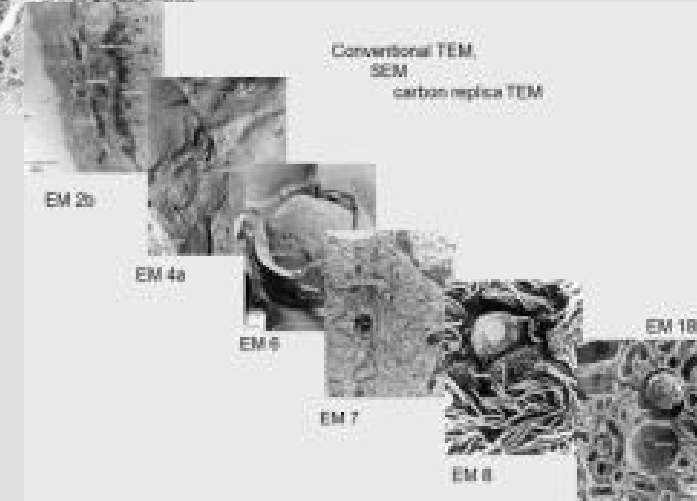
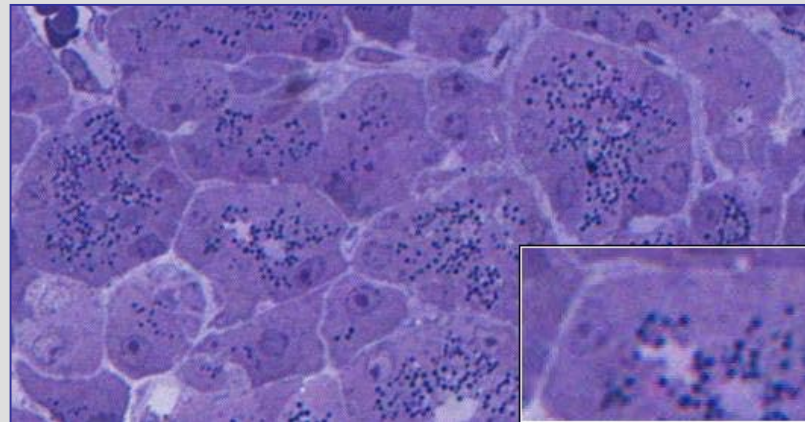
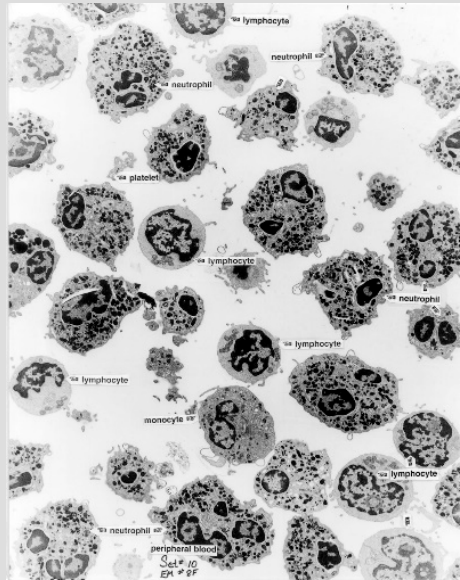
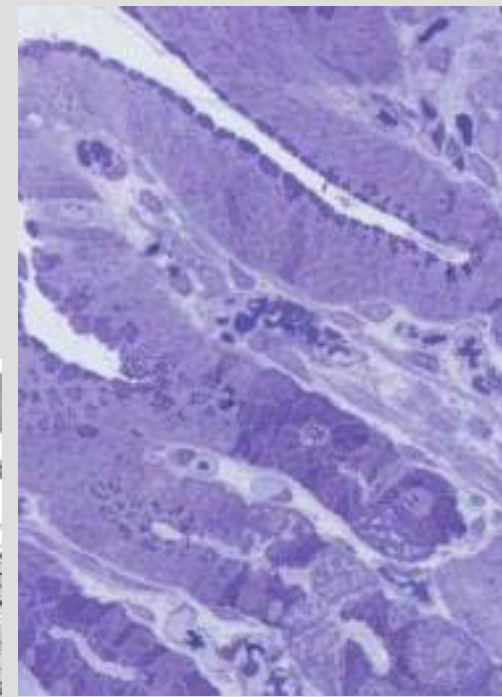
