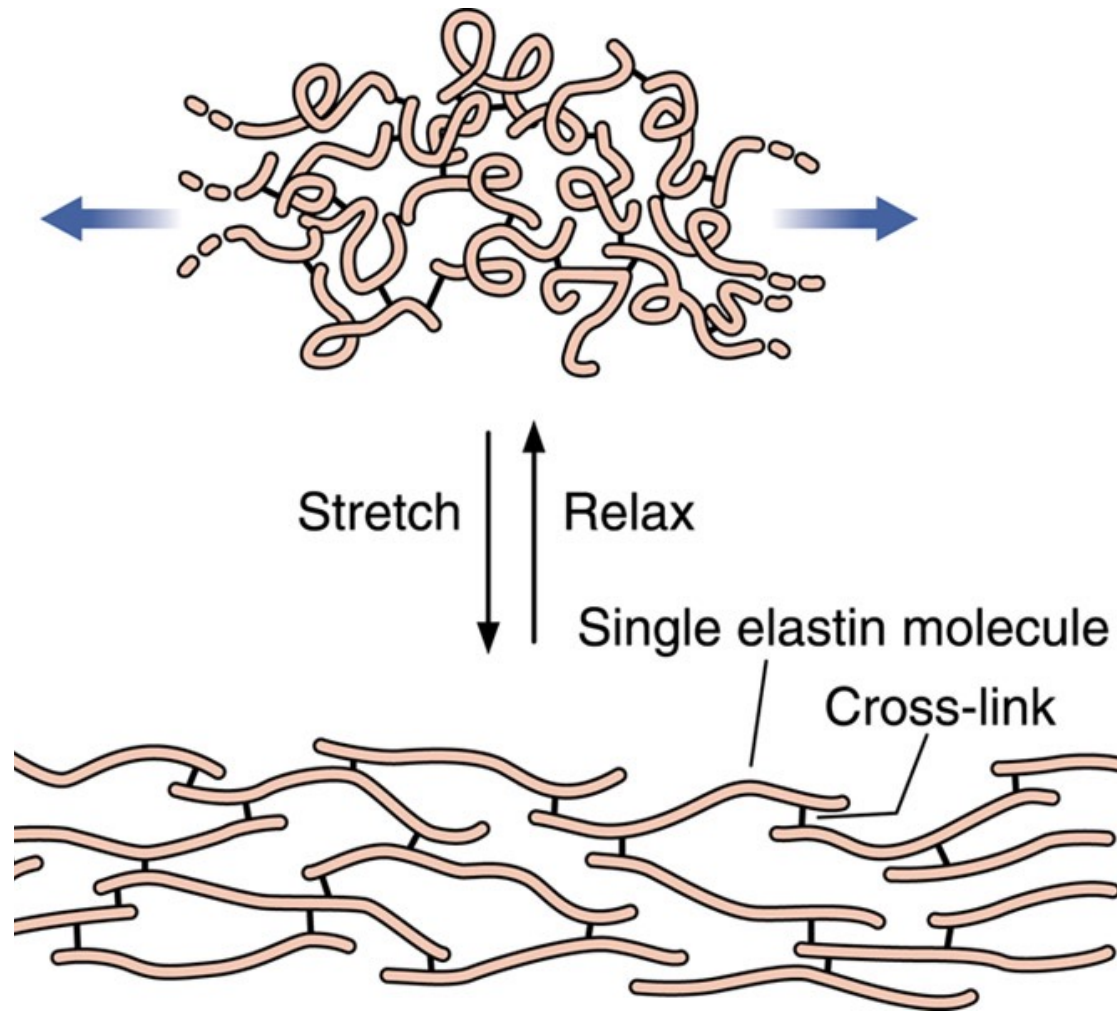


Type III collagen (reticular) fibers stained with silver.

