

# **HISTOLOGY DRAWINGS**

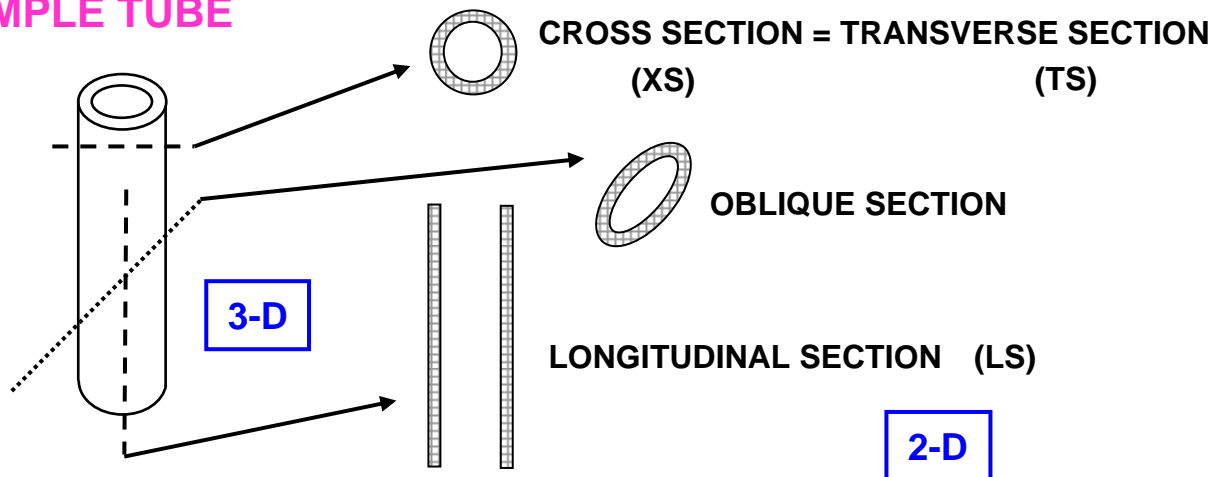
**created by Dr Carol Lazer  
during the period 2000-2005**

## **INTRODUCTION**

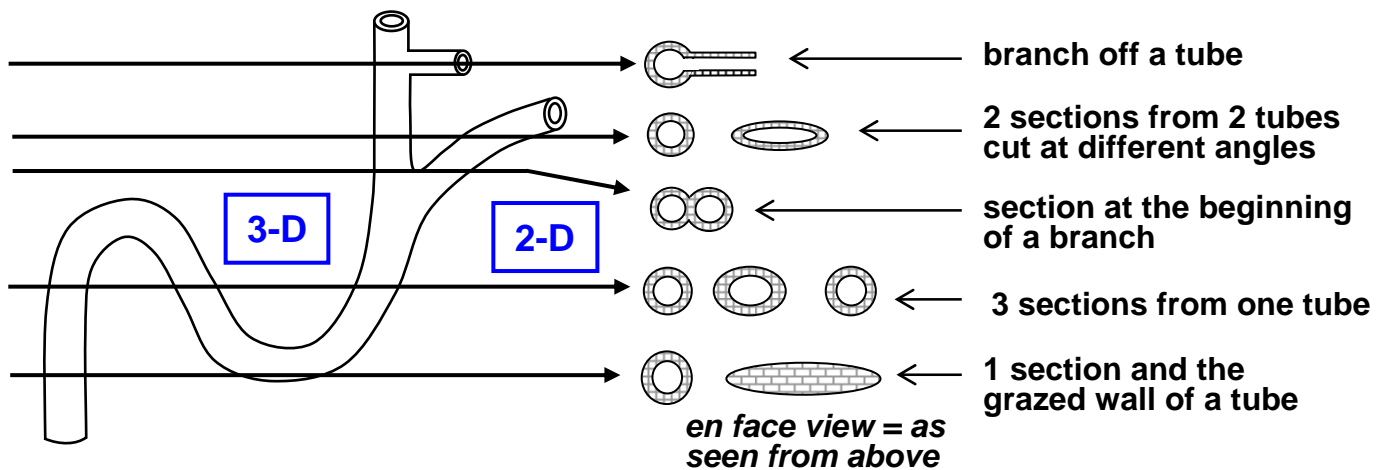
- The first pages illustrate introductory concepts for those new to microscopy as well as definitions of commonly used histology terms.
- The drawings of histology images were originally designed to complement the histology component of the first year Medical course run prior to 2004.
- They are sketches from selected slides used in class from the teaching slide set.
- These labelled diagrams should closely follow the current Science courses in histology, anatomy and embryology and complement the virtual microscopy used in the current Medical course.

# STEREOLOGY: SLICING A 3-D OBJECT

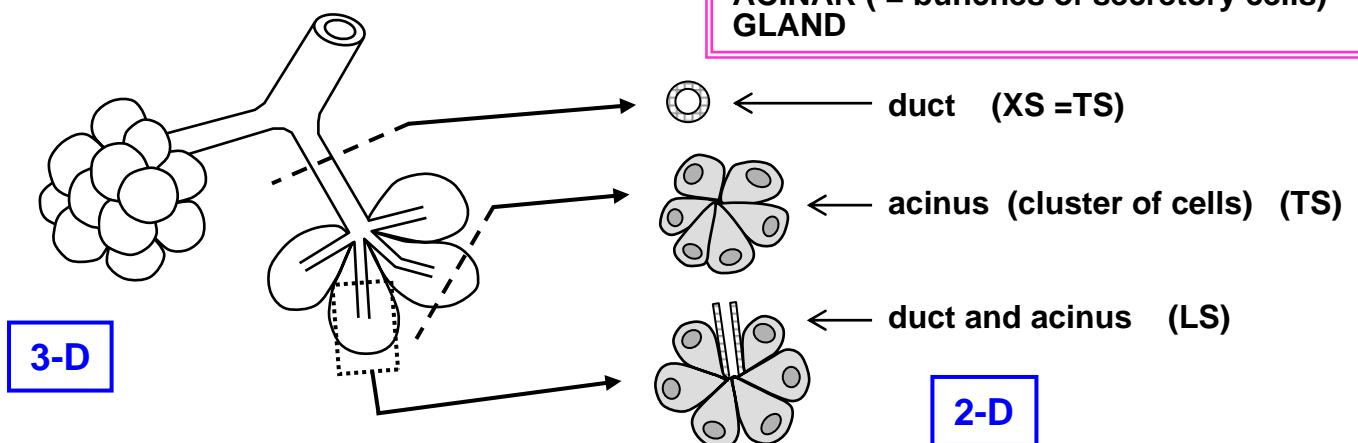
## SIMPLE TUBE



## BENDING AND BRANCHING TUBE



## COMPLEX STRUCTURE (gland)



**COMPOUND** (= branched ducts)  
**ACINAR** (= bunches of secretory cells)  
**GLAND**

Do microscope images of 2-D slices represent a single plane of section of a 3-D structure?

*No, 2-D slices have a thickness which can vary from a sliver of one cell to several cells deep. With the limited depth of field of high power lenses it is possible to focus through the various levels within a slice.*

Do all microscope slides show 2-D slices of 3-D structures?

*No, slides can also be smears, where entire cells lie on the surface of the slide, or whole tissue mounts of very thin structures, such as mesentery.*

# LININGS, COVERINGS & TERMINOLOGY

## KEY



epithelium



connective tissue  
beneath epithelium



connective tissue,  
muscle, glands, etc

## GENERALISED SECTION OF THE BODY

**epidermis**  
(keratinised stratified  
squamous epithelium)  
**ORIGIN:** ectoderm

**SKIN**  
Covers the  
external surface.

**dermis**

**ADVENTITIA**  
Connective tissue of  
one structure meets  
connective tissue of  
another structure.

**mesothelium**  
(simple squamous epithelium)  
**ORIGIN:** mesoderm

**lamina propria**

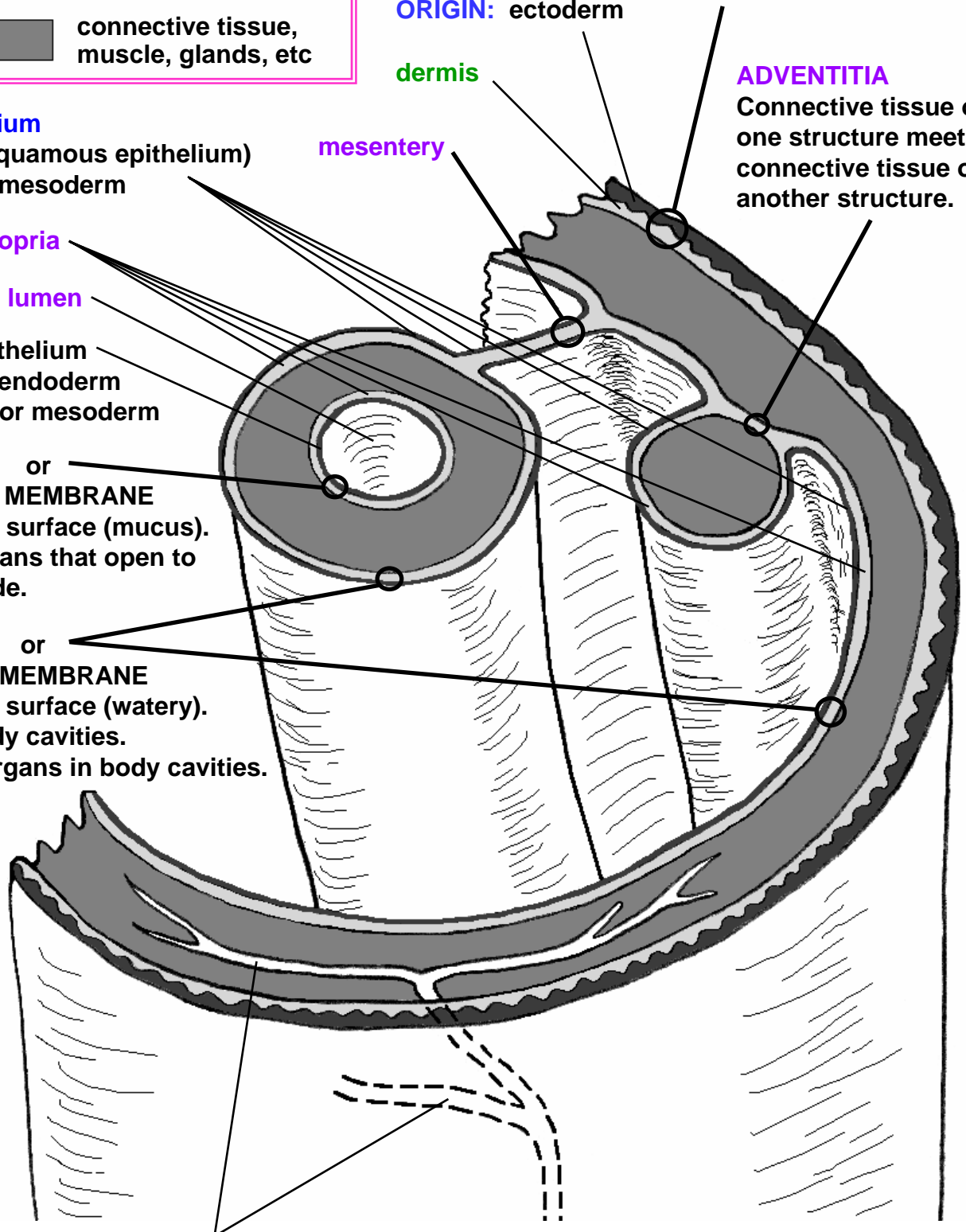
**lumen**

**lining epithelium**  
**ORIGIN:** endoderm  
or mesoderm

**MUCOSA** or  
**MUCOUS MEMBRANE**  
has a wet surface (mucus).  
Lines organs that open to  
the outside.

**SEROSA** or  
**SEROUS MEMBRANE**  
has a wet surface (watery).  
Lines body cavities.  
Covers organs in body cavities.

blood vessel lined by **endothelium**  
(simple squamous epithelium)  
**ORIGIN:** mesoderm

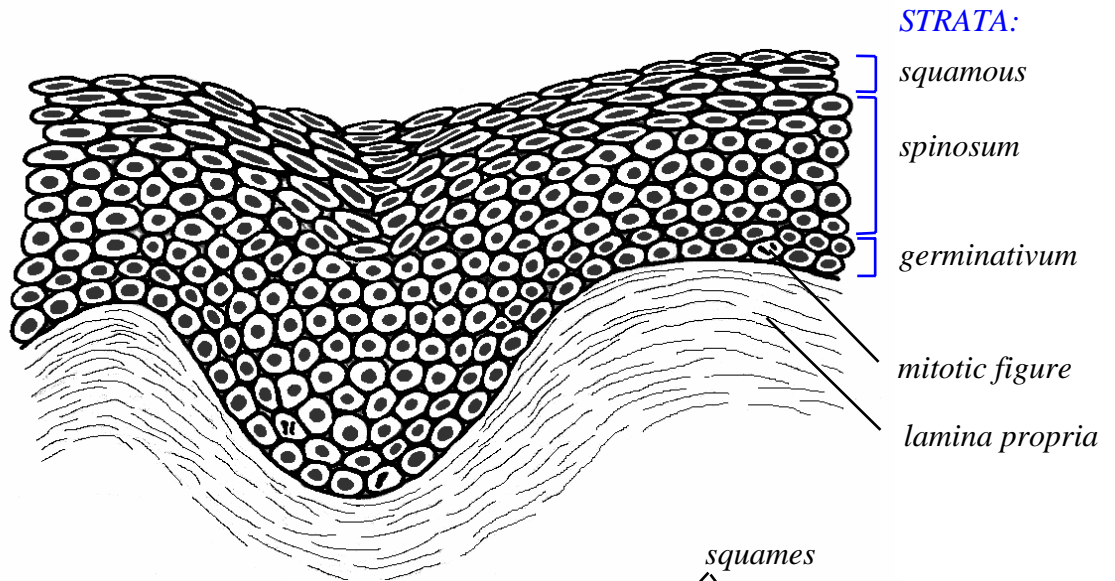


# COVERING AND LINING EPITHELIA

## STRATIFIED EPITHELIA

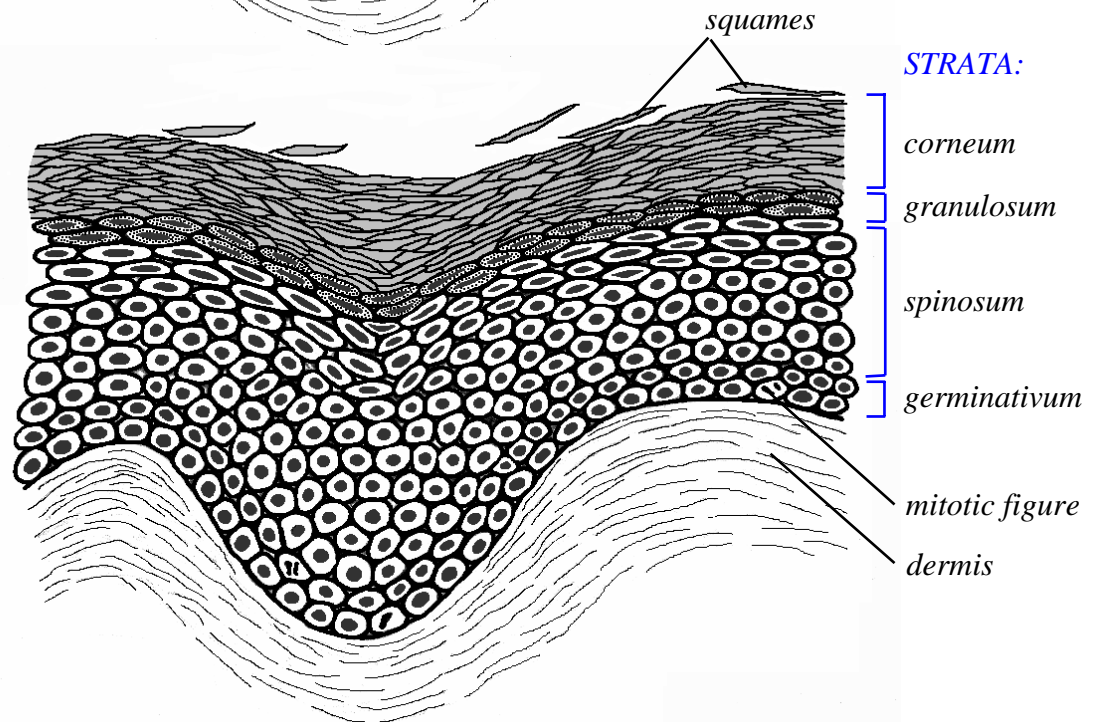
**EPITHELIUM:**  
non-keratinised  
stratified squamous