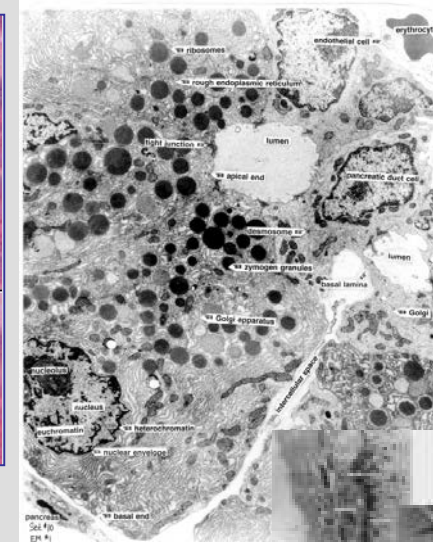
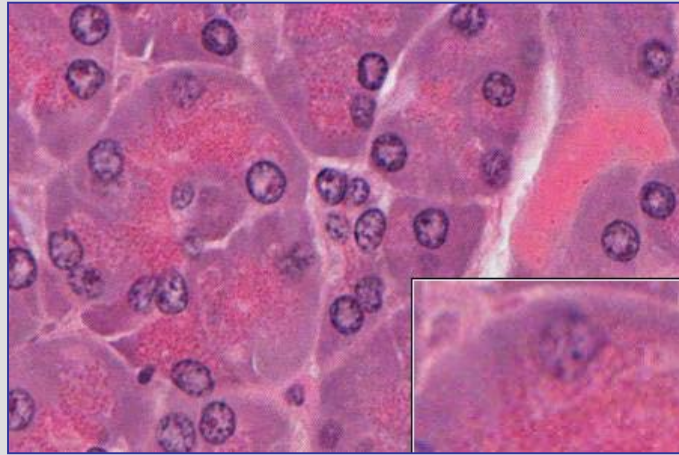
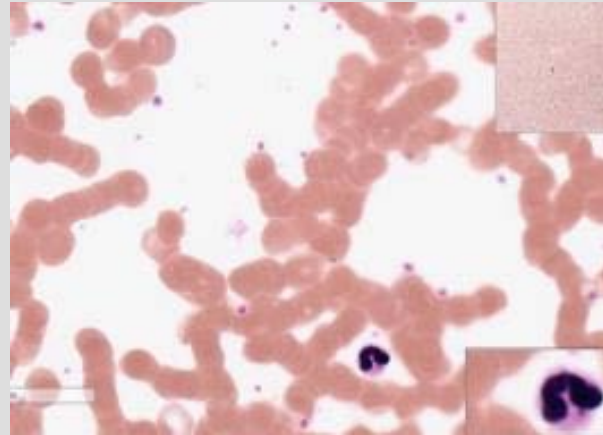