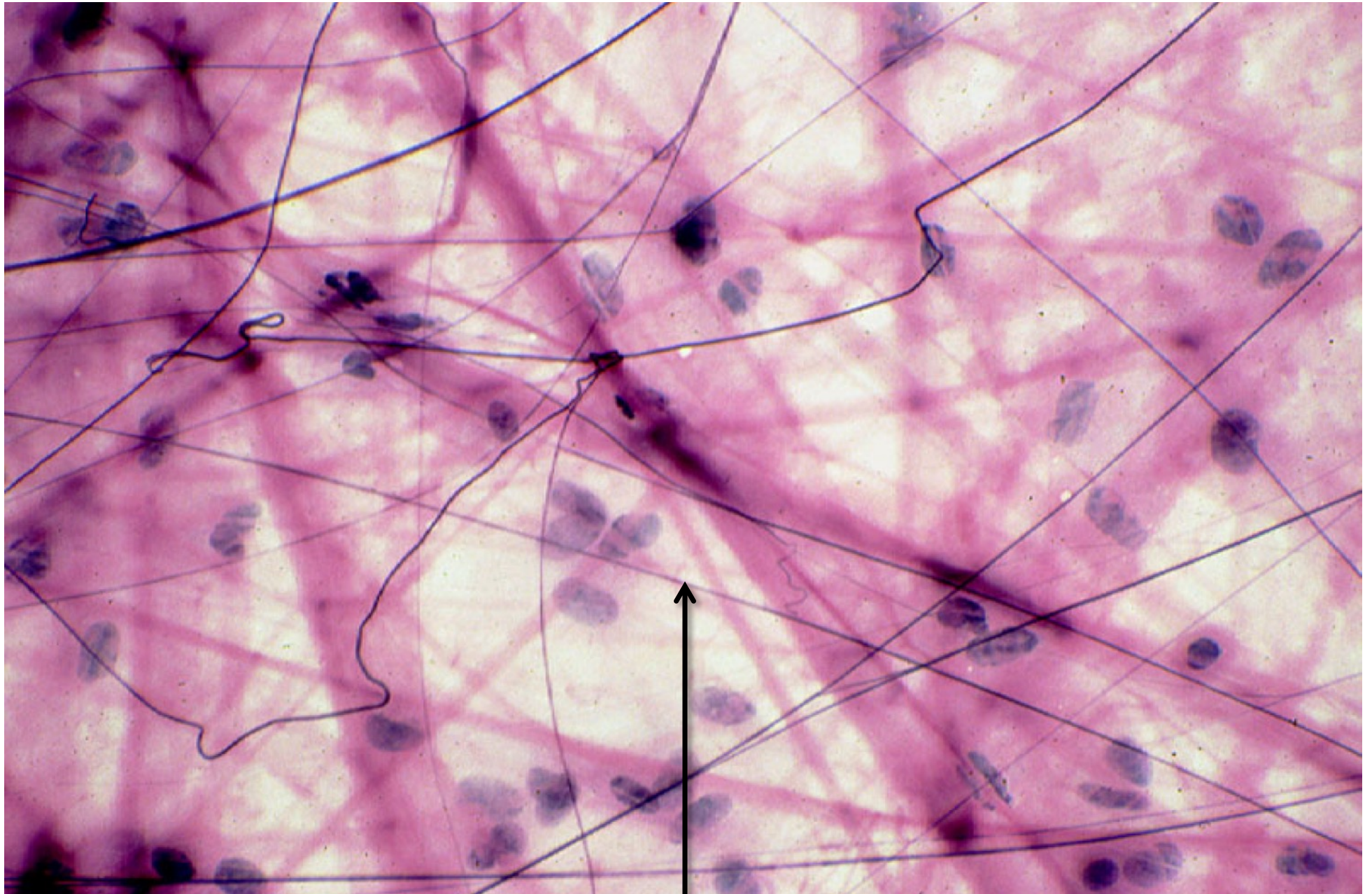
Structure of elastic fibers



Elastic fibers are composed of an elastin core surrounded by microfibrils (composed of fibrillin)



Elastin can expand and contract.



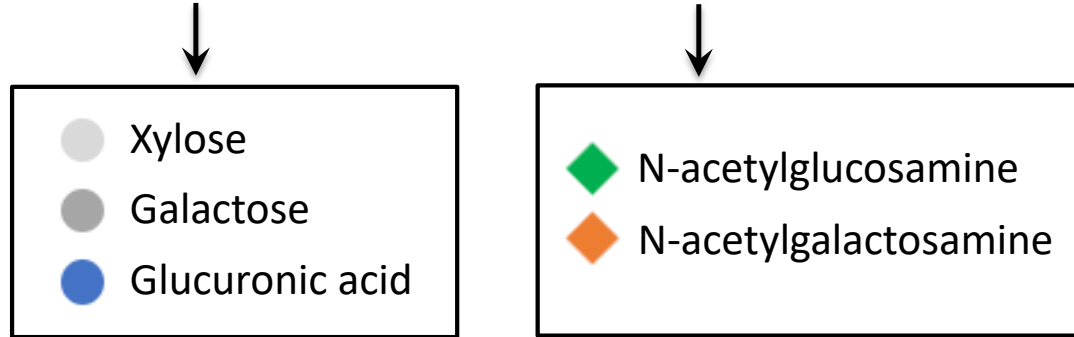
Elastic fibers

Ground substance

- A viscous gel that fills spaces between cells and fibers in connective tissue.
- Functions: binds water, fills space, acts as a barrier to infection, binds fibers and anchors cells to ECM.
- Not well seen in histologic sections (looks clear).
- Main constituents: glycosaminoglycans, proteoglycans, glycoproteins.

Glycosaminoglycans (GAGs) are just chains of disaccharides
(one plain sugar + one amino sugar).

Examples only!
Don't memorize.



There are two kinds of GAGs:



Hyaluronic acid

REALLY long, doesn't need a core protein.



All the other GAGs (e.g., chondroitin sulfate)

Shorter, and always bound to a core protein.

Natural-looking
beauty is a click away.

OUR LATEST LAUGH LINE SOLUTIONS

Introducing **Restylane® Refyne** & **Restylane® Defyne**, two hyaluronic acid gel fillers for laugh lines (nasolabial folds & marionette lines) made with XpresHAn Technology™ that helps maintain natural expression in motion. So your smiles, laughs, frowns and kisses look natural and supported.¹⁻³