**TISSUE / ORGAN:**  
oesophagus



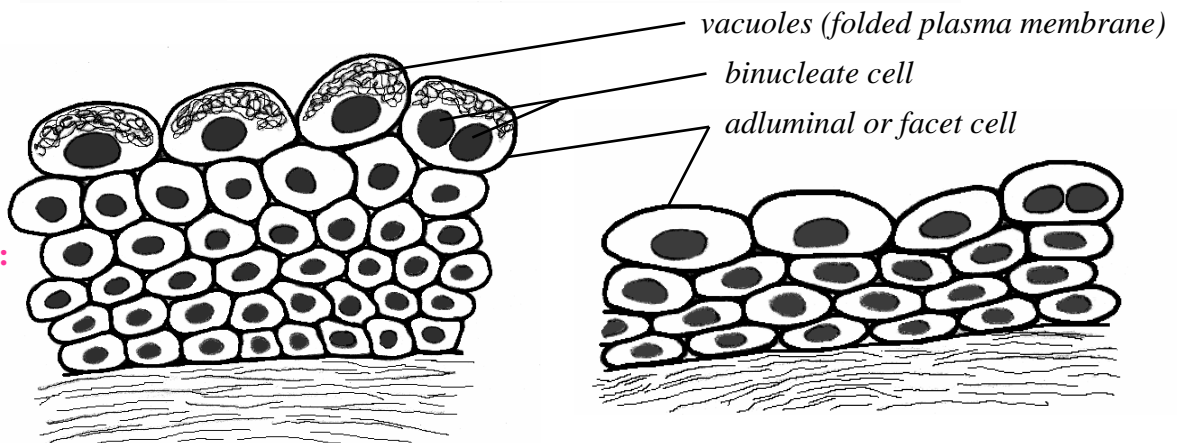
**EPITHELIUM:**  
keratinised  
stratified squamous

**TISSUE / ORGAN:**  
skin (epidermis)

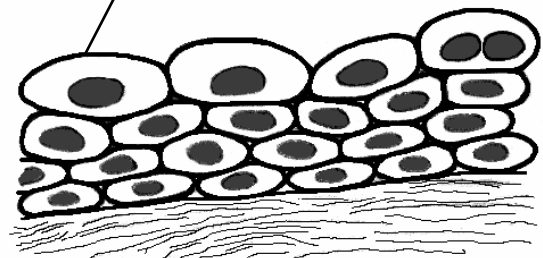


**EPITHELIUM:**  
transitional

**TISSUE / ORGAN:**  
bladder (relaxed)



**TISSUE / ORGAN:**  
bladder (stretched)



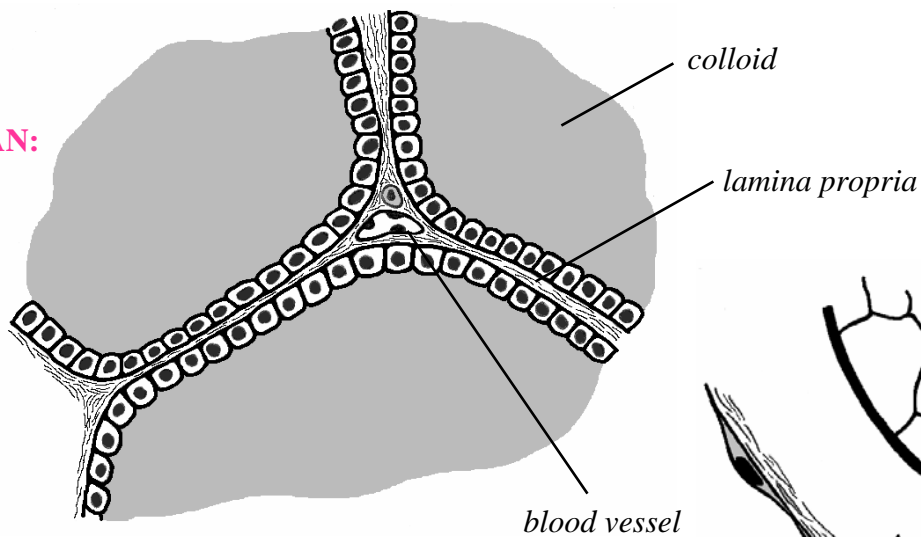
## SIMPLE EPITHELIA

### EPITHELIUM:

*simple cuboidal*

### TISSUE / ORGAN:

*thyroid*

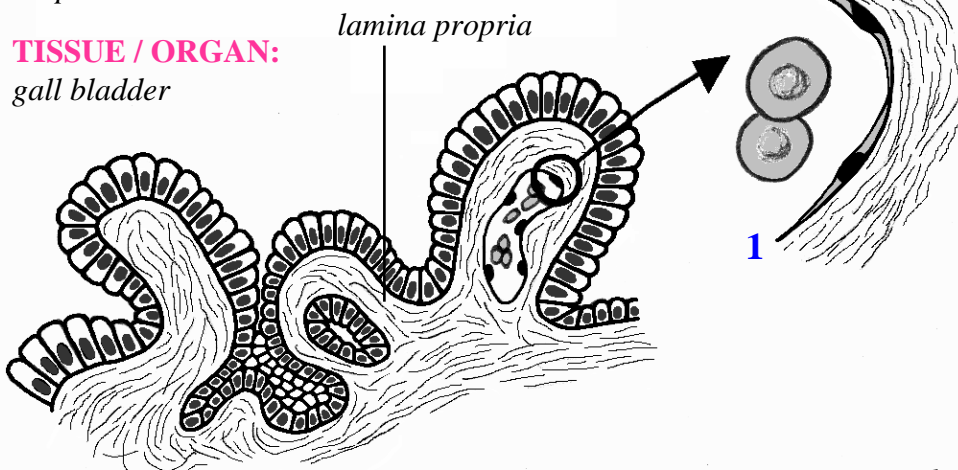


### EPITHELIUM:

*simple columnar*

### TISSUE / ORGAN:

*gall bladder*

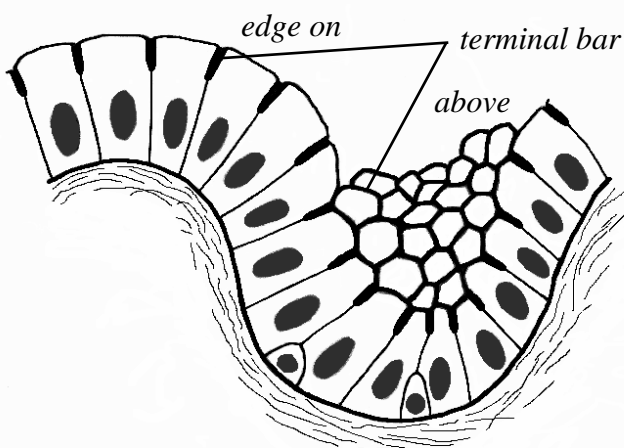
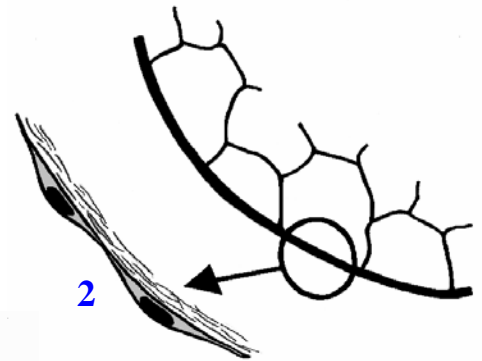


### EPITHELIUM:

*simple squamous*

### TISSUES / ORGANS:

- 1 endothelium lining blood vessel
- 2 mesothelium of serosa covering lung

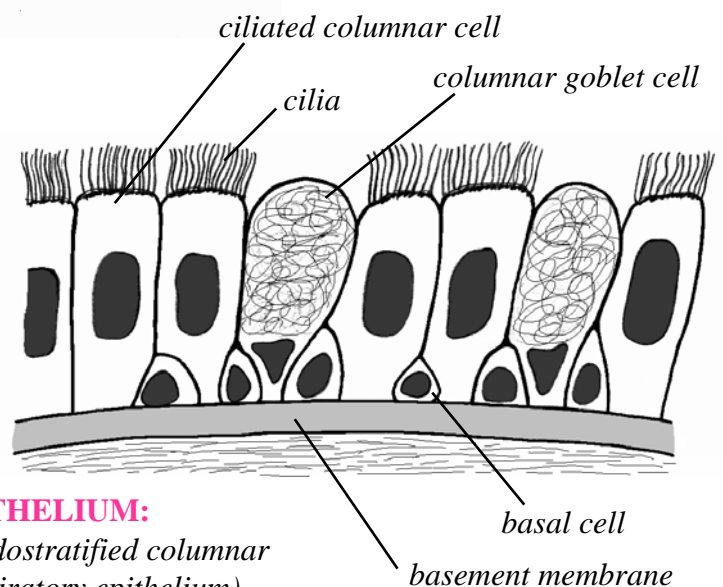


### EPITHELIUM:

*simple columnar or pseudostratified columnar*

### TISSUE / ORGAN:

*seminal vesicle (ox)*



### EPITHELIUM:

*pseudostratified columnar (respiratory epithelium)*

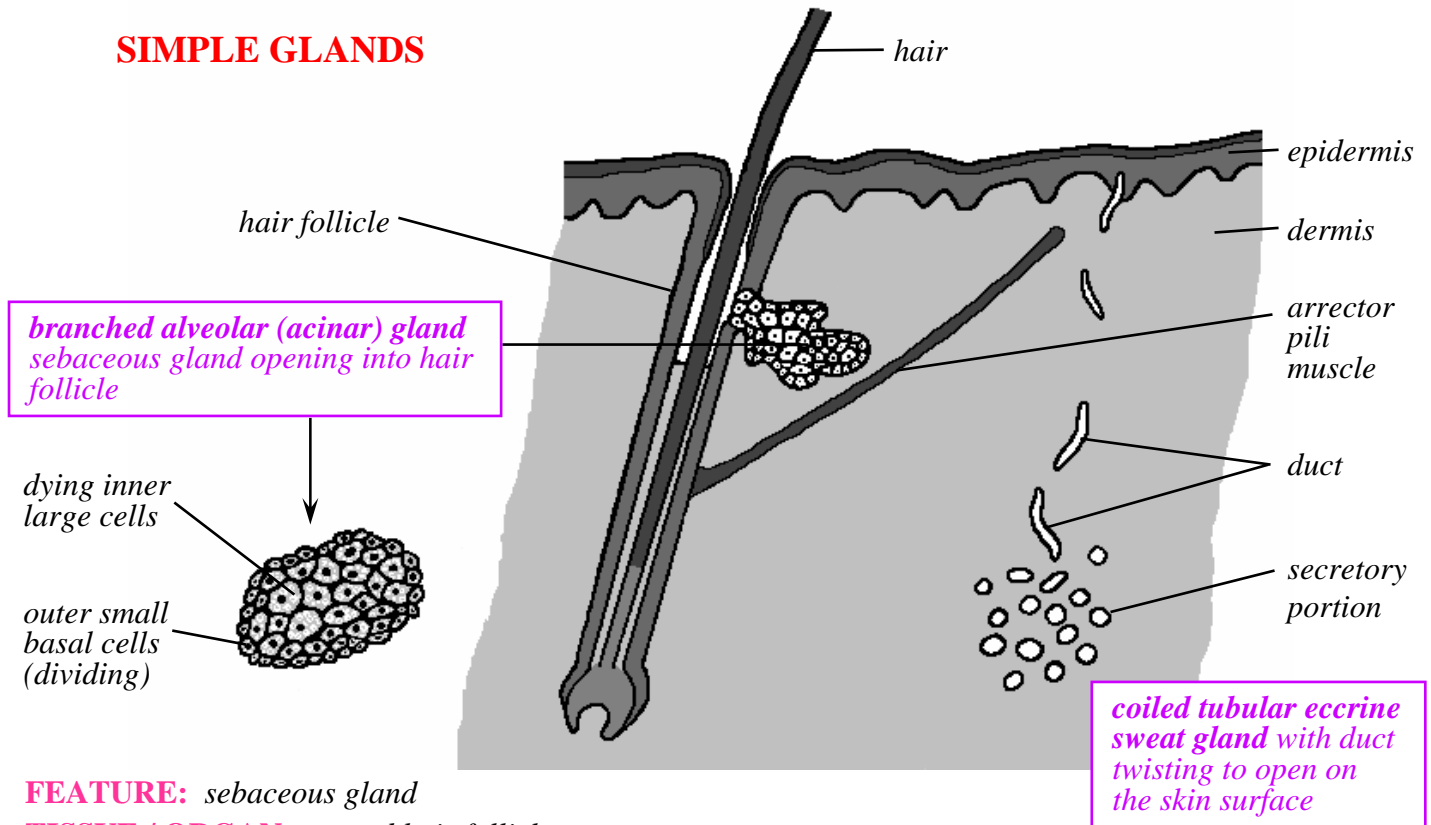
*MORE FULLY: pseudostratified ciliated columnar epithelium with goblet cells*