Medical School Histology Basics

Introduction to Microscopy

VIBS 243 lab



Larry Johnson

Texas A&M University

Objectives

- Learn the difference in magnification and resolution
- Learn about different types of staining for LM and observe details of cells by EM
- Learn how cell/organelles look different at different magnifications
- Learn about different types of EM

Use your atlas!



pancreas



blood



stomach

testis

Use your atlas!
Use your atlas!
Use your atlas!

MAGNIFICATION VS. RESOLUTION

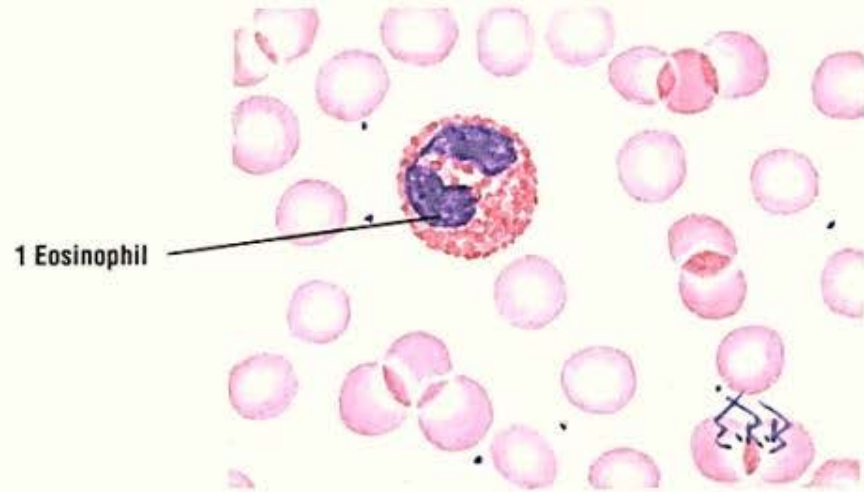
1. MAGNIFICATION - INCREASE IN IMAGE SIZE
2. RESOLUTION - SMALLEST DISTANCE BETWEEN TWO POINTS THAT CAN BE SEEN (DISTINGUISHED)

RESOLUTION is CALCULATED BY
 $0.61 \text{ (WAVELENGTH) / NUMERICAL APERTURE}$

0.25 μm FOR LIGHT MICROSCOPE

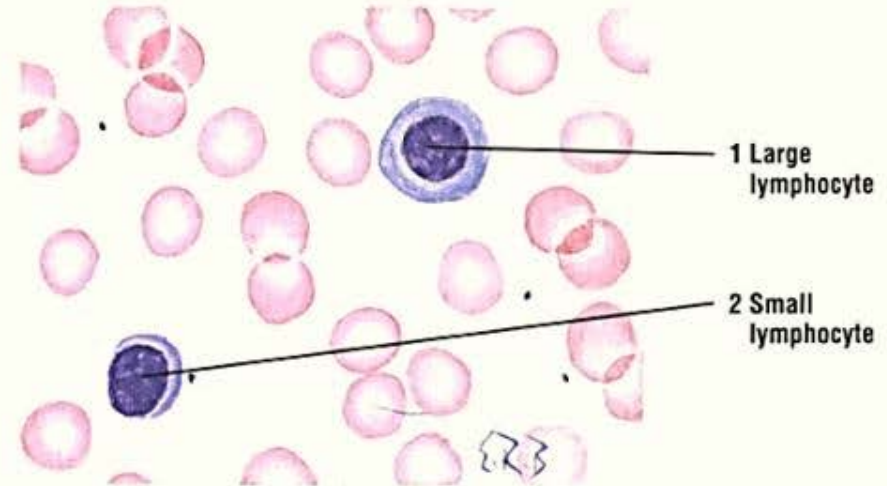
0.1 nm FOR ELECTRON MICROSCOPE

Ref code # 5



1 Eosinophil

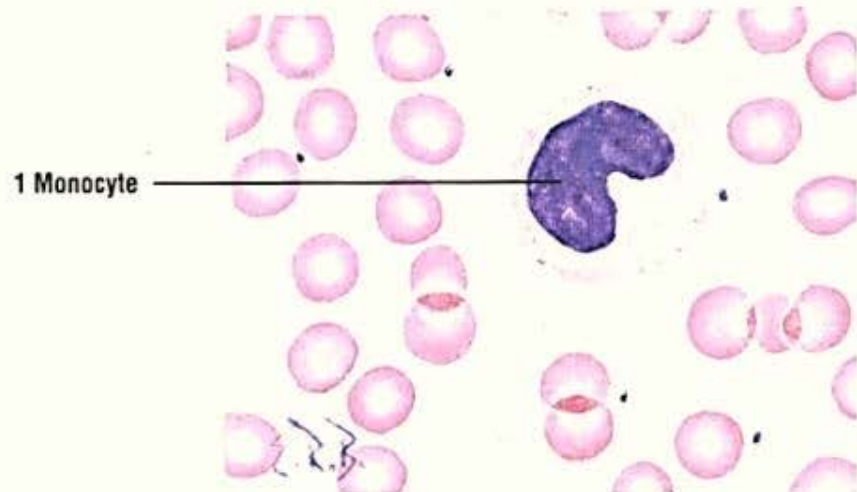
Fig. 4-4 Eosinophils. Wright's stain. Oil immersion.