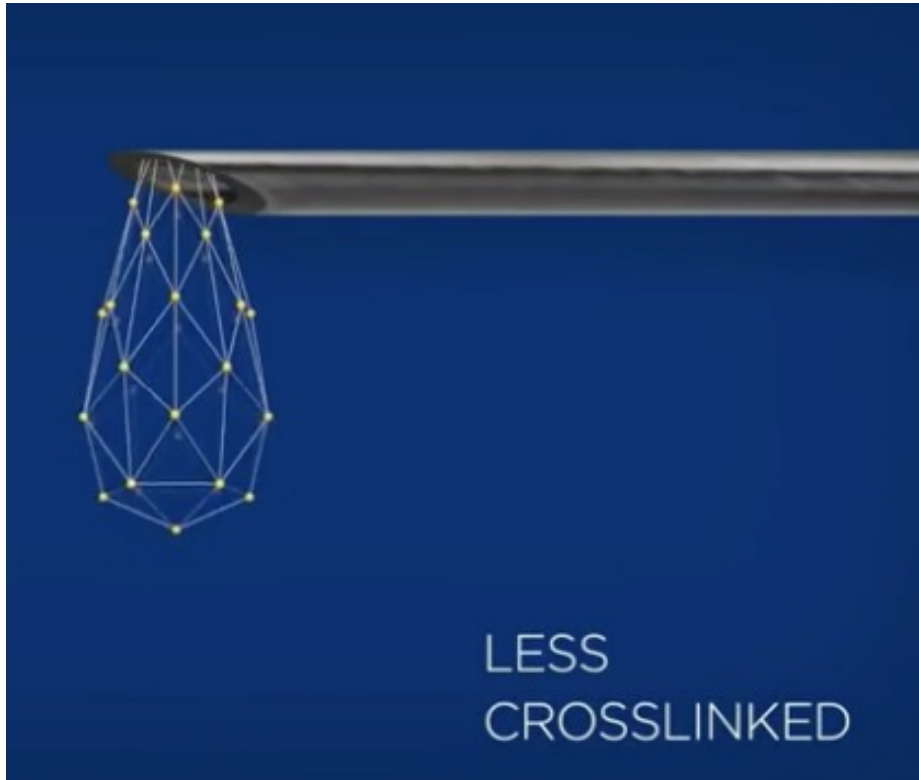
Restylane
REFYNE

Restylane
DEFYNE™

Actual patient. Individual results may vary.

IMPORTANT SAFETY INFORMATION • INSTRUCTIONS FOR USE

The Restylane family of products includes Restylane®, Restylane-L®, Restylane® Lyft with Lidocaine, Restylane® Silk, Restylane® Refyne, and Restylane® Defyne. Restylane® and Restylane-L® are for mid-to-deep injection into the facial tissue for the correction of moderate to severe facial wrinkles and folds, such as nasolabial folds. Restylane® and Restylane-L® are also indicated for injection into the lips in patients over the age of 21.

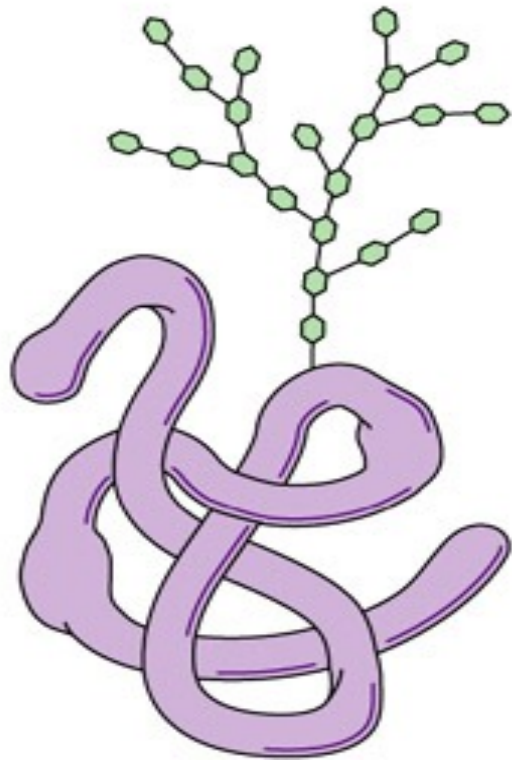


Restylane Refyne

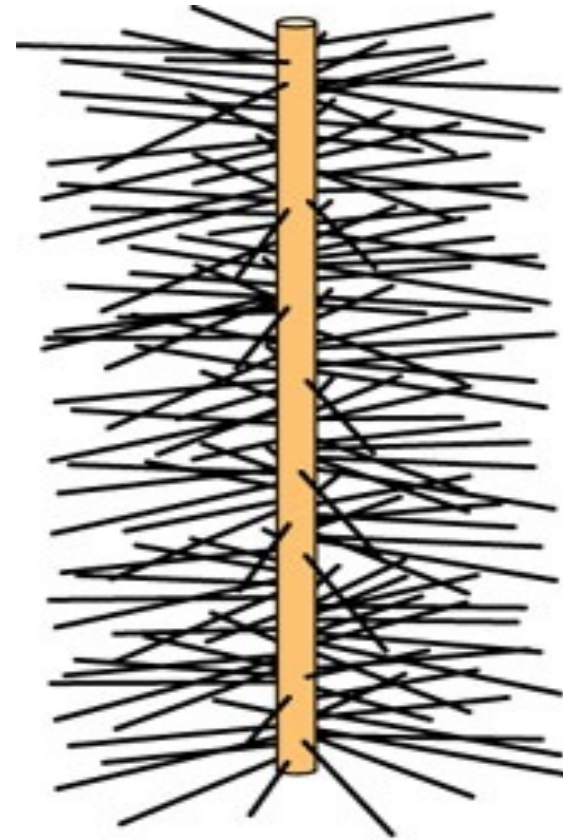


Restylane Defyne

Proteoglycans consist of a protein core with a bunch of attached GAGs. They contain more carbohydrate than protein.



Glycoproteins are globular proteins with attached carbohydrates. They contain more protein than carbohydrate.