### TISSUE / ORGAN:



# EXOCRINE GLANDS & DUCTS

## SIMPLE GLANDS

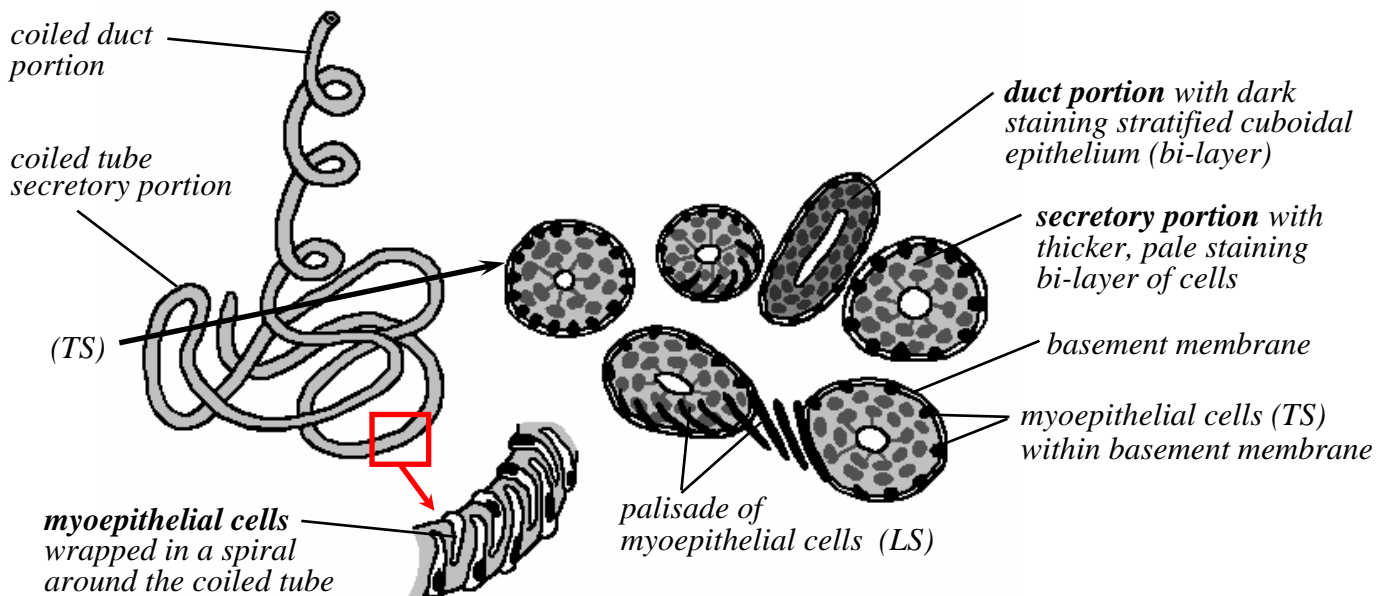


**FEATURE:** sebaceous gland

**TISSUE / ORGAN:** around hair follicle  
in dermis of skin

**FEATURE:** eccrine sweat gland

**TISSUE / ORGAN:** dermis of skin  
(also in hypodermis)



**FEATURE:** duct and secretory portions,  
myoepithelial cells

**TISSUE / ORGAN:** eccrine sweat gland

Are myoepithelial cells only present around sweat glands and what is their function?

They are found around the secretory acini and some ducts of many glands. They contract under autonomic nervous control to expel the glandular secretions.

## COMPOUND GLAND

### GLAND STRUCTURE

lobe  
lobule  
layers of connective tissue  
connective tissue septum (between lobules)  
secretory tube and acinus

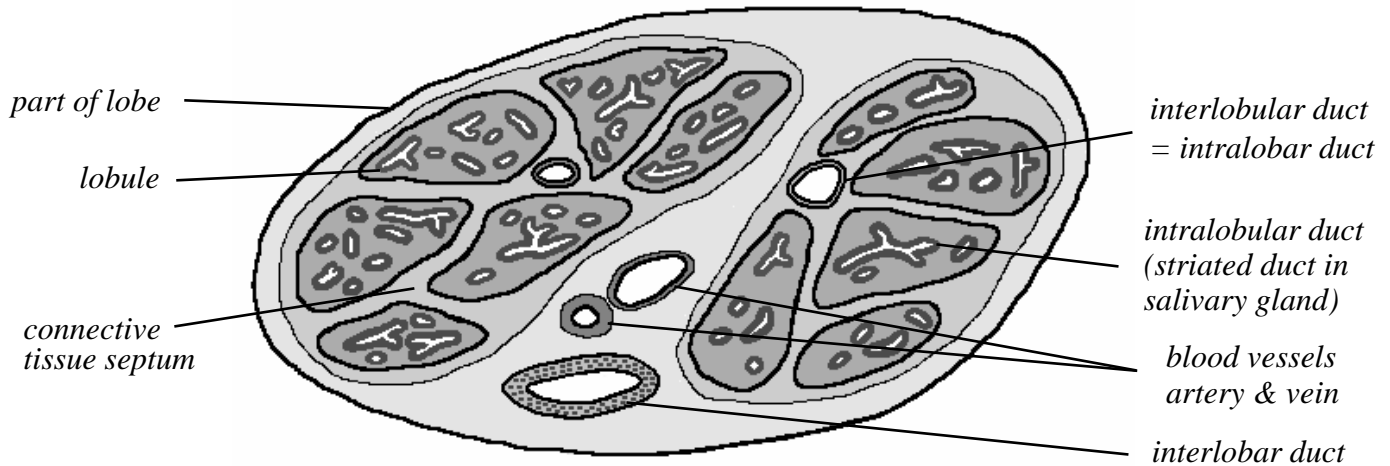
### DUCT ORGANISATION

interlobar duct = excretory duct  
[drains the lobes of a gland]  
interlobular duct = intralobar duct  
[drains many lobules in a lobe]  
intralobular duct (e.g. striated duct)  
[drains many acini in a lobule]  
intercalated duct  
[drains each acinus]

acinus = alveolus = adenomere

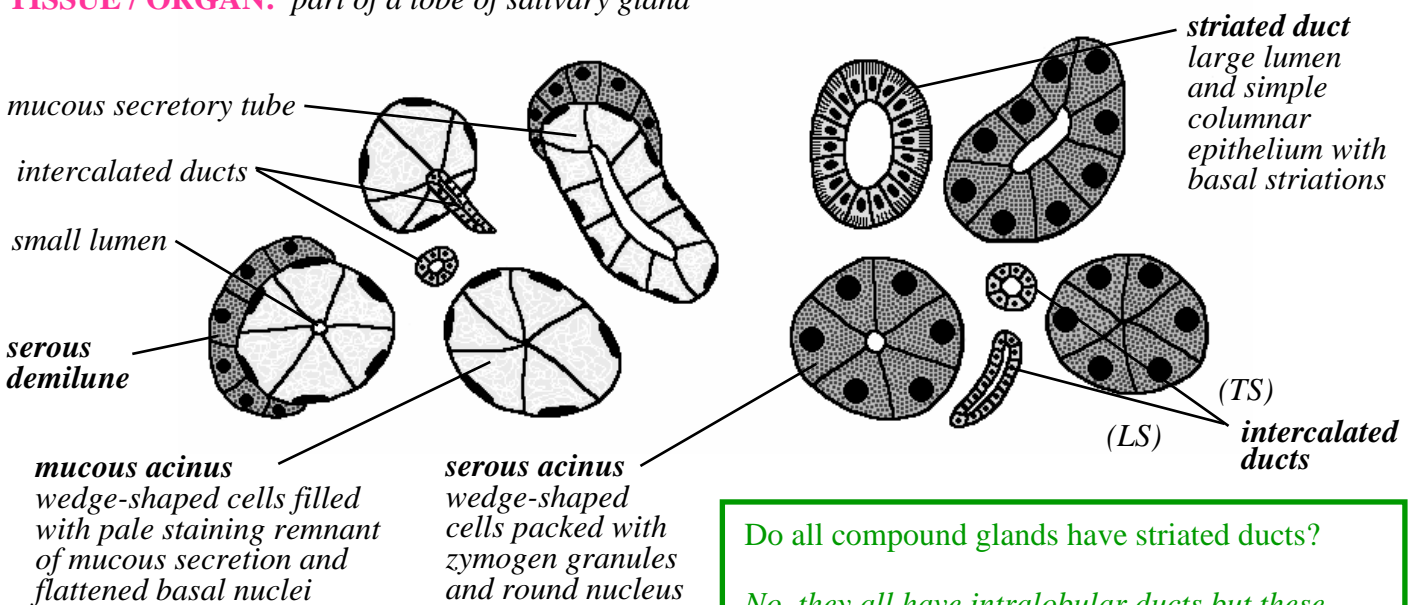
**FEATURE:** lobe, lobules and ducts

**TISSUE / ORGAN:** compound tubulo-alveolar (tubulo-acinar) gland



**FEATURE:** lobe, lobules and ducts (TS)

**TISSUE / ORGAN:** part of a lobe of salivary gland



**FEATURE:** serous and mucous acini and ducts

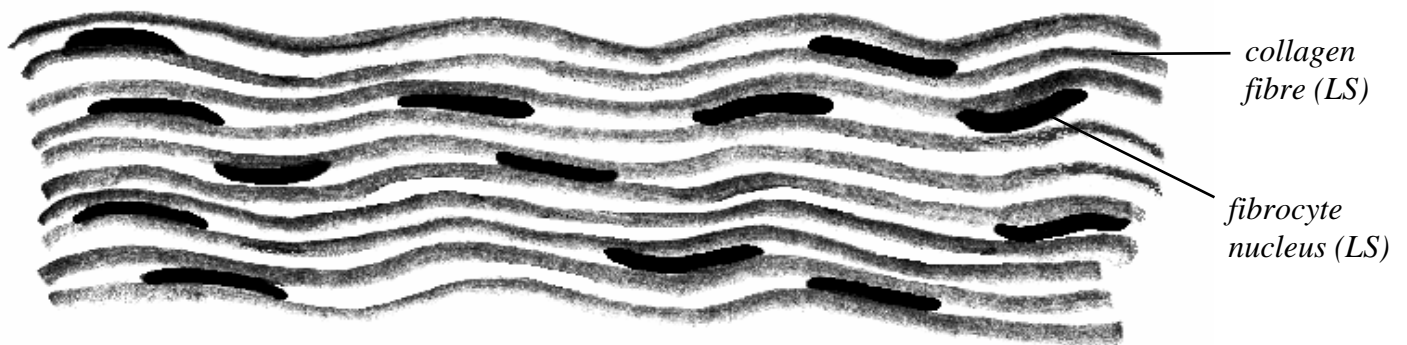
**TISSUE / ORGAN:** submandibular salivary gland

Do all compound glands have striated ducts?

No, they all have intralobular ducts but these have a characteristic appearance in the salivary gland and so have a different name.

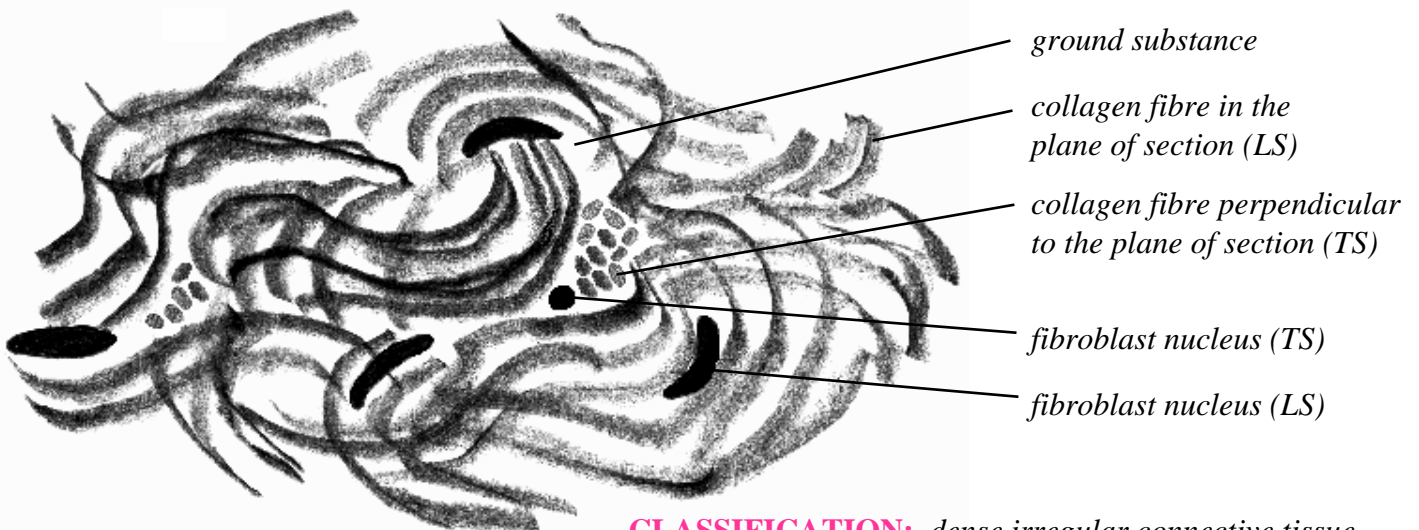
# CONNECTIVE TISSUE

## DENSE CONNECTIVE TISSUE



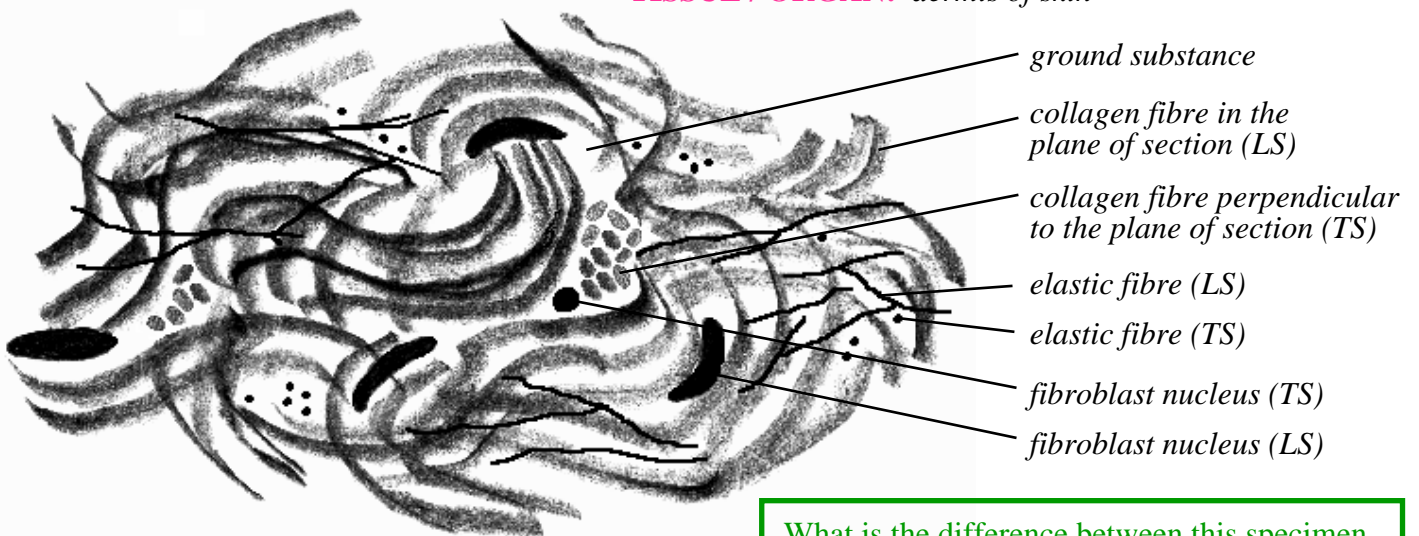
**CLASSIFICATION:** dense regular connective tissue (showing crimp pattern)