1 Large lymphocyte

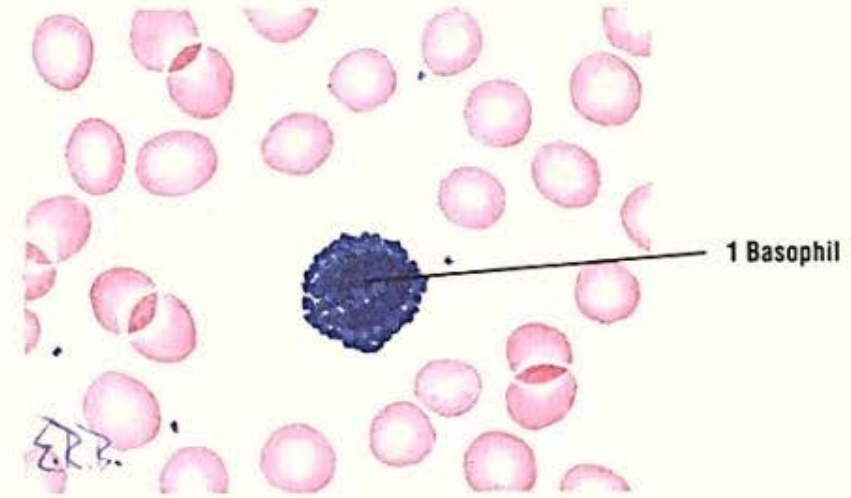
2 Small lymphocyte

Fig. 4-5 Lymphocytes. Wright's stain. Oil immersion.



1 Monocyte

Fig. 4-6 Monocytes. Wright's stain. Oil immersion.



1 Basophil

Fig. 4-7 Basophils. Wright's stain. Oil immersion.

Blood

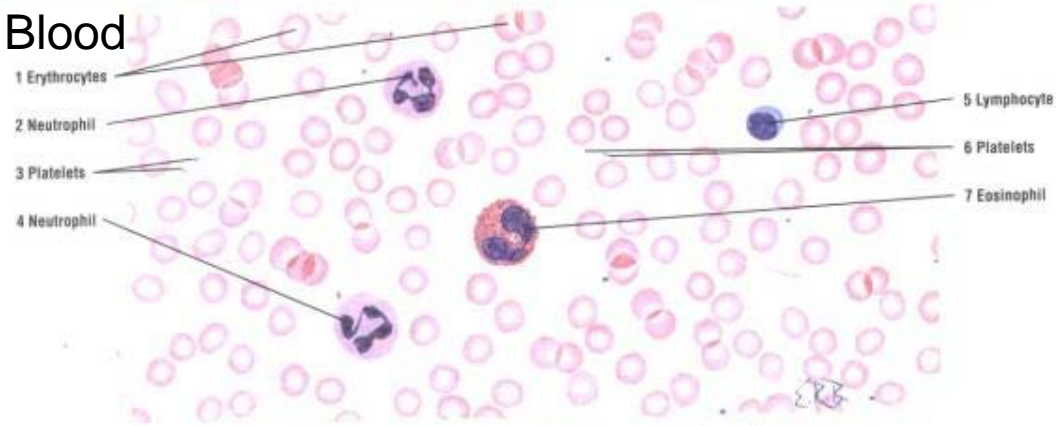


Fig. 4-1 Human Blood Smear. Wright's stain. High magnification.

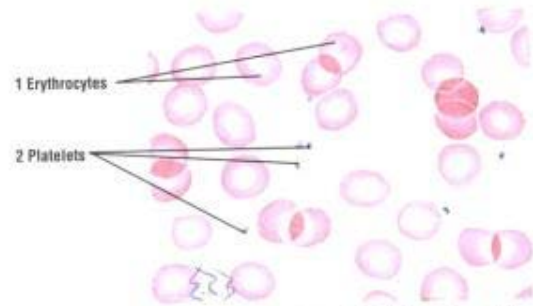


Fig. 4-2 Erythrocytes and Platelets. Wright's stain, Oil immersion.