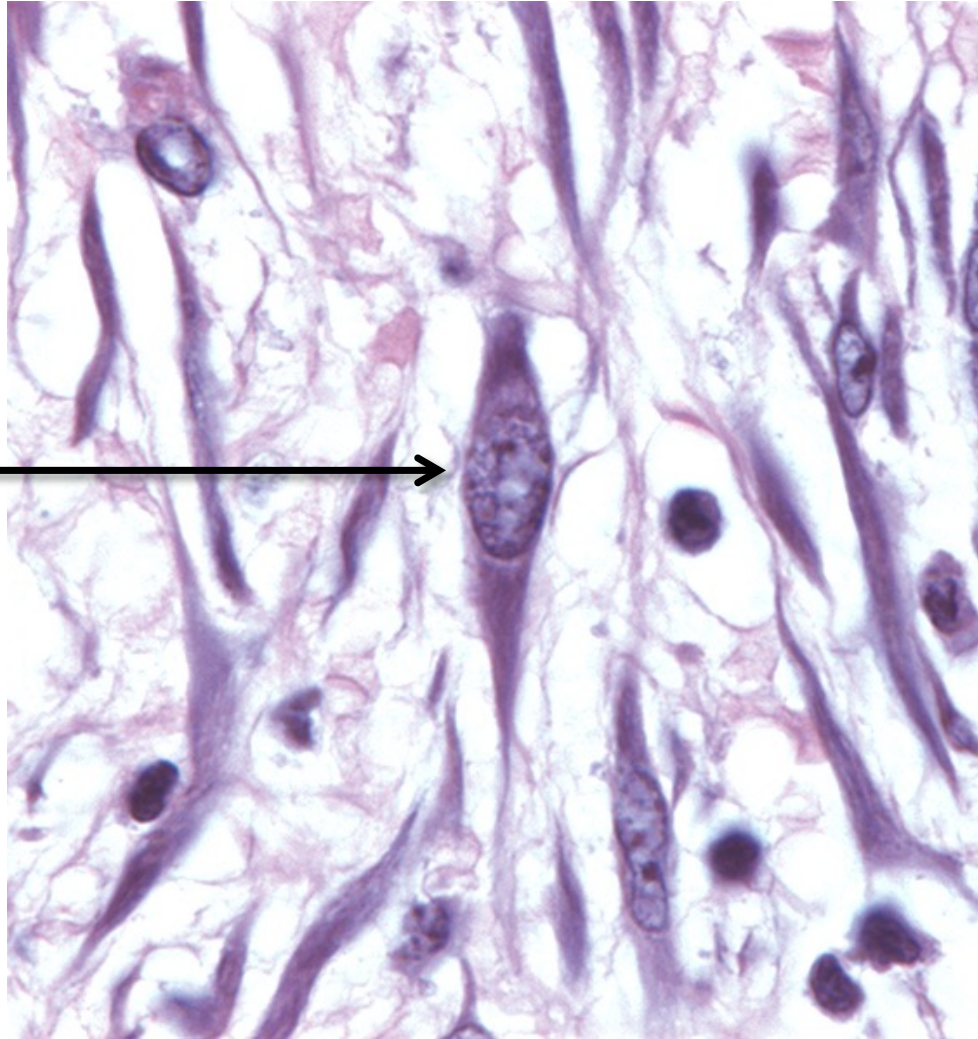


Connective Tissue Lecture Outline

- Introduction
- Extracellular matrix of connective tissue
- Cells of connective tissue