**TISSUE / ORGAN:** tendon or ligament fascicle



**CLASSIFICATION:** dense irregular connective tissue

**TISSUE / ORGAN:** dermis of skin



**CLASSIFICATION:** dense irregular connective tissue

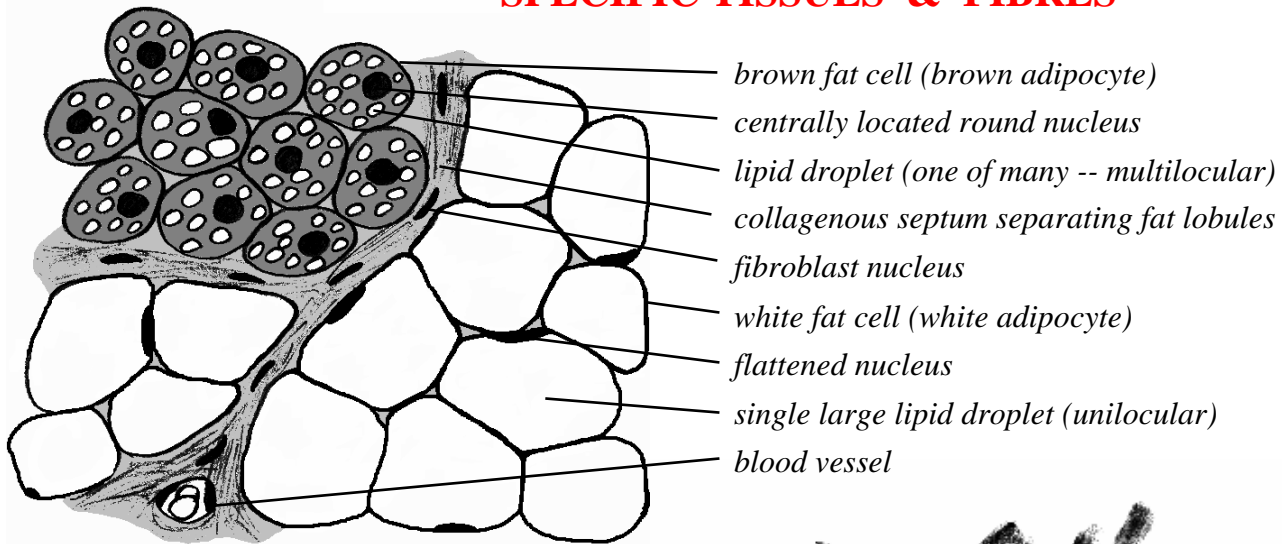
**TISSUE / ORGAN:** dermis of skin

What is the difference between this specimen and the one before?

*It is stained to show elastic fibres. These were always present but not seen without the special stain.*



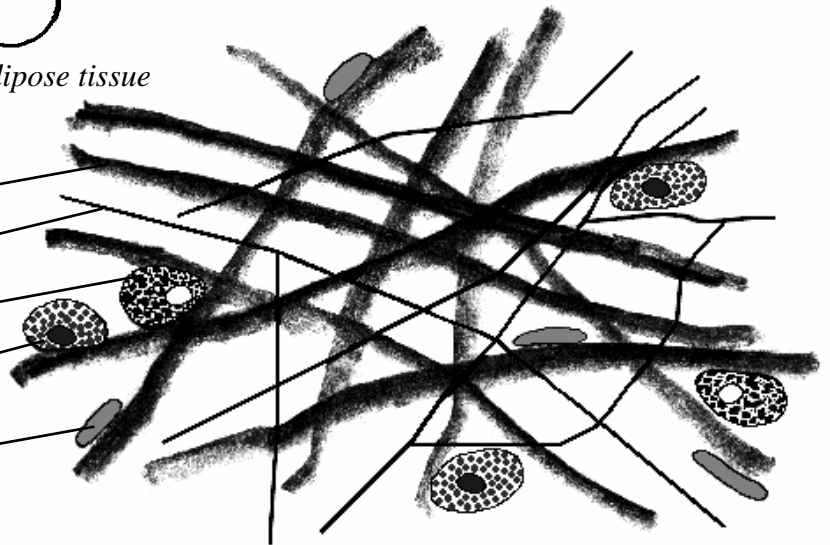
## SPECIFIC TISSUES & FIBRES



**CLASSIFICATION:** brown and white adipose tissue

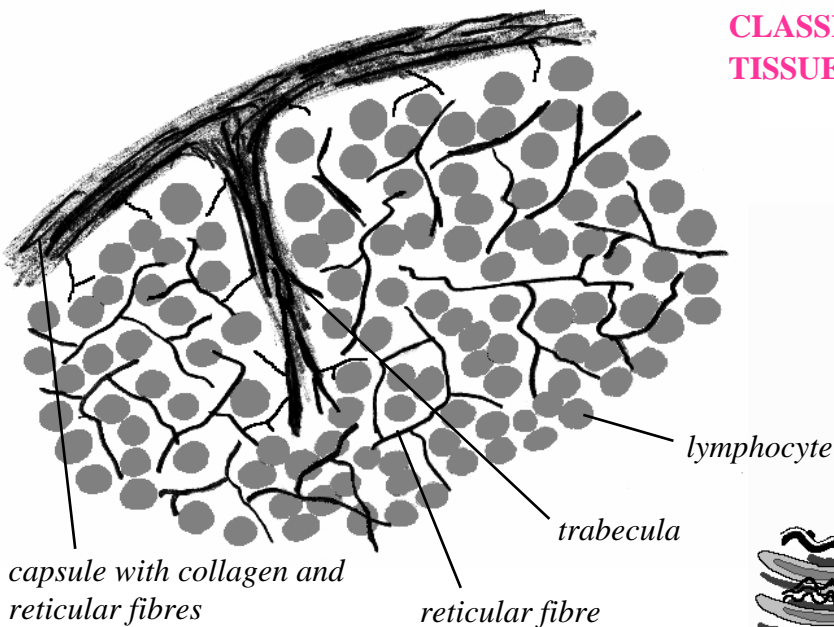
**TISSUE / ORGAN:** fat stored in body

collagen fibre  
anastomosing elastic fibre  
macrophage  
mast cell  
fibroblast nucleus



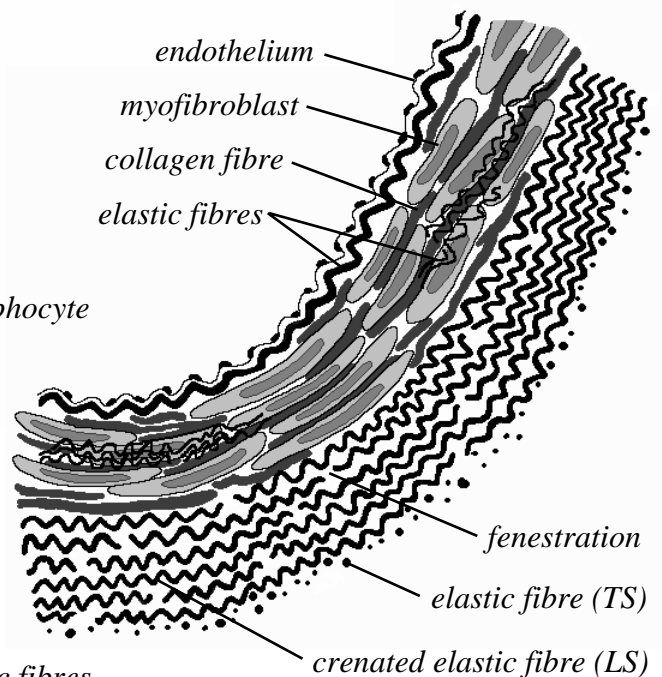
**CLASSIFICATION:** loose connective tissue

**TISSUE / ORGAN:** mesentery



**CLASSIFICATION:** reticular fibres

**TISSUE / ORGAN:** lymph node



**CLASSIFICATION:** elastic fibres

**TISSUE / ORGAN:** elastic artery (brachial artery)

## BLOOD CELLS (SMEAR)

FEATURE: blood cell types

TISSUE / ORGAN: peripheral blood

MONONUCLEAR  
LEUKOCYTES or  
AGRANULOCYTES

POLYMORPHONUCLEAR  
LEUKOCYTES or  
GRANULOCYTES

**erythrocyte**  
biconcave disc  
with pale centre

**rouleaux formation**  
stack of erythrocytes

**platelets**  
cytoplasmic  
fragments with a  
dark chromomere  
and pale hyalomere

**small lymphocyte**  
with a large, round  
nucleus and blue  
cytoplasmic rim

**monocyte**  
with a single nucleus that may  
be irregular or bean shaped  
and blue cytoplasm which may  
have tiny granules or vacuoles

Indentation of the nucleus  
(monocyte or lymphocyte)  
is caused by proximity to  
the Golgi apparatus.

**neutrophil**  
with multi-  
lobed nucleus  
and many small  
granules

**eosinophil**  
with bi-lobed  
nucleus and  
many large  
red granules  
of similar size

**basophil**  
with many  
blue granules  
of different  
size that  
obscure the  
nucleus

## BLOOD-RELATED CELLS (SECTION)

numerous red  
granules in  
cytoplasm  
overlapping  
lobes of nucleus

basophilic  
cytoplasm (rER)  
eosinophilic (or pale)  
perinuclear region  
(Golgi apparatus)  
eccentric nucleus  
(clock-faced)

FEATURE: tissue eosinophil (and plasma cells)

TISSUE / ORGAN: lamina propria of glands of  
stomach mucosa

FEATURE: plasma cell

TISSUE / ORGAN: lamina propria of salivary  
gland secretory acini

adipocyte

marrow  
cells

single, large,  
lobulated  
nucleus

eosinophilic  
cytoplasm

bone  
trabecula

osteocyte

multiple  
nuclei in  
osteoclast

eosinophilic  
cytoplasm

shrinkage  
artefact

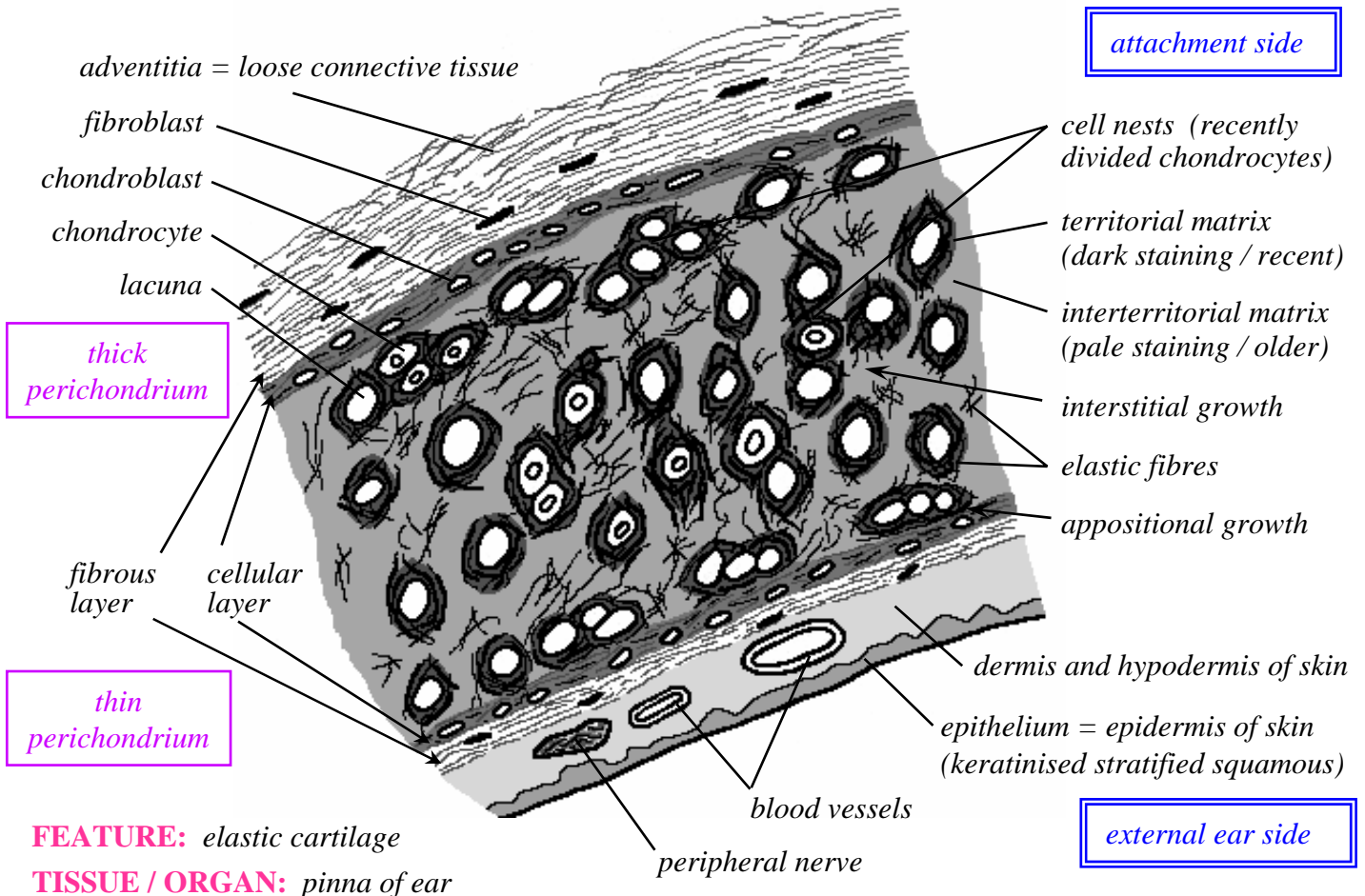
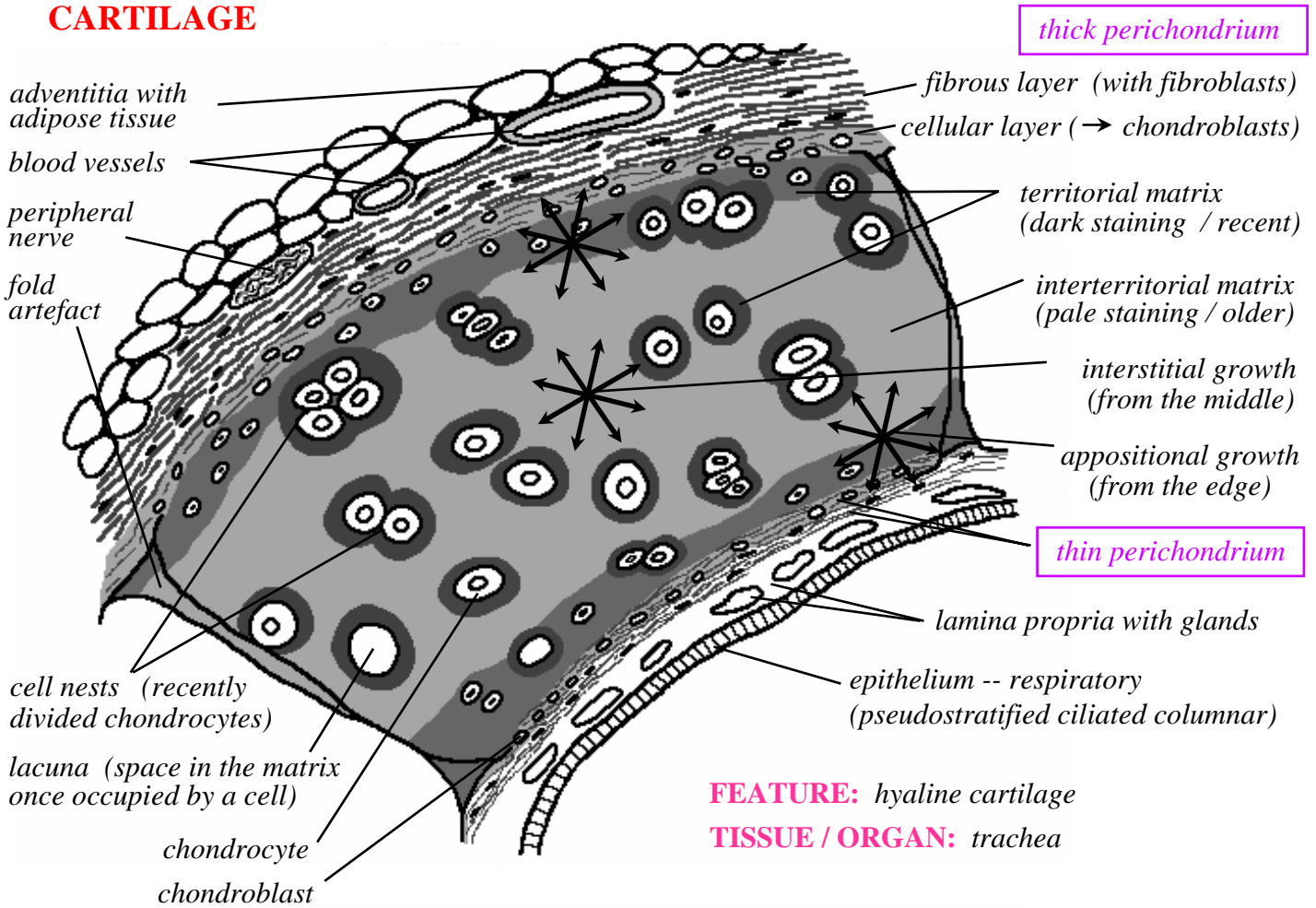
FEATURE: megakaryocyte  
TISSUE / ORGAN: bone marrow