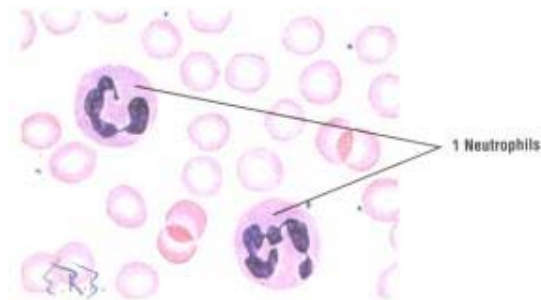


Fig. 4-3 Neutrophils. Wright's stain, Oil immersion.

Ref code
5

Identify White Blood Cells

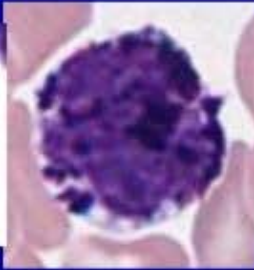
Ref code
12



Neutrophil



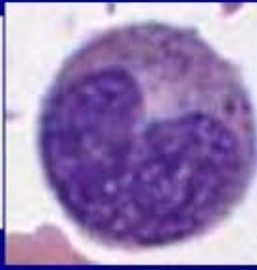
Eosinophi



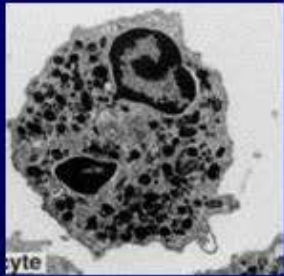
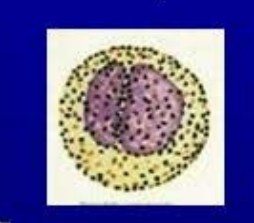
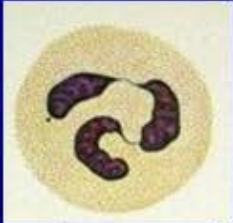
Basophil