Fibroblasts

Spindle-shaped
(long, with
tapered ends)
and kind of
boring

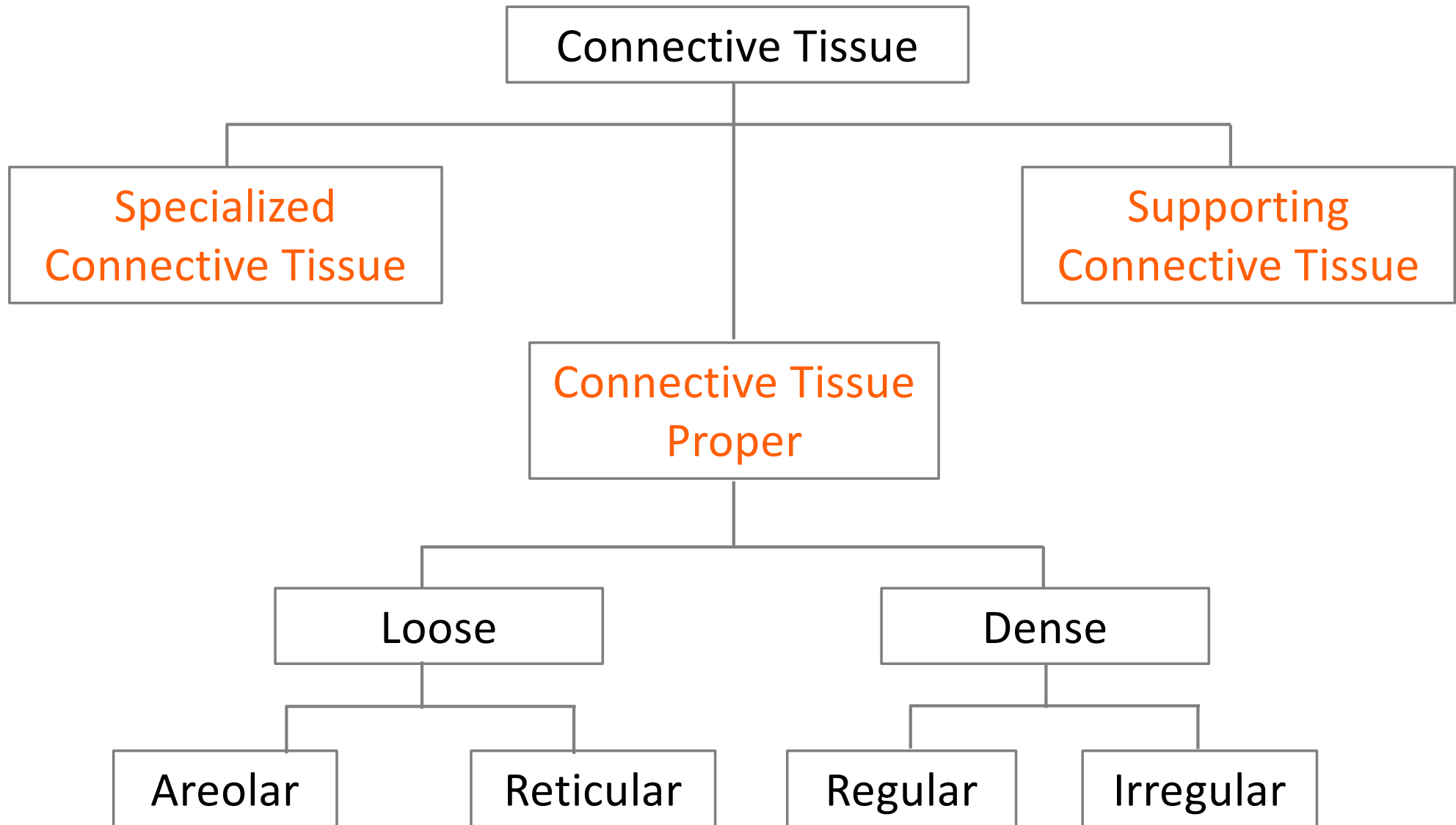


Fibroblasts are the most common cell in connective tissue.
Super active: make collagen, elastin, ground substance.

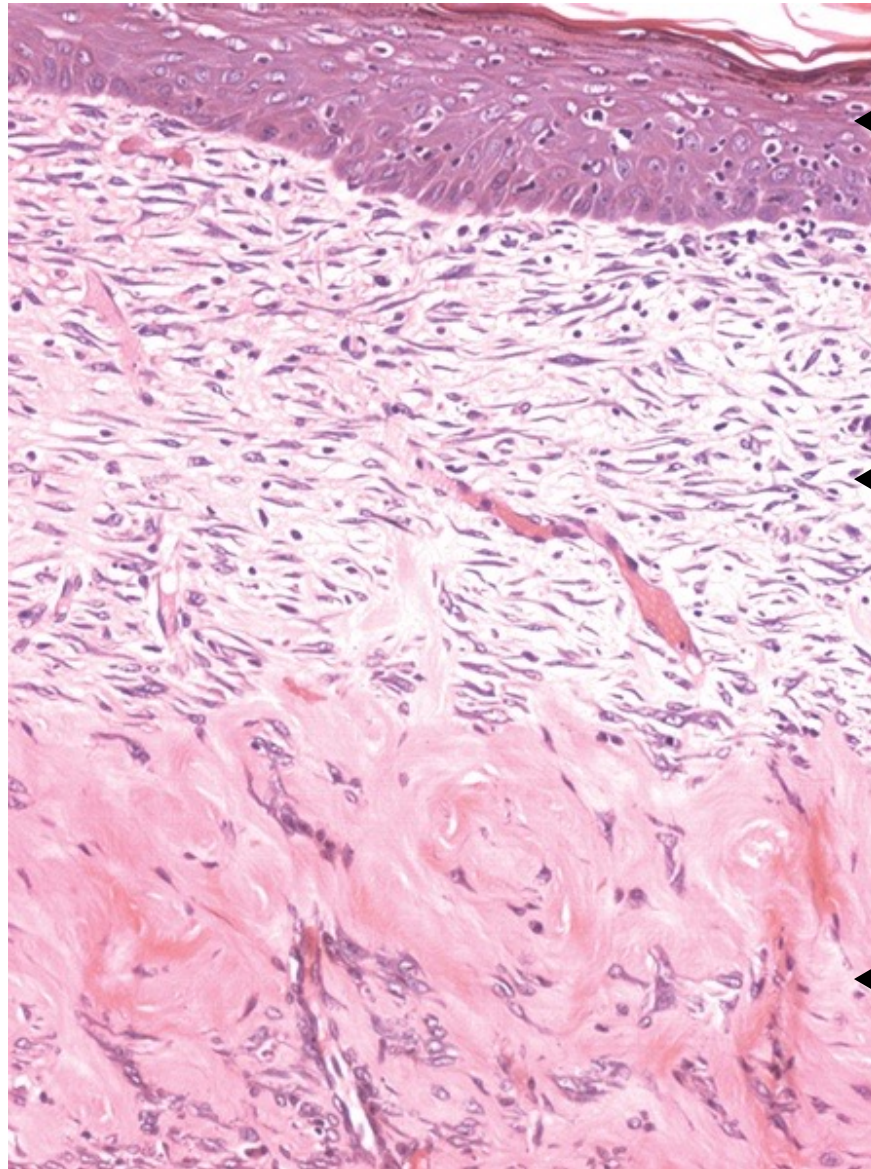
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Classification of connective tissue proper