not to be  
confused with

FEATURE: osteoclast  
TISSUE / ORGAN: bone trabecula

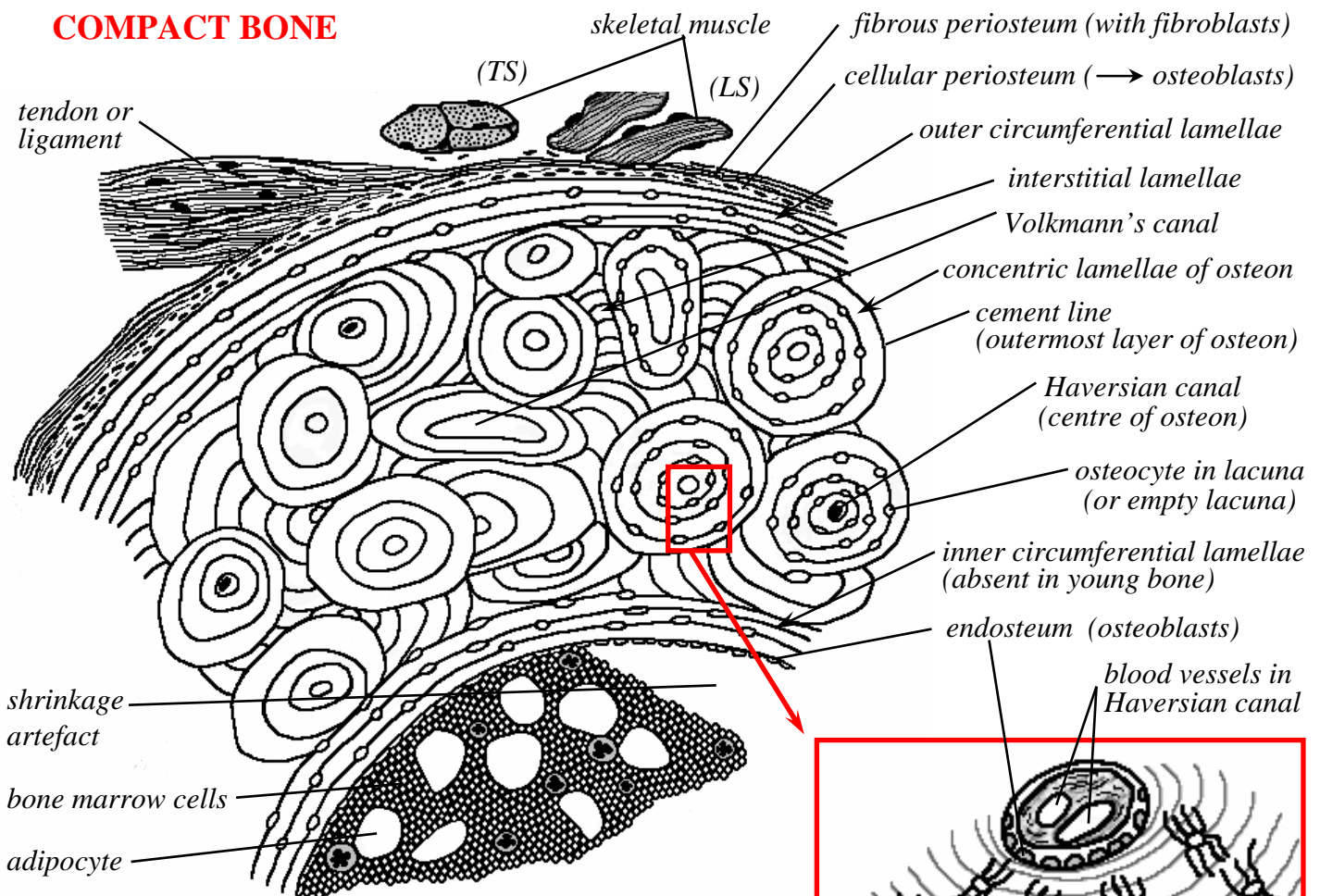
# CARTILAGE AND BONE

## CARTILAGE



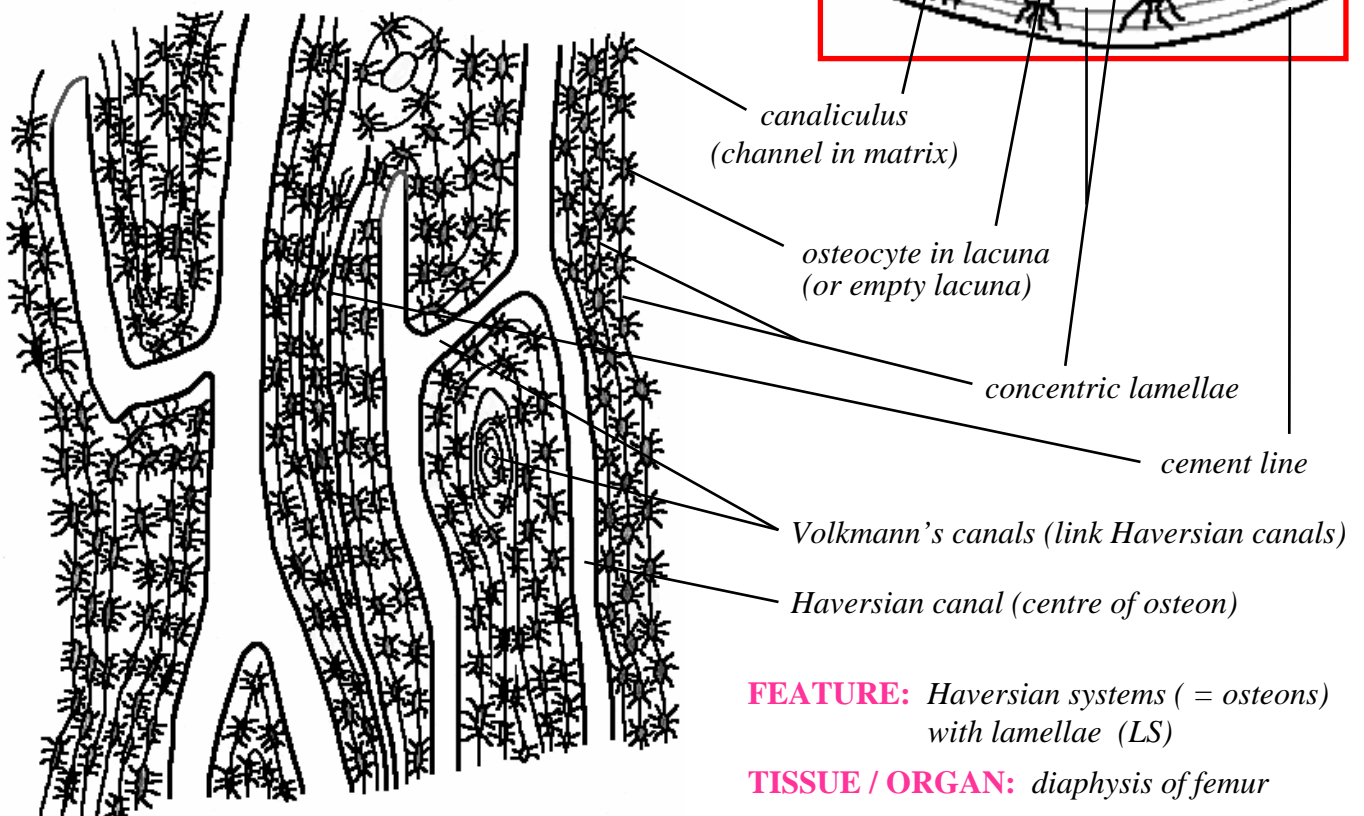
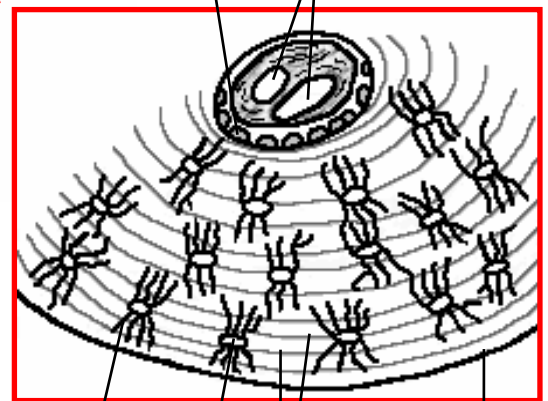