Connective Tissue Proper in a Nutshell



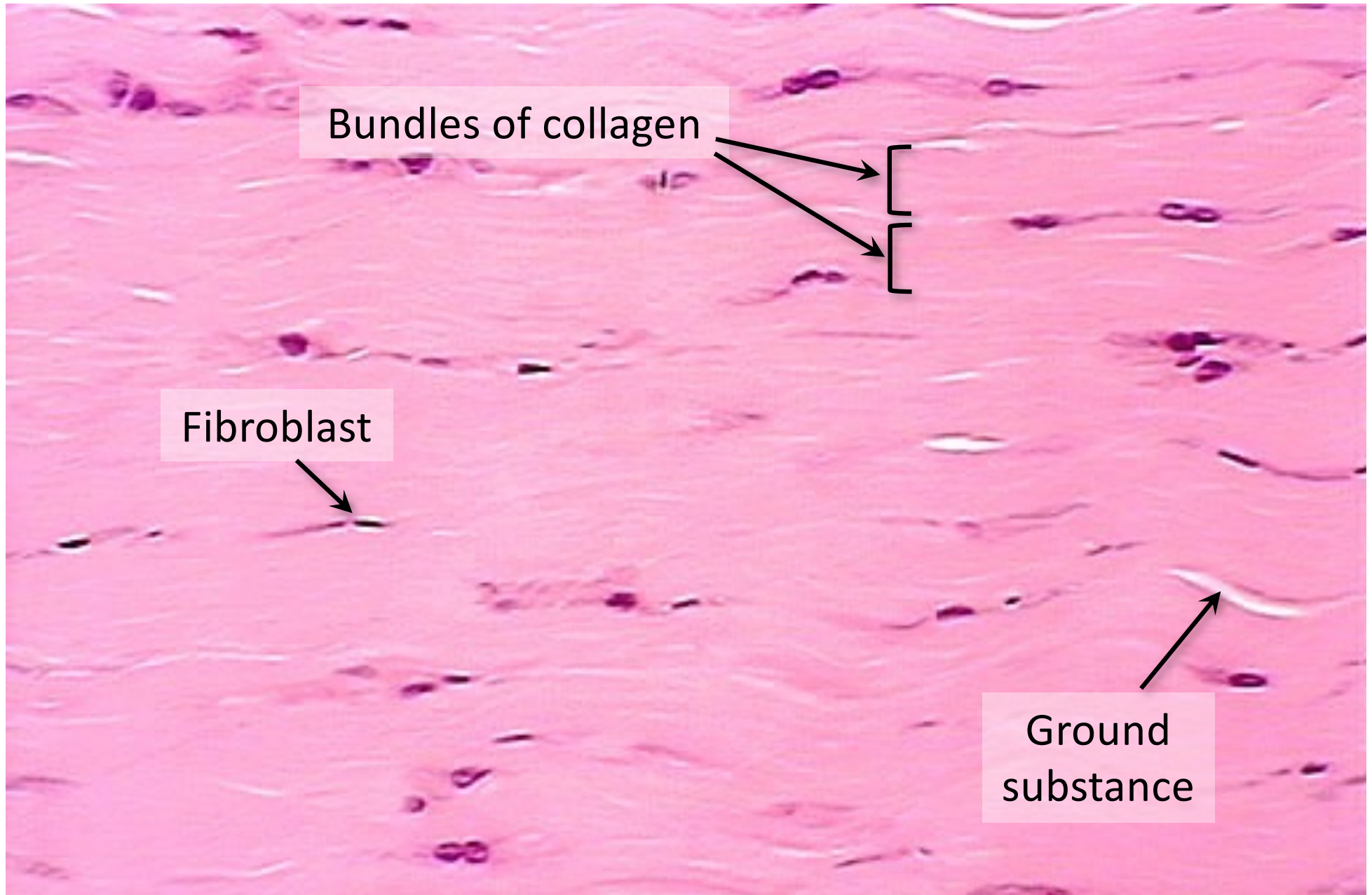
← Epithelium

← Loose connective tissue
provides delicate support

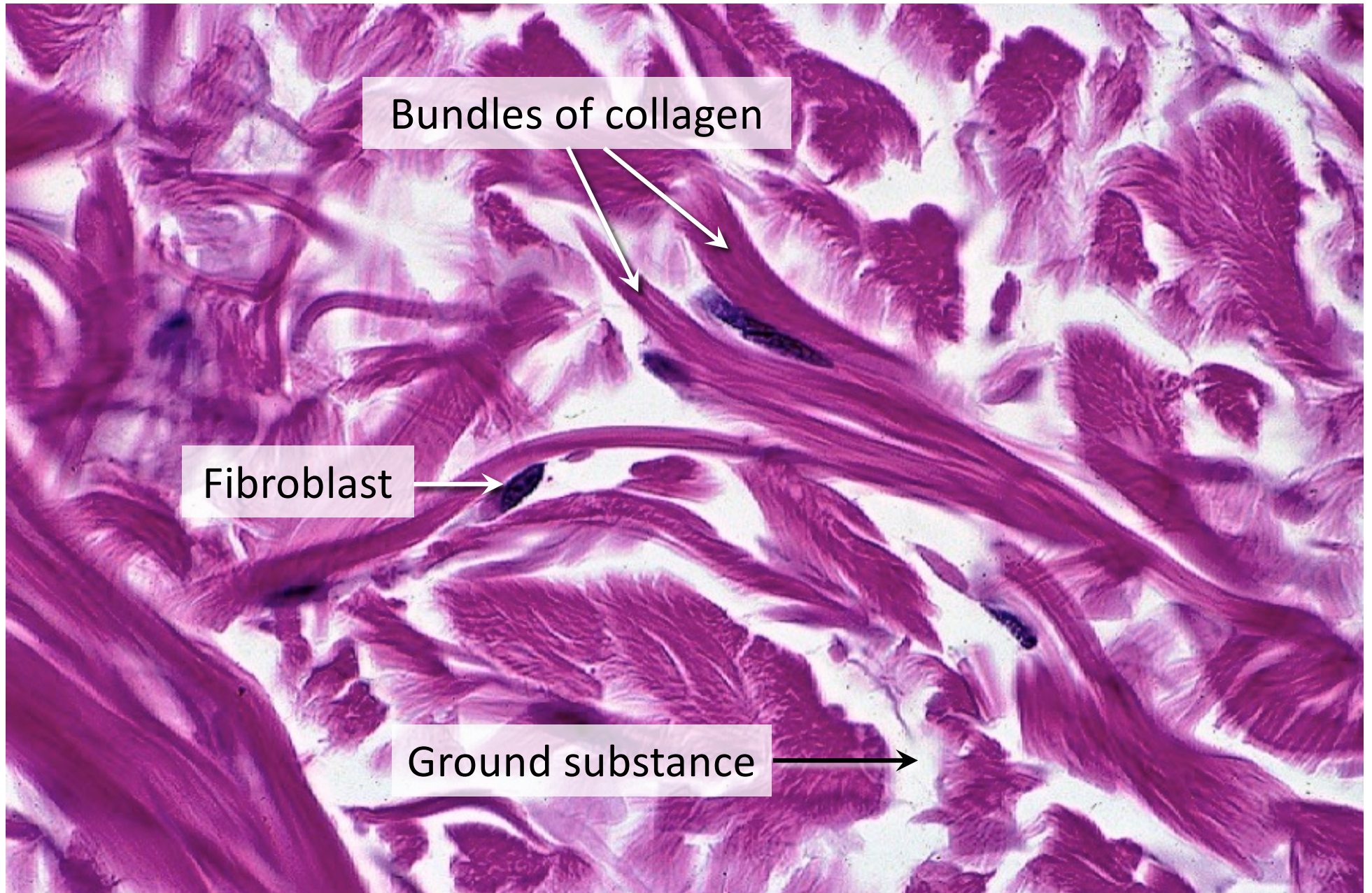
← Dense connective tissue
resists stretching forces

The Four Types of Connective Tissue Proper

Type	Microscopic Appearance	Main Function	Main Locations
Dense regular	Thick, pink collagen bundles all parallel to each other.	Resists stretching forces in one direction.	Tendons, ligaments
Dense irregular	Thick, pink collagen bundles running in different directions.	Resists stretching forces in multiple directions.	Dermis, organ capsules
Loose areolar	Lots of ground substance with scattered cells and thin fibers.	Provides delicate support and cushioning.	Under epithelium, around blood vessels
Loose reticular	Delicate network of fine type III collagen (reticular) fibers.	Provides a flexible structural framework.	Lymph nodes, spleen, bone marrow



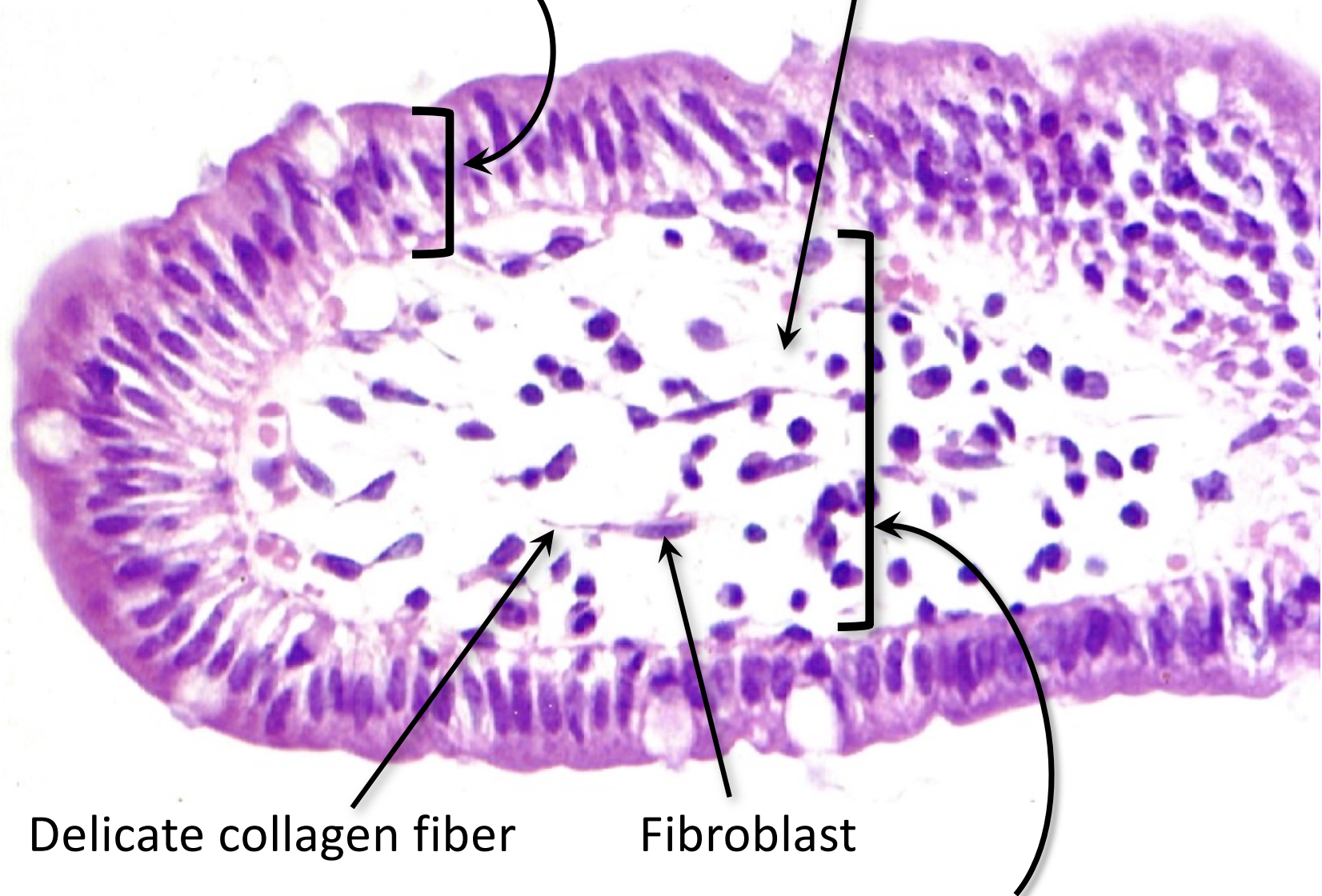
Dense regular connective tissue



Dense irregular connective tissue

Simple columnar epithelium

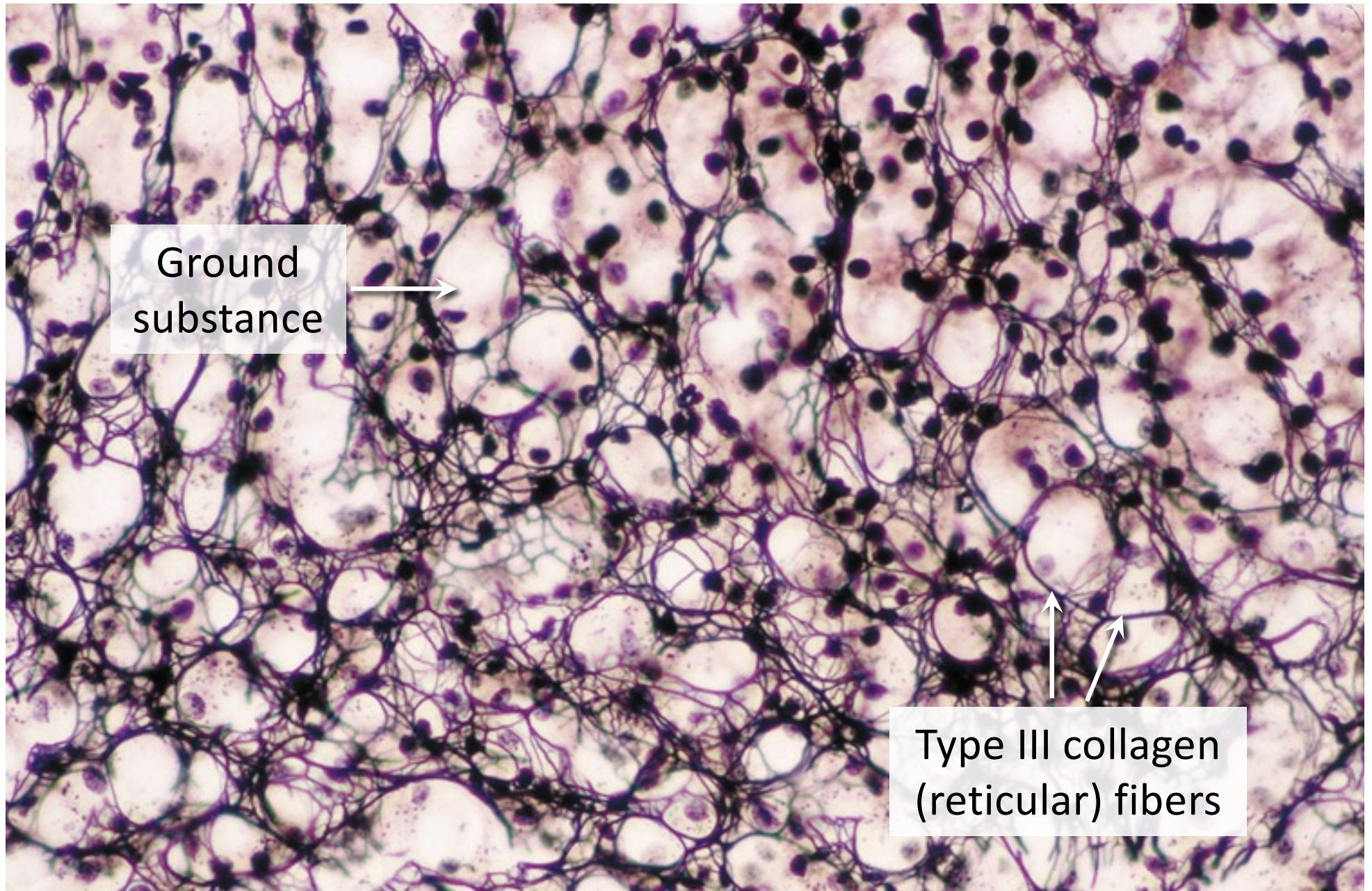
Ground substance



Delicate collagen fiber

Fibroblast

Loose areolar connective tissue



Loose reticular connective tissue