## COMPACT BONE



**FEATURE:** Haversian systems (= osteons) with lamellae (TS)

**TISSUE / ORGAN:** diaphysis (shaft) of femur

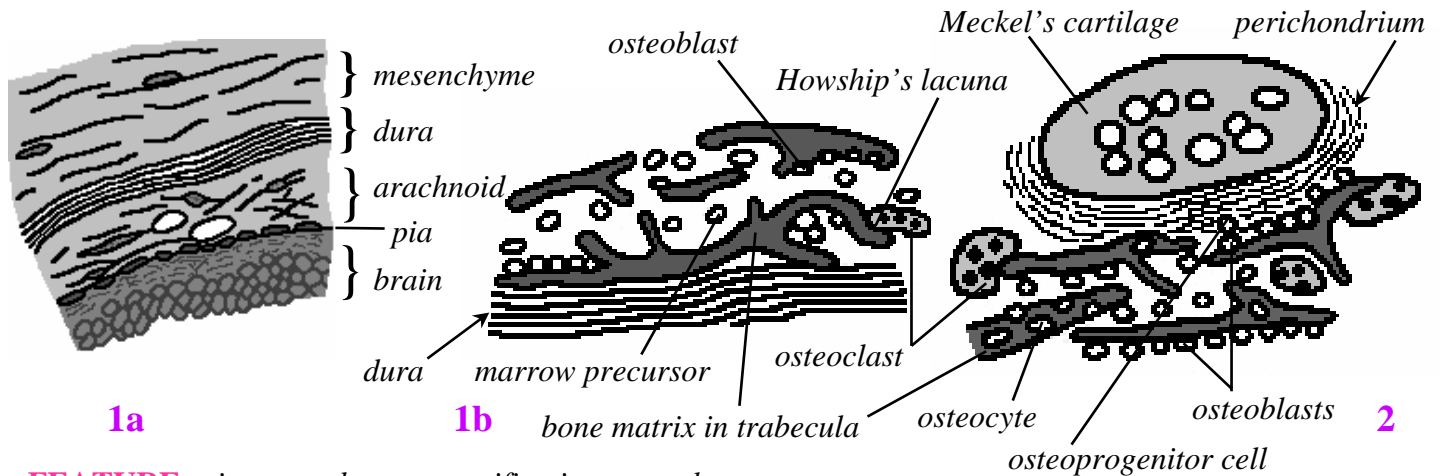


**FEATURE:** Haversian systems (= osteons) with lamellae (LS)

**TISSUE / ORGAN:** diaphysis of femur



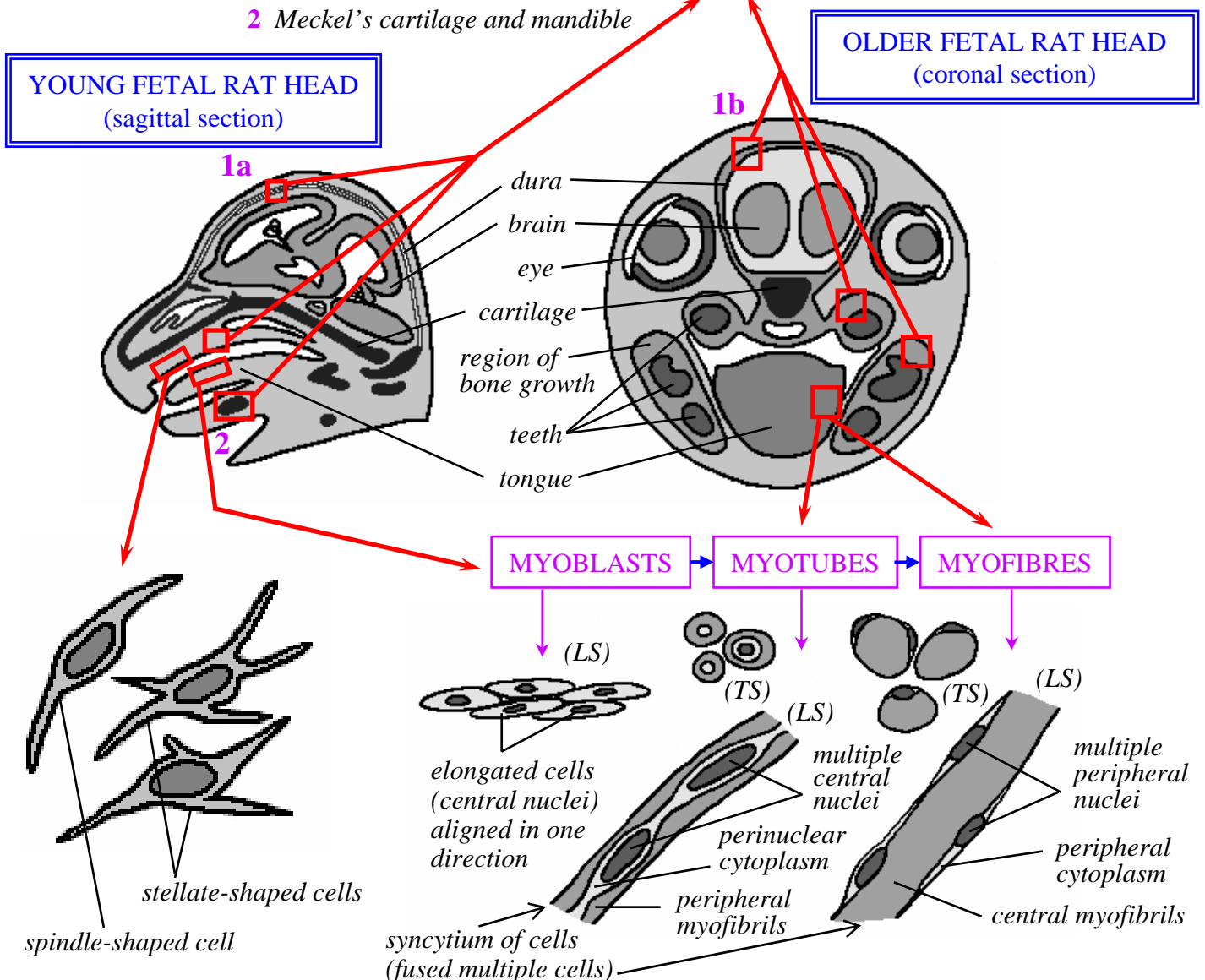
# BONE / MUSCLE FORMATION & JOINTS



**FEATURE:** intramembranous ossification examples

**TISSUE / ORGAN:** 1 dura mater and calvaria  
2 Meckel's cartilage and mandible

## INTRAMEMBRANOUS OSSIFICATION



## STRIATED MUSCLE DEVELOPMENT

**FEATURE:** spindle- and stellate-shaped cells

**TISSUE / ORGAN:** mesenchyme  
(undifferentiated mesoderm)

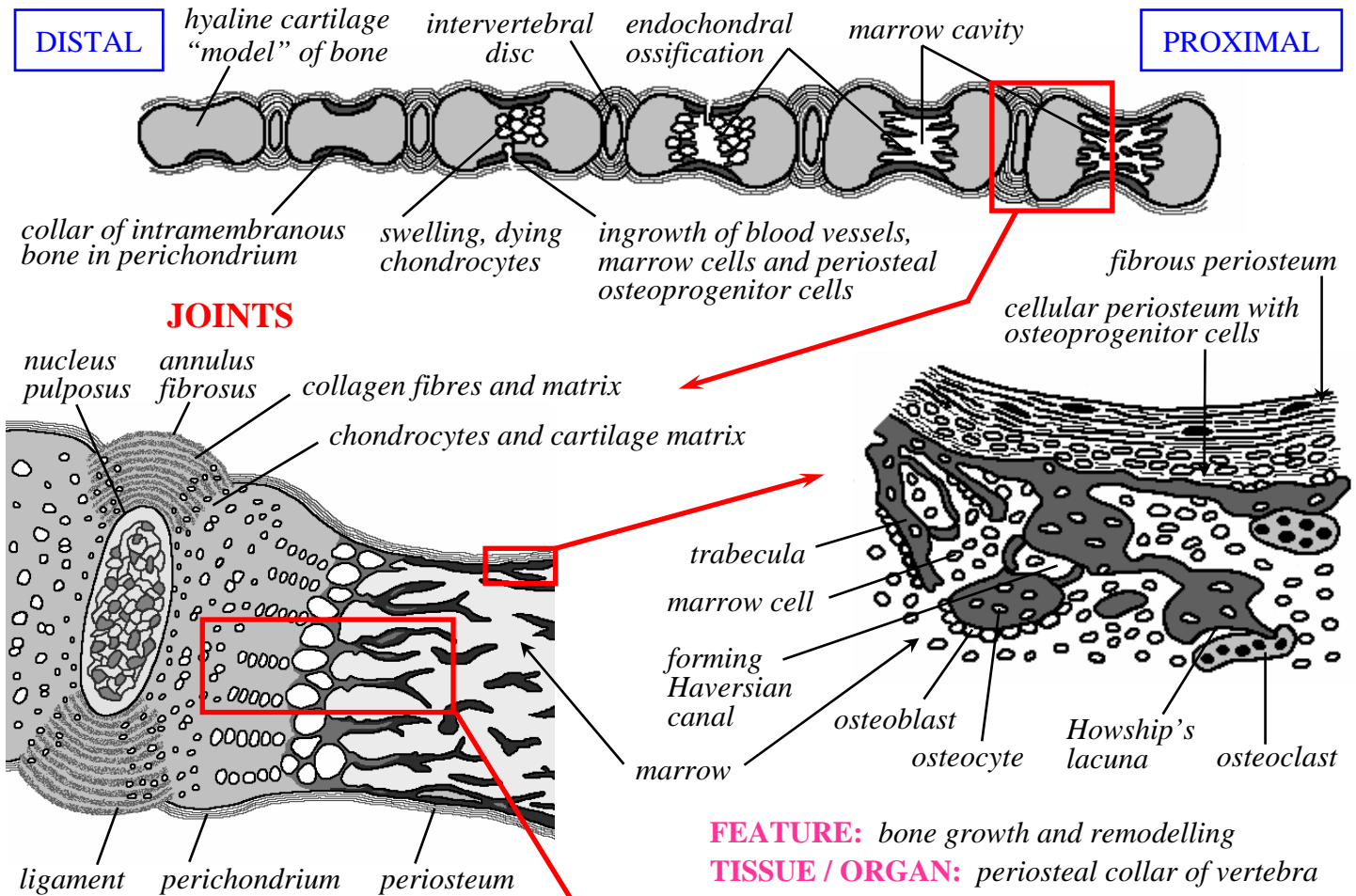
**FEATURE:** myoblasts and myotubes  
(developing striated muscle cells)

**TISSUE / ORGAN:** fetal tongue

## OSSIFICATION & JOINTS

**FEATURE:** stages in long bone development

**TISSUE / ORGAN:** fetal rat tail



### JOINTS

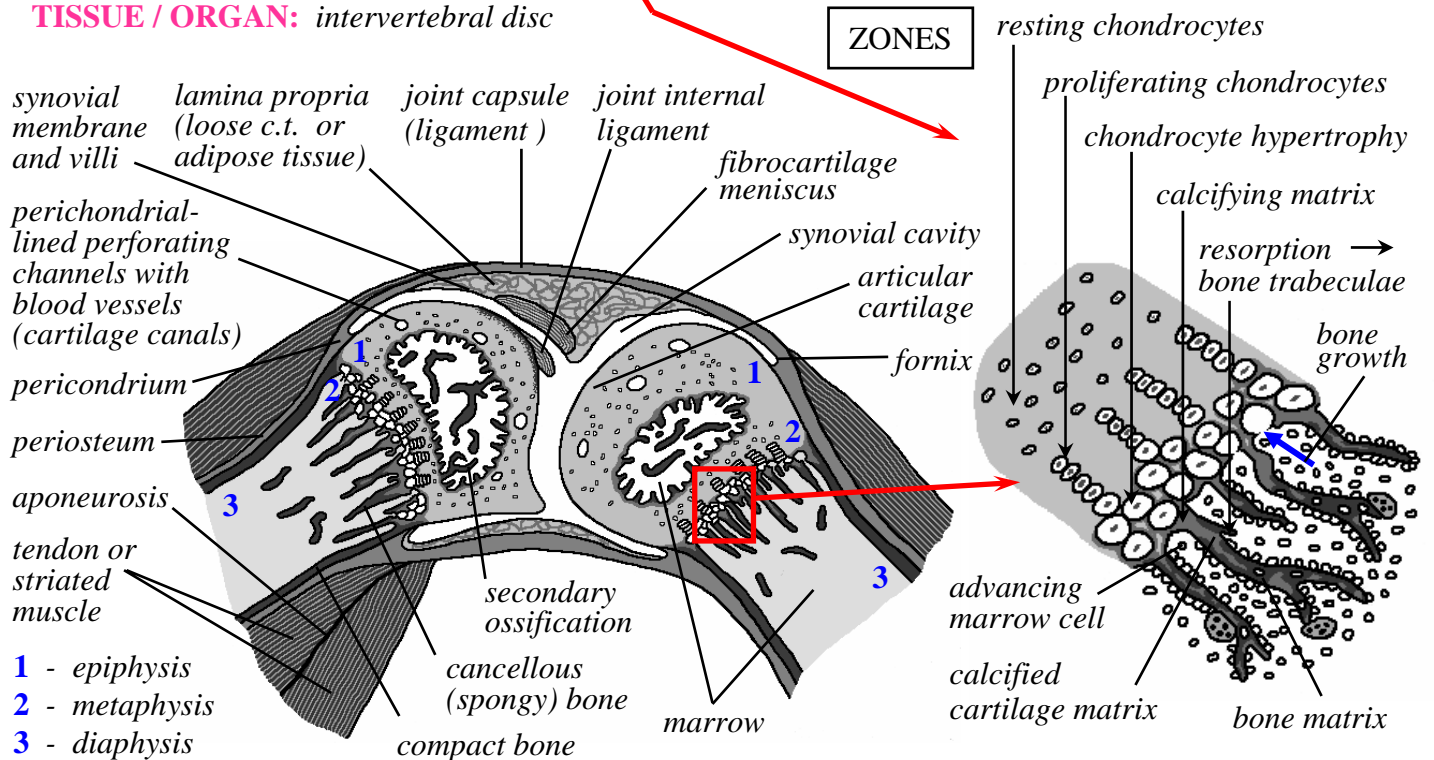
**FEATURE:** bone growth and remodelling

**TISSUE / ORGAN:** periosteal collar of vertebra

## ENDOCHONDRAL OSSIFICATION

**FEATURE:** developing symphysis joint

**TISSUE / ORGAN:** intervertebral disc



**FEATURE:** generalised synovial joint

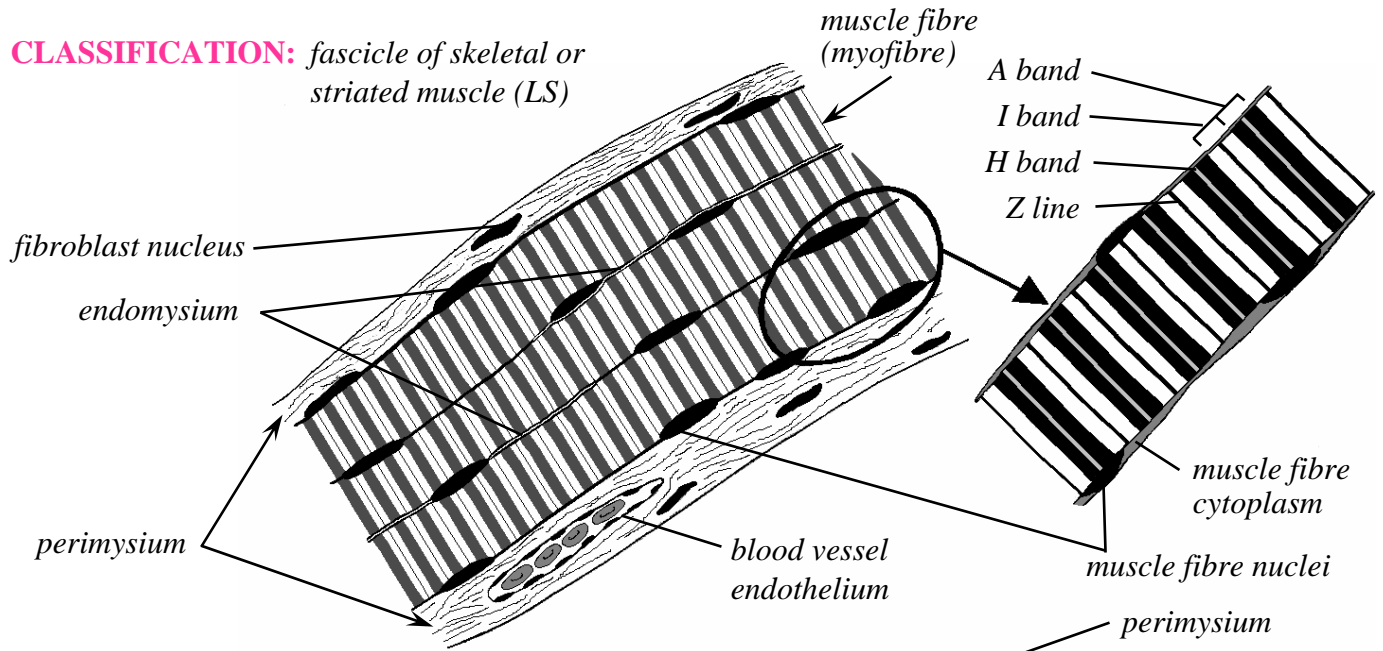
**TISSUE / ORGAN:** knee (or elbow)

**FEATURE:** epiphyseal disc (growth plate)

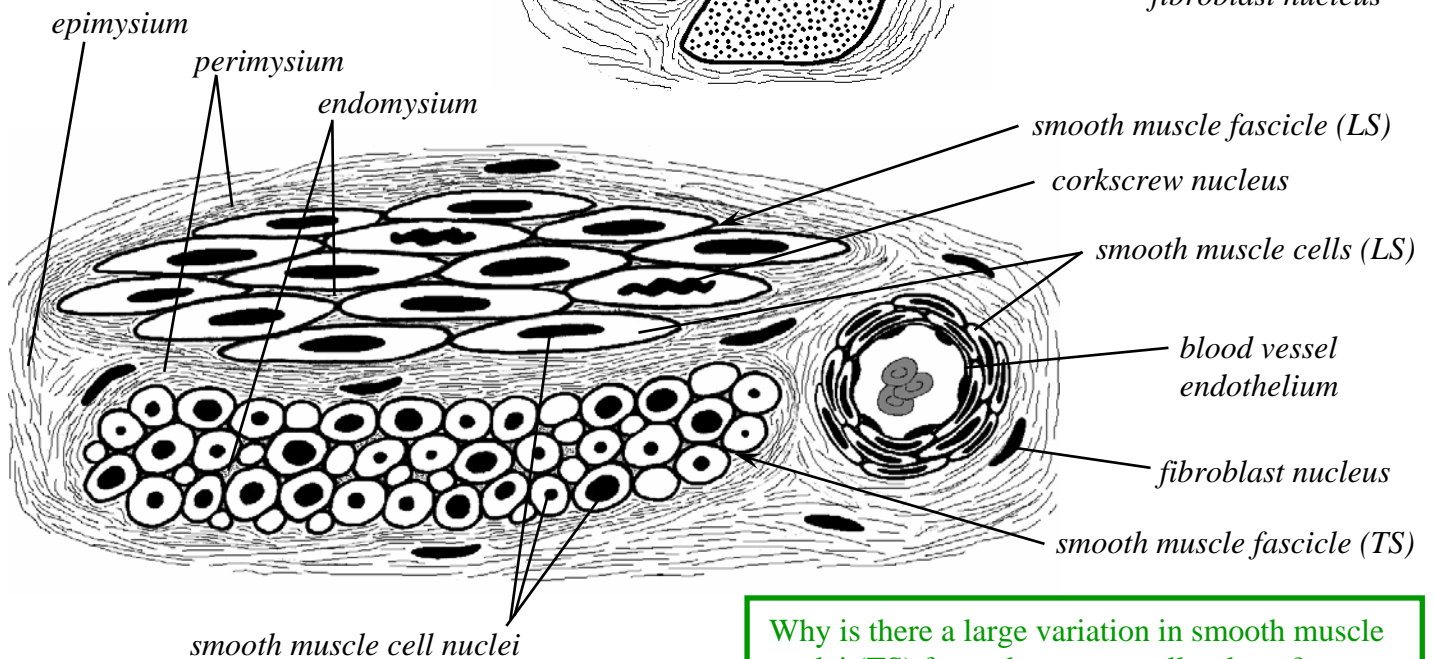
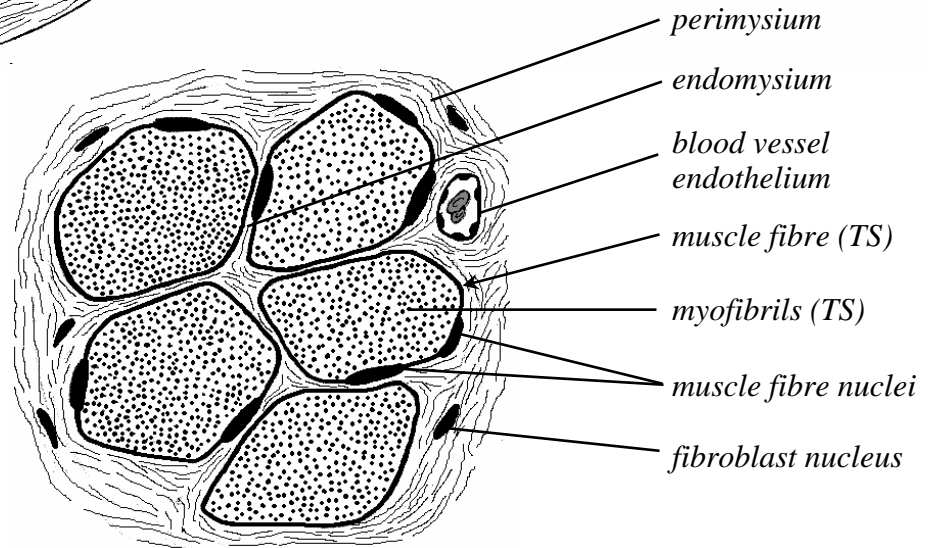
**TISSUE / ORGAN:** growth zone of long bone

# MUSCLE

**CLASSIFICATION:** fascicle of skeletal or striated muscle (LS)



**CLASSIFICATION:** fascicle of skeletal or striated muscle (TS)



**CLASSIFICATION:** smooth muscle in fascicles (LS & TS) and arteriole wall

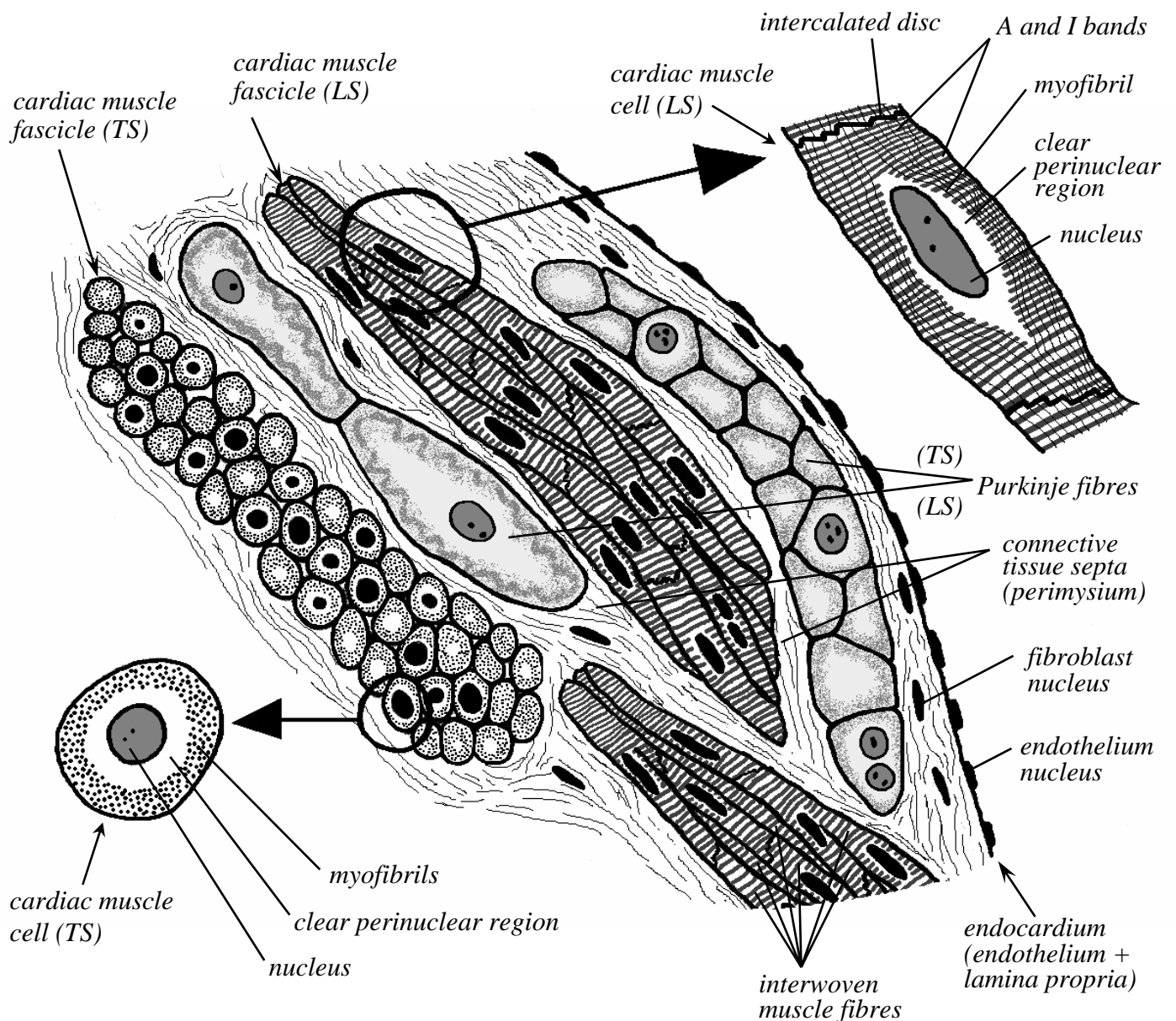
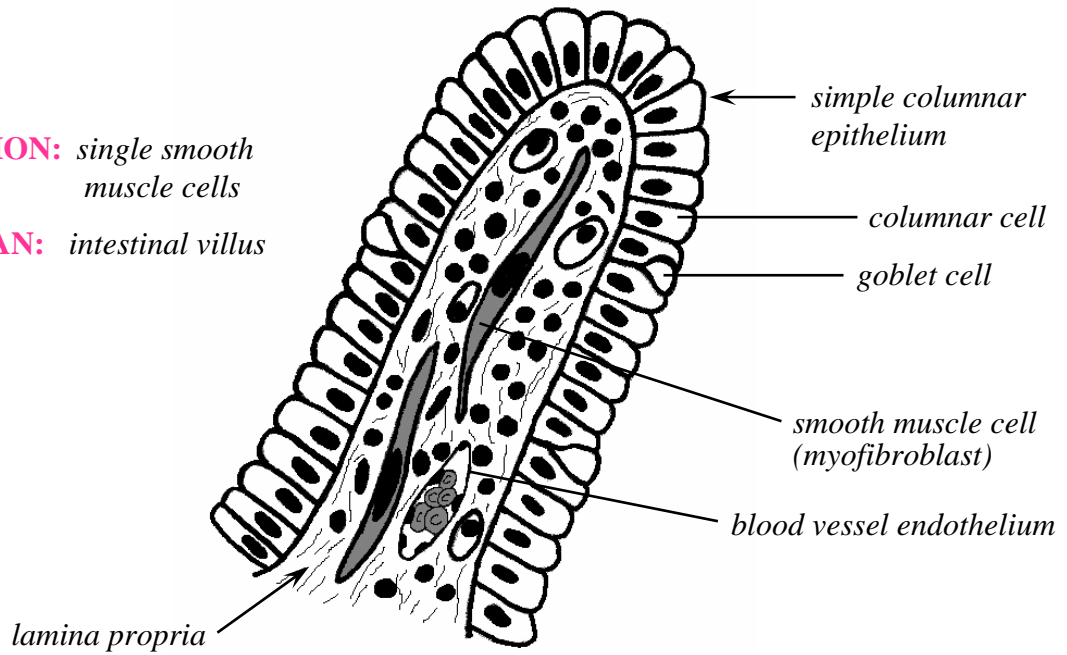
Why is there a large variation in smooth muscle nuclei (TS) from absent to small to large?

The cells are so long that sections cut the ovoid nucleus from centre to edge or even miss it.



**CLASSIFICATION:** single smooth muscle cells

**TISSUE / ORGAN:** intestinal villus



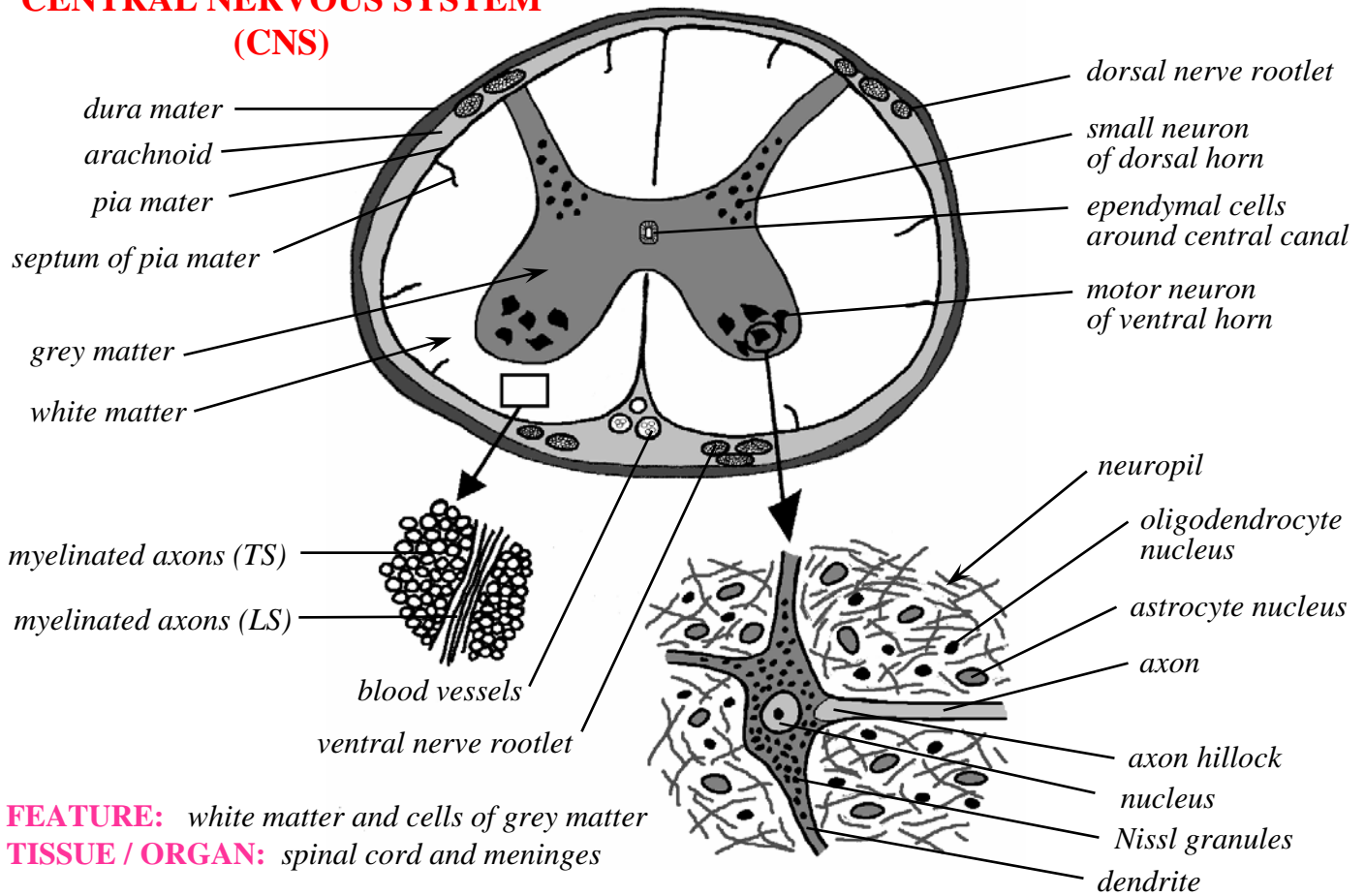
**CLASSIFICATION:** cardiac muscle fascicles

**TISSUE / ORGAN:** heart (interventricular septum)

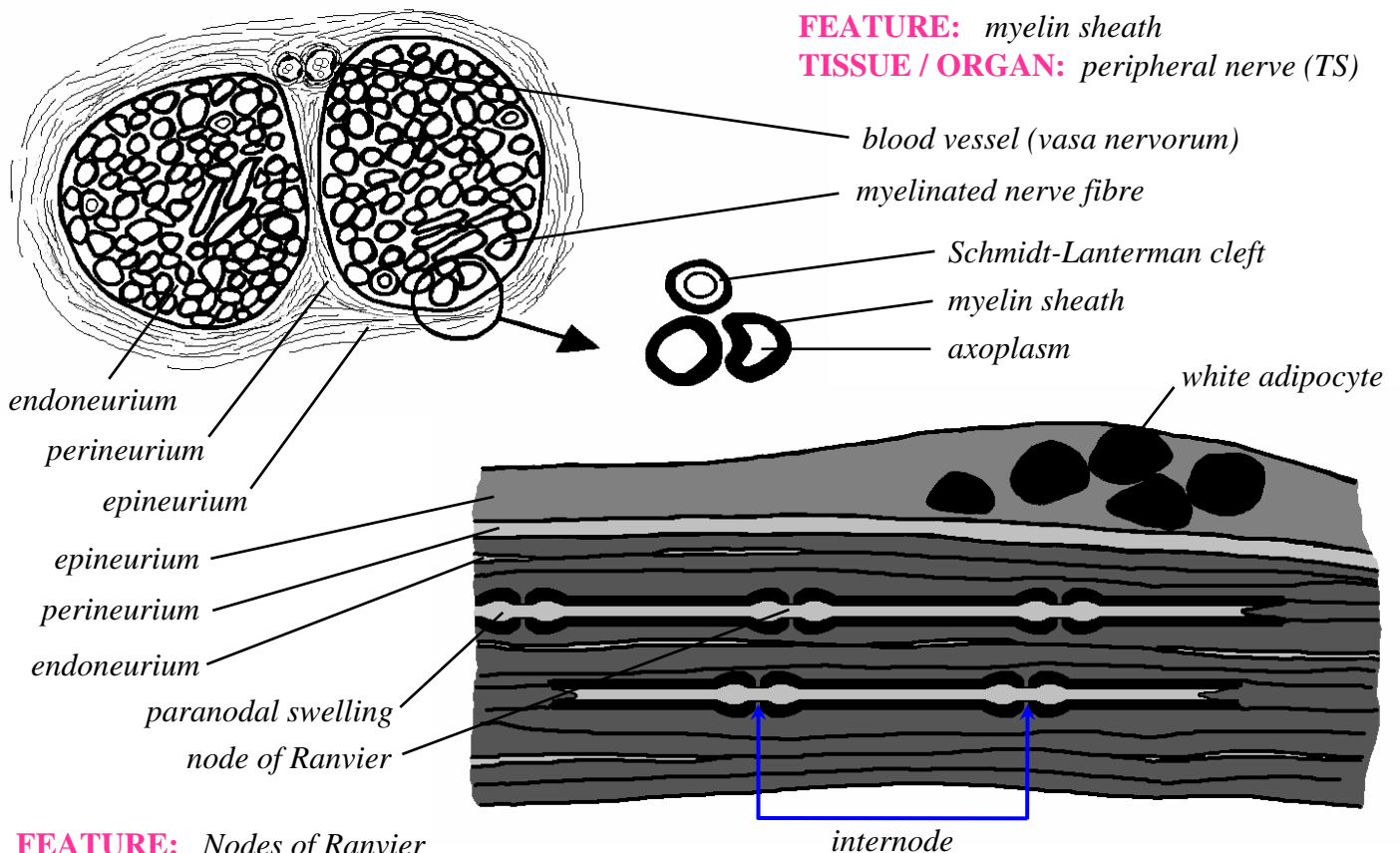


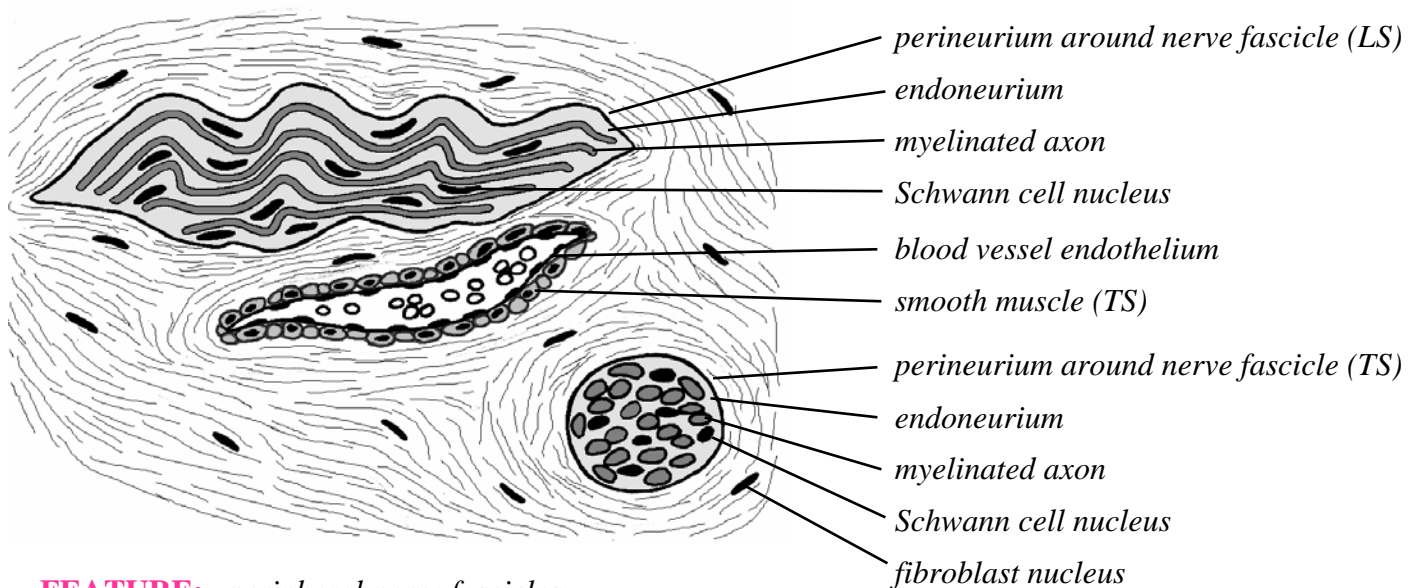
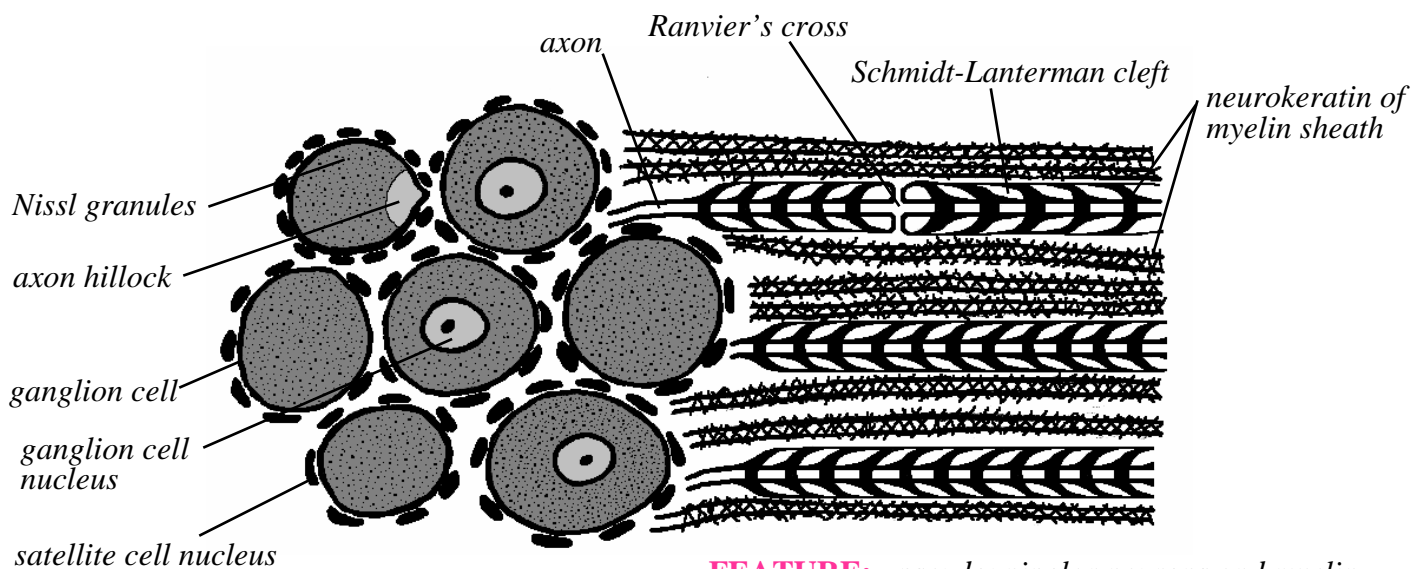
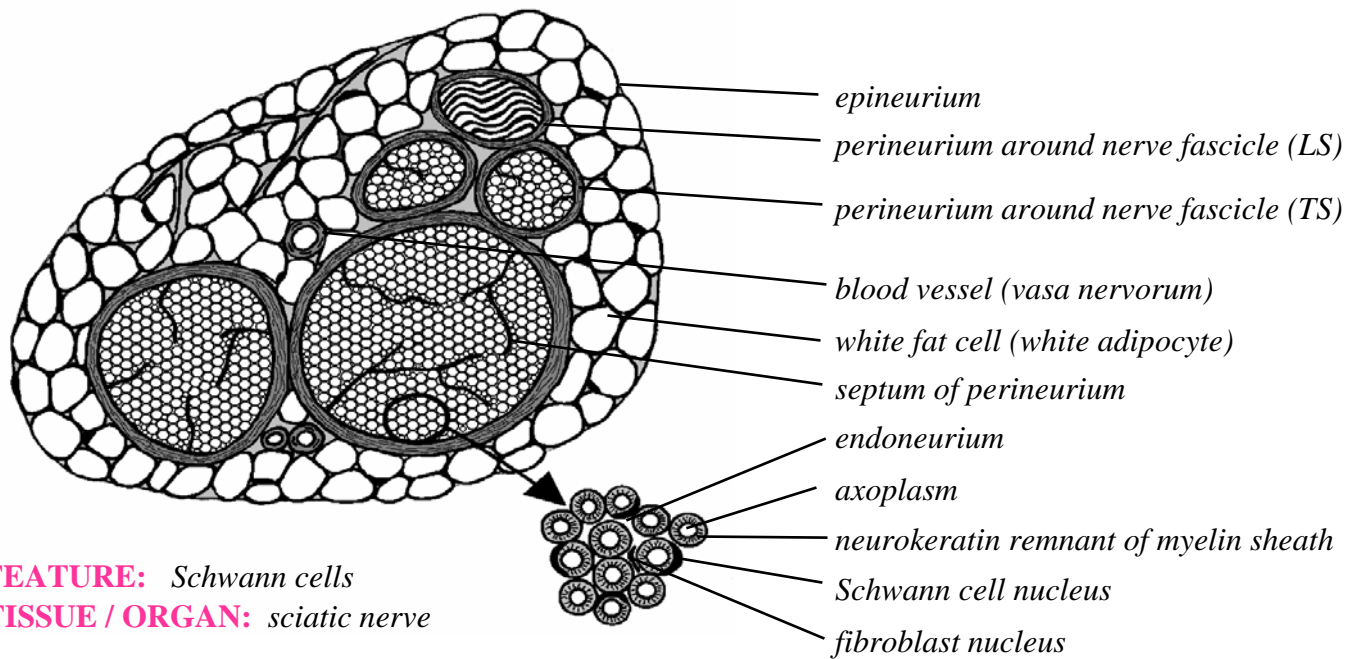
# NERVOUS TISSUE

## CENTRAL NERVOUS SYSTEM (CNS)



## PERIPHERAL NERVOUS SYSTEM (PNS)



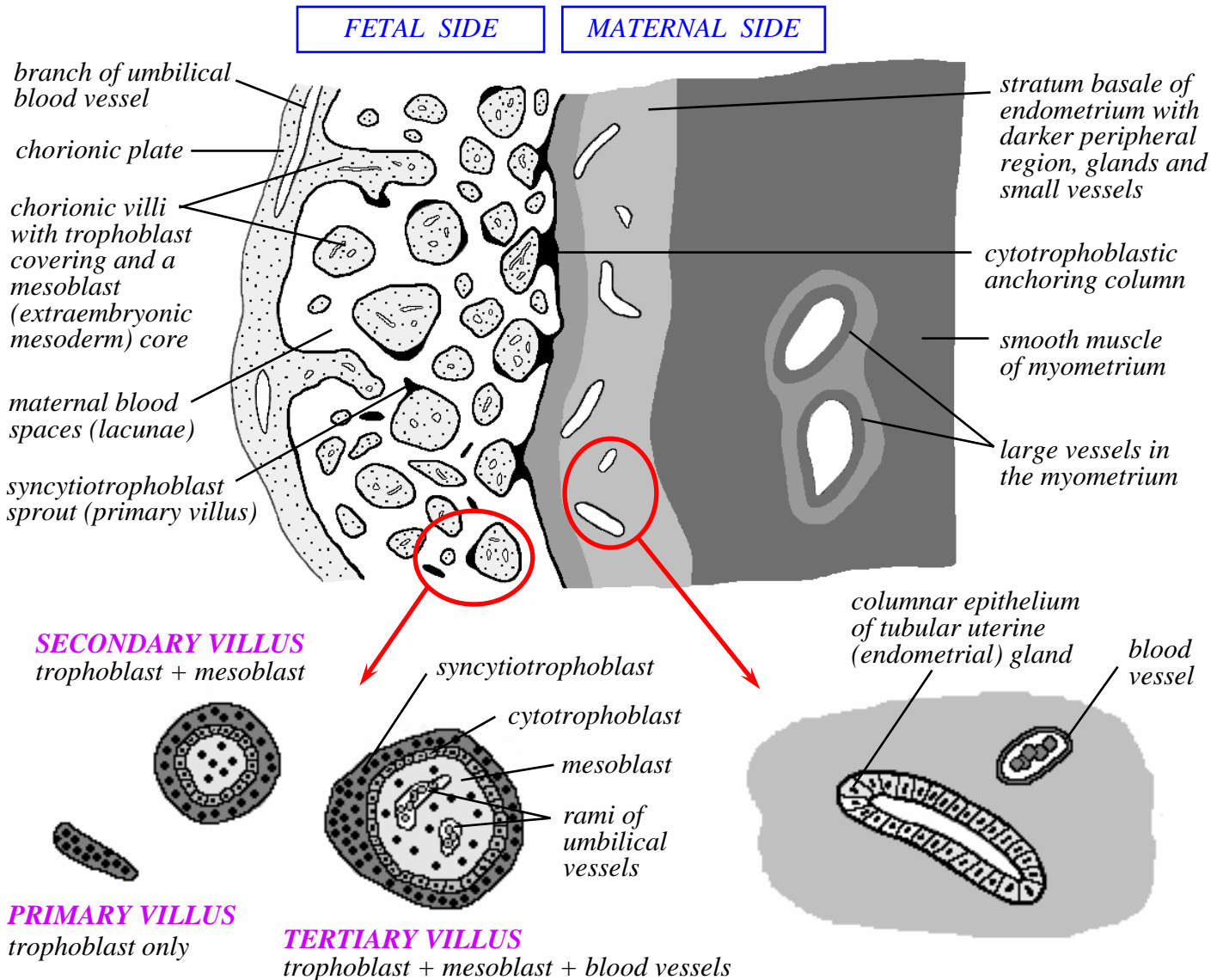


# FETAL MEMBRANES

## PLACENTA

**FEATURE:** chorionic plate, villi, uterine wall

**TISSUE / ORGAN:** placenta (3 months)



## UMBILICAL CORD

**FEATURE:** vessels and Wharton's jelly

**TISSUE / ORGAN:** umbilical cord (TS)

Wharton's jelly is an artefact of "dead" umbilical cord. What should "living" cord look like and why is this different?

Before birth the cord has three large vessels and very little connective tissue. After birth the blood flow stops and without blood pressure the vessels collapse. The connective tissue swells with fluid that leaks from the vessels.