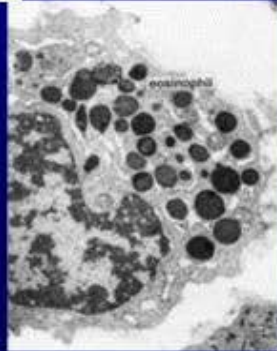
Lymphocyte



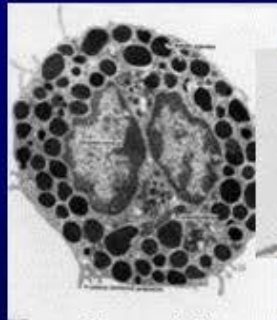
Monocyte



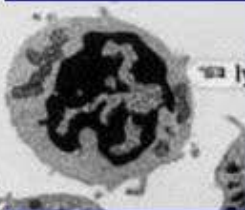
Neutrophil



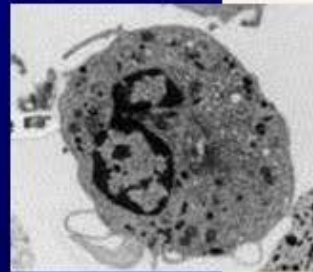
Eosinophil



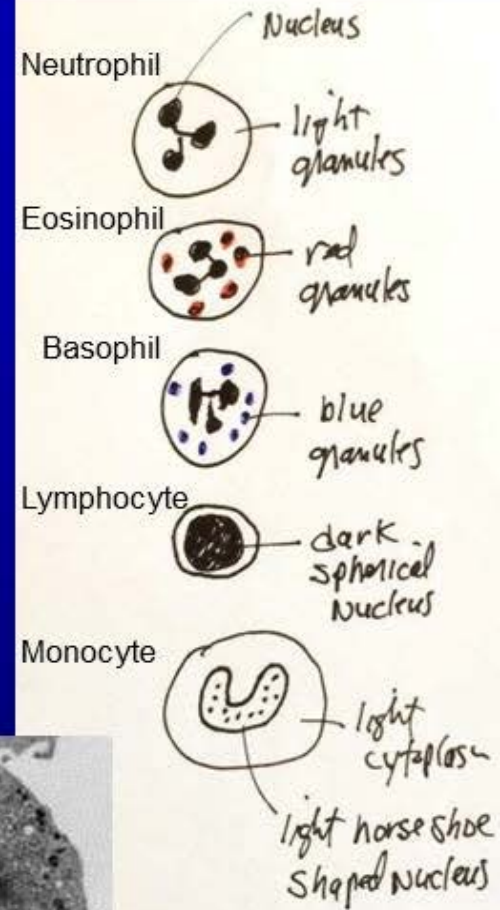
Basophil



Lymphocyte

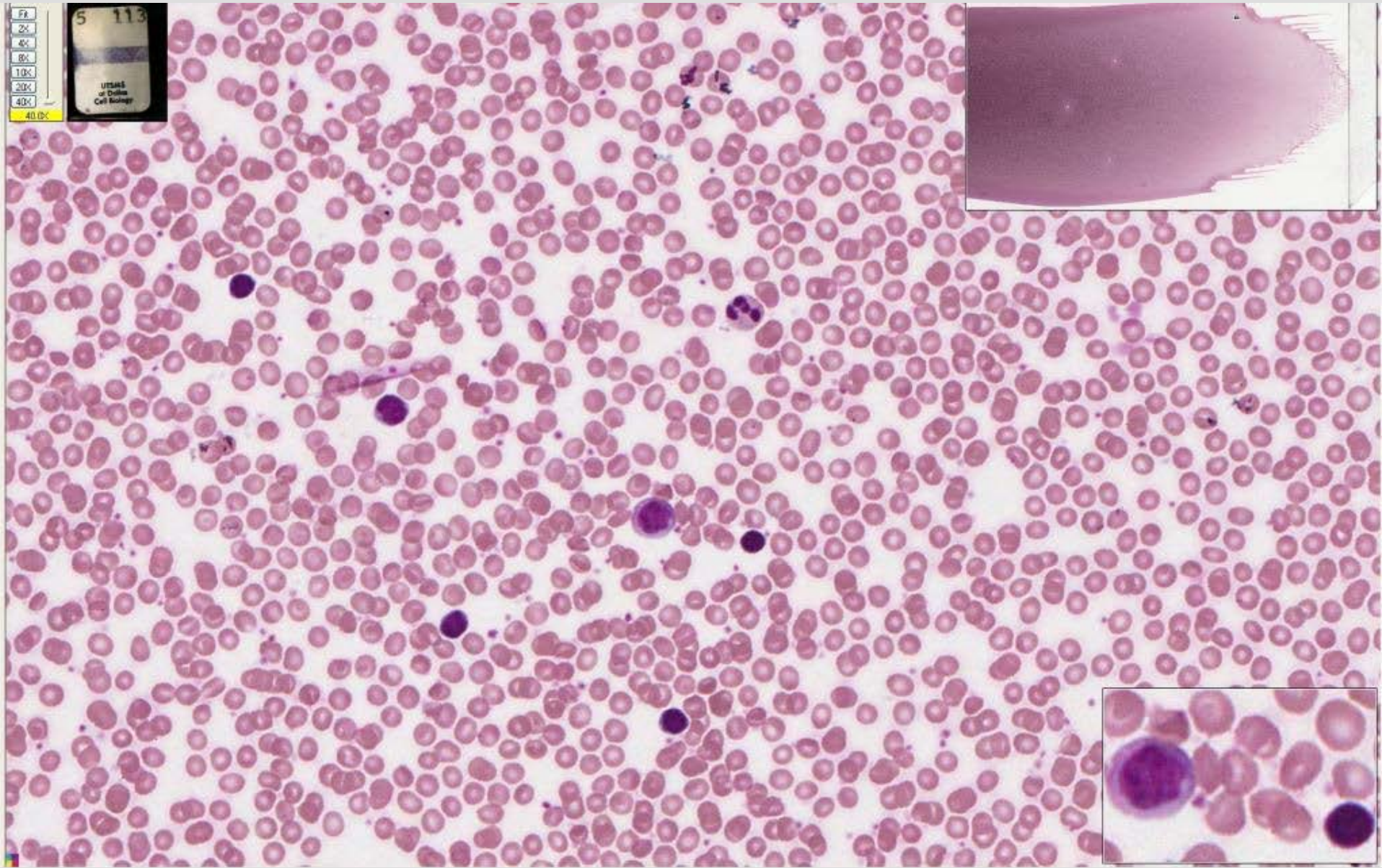


Monocyte



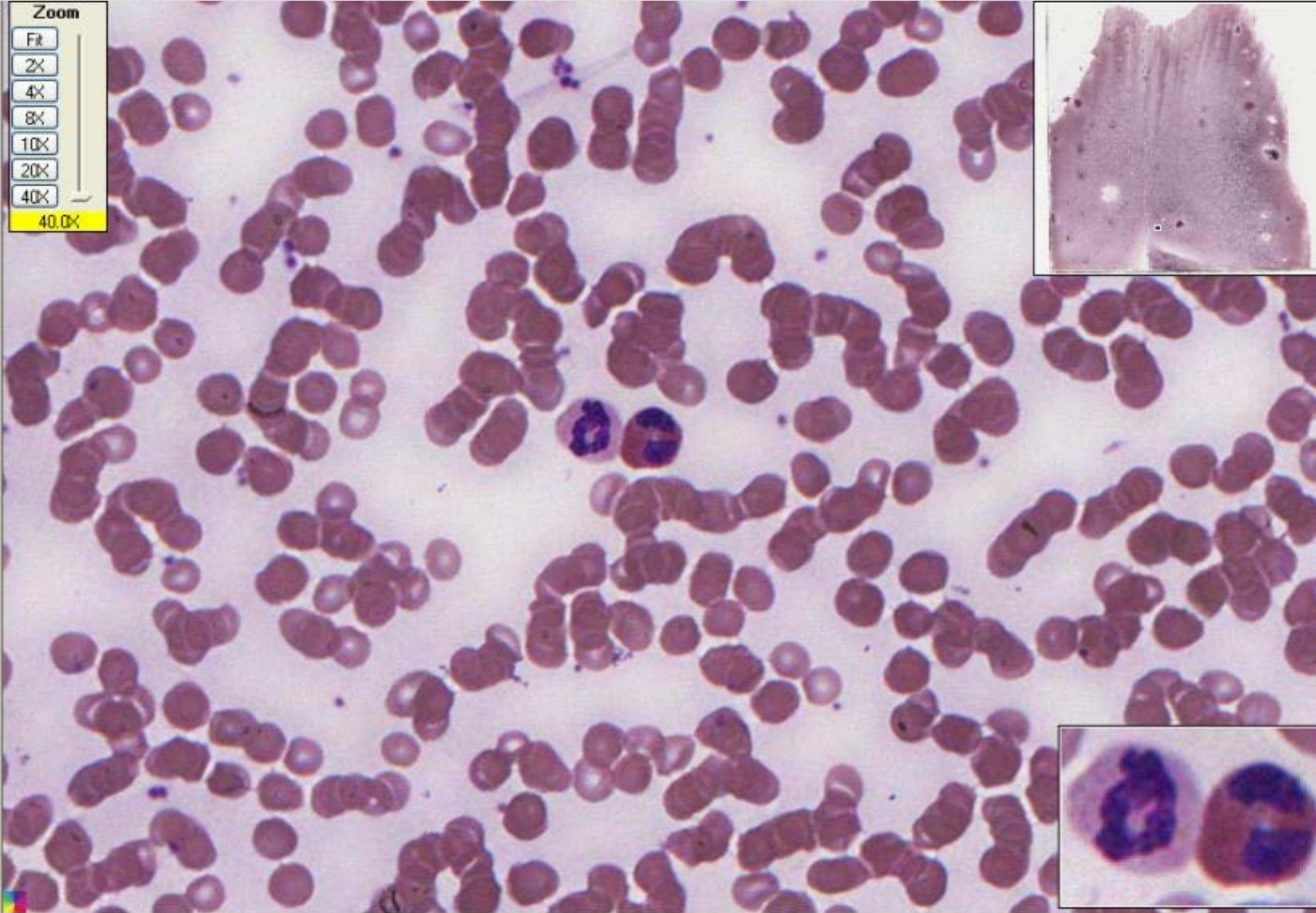
113

Peripheral blood smear (May-Grunwald-Giemsa)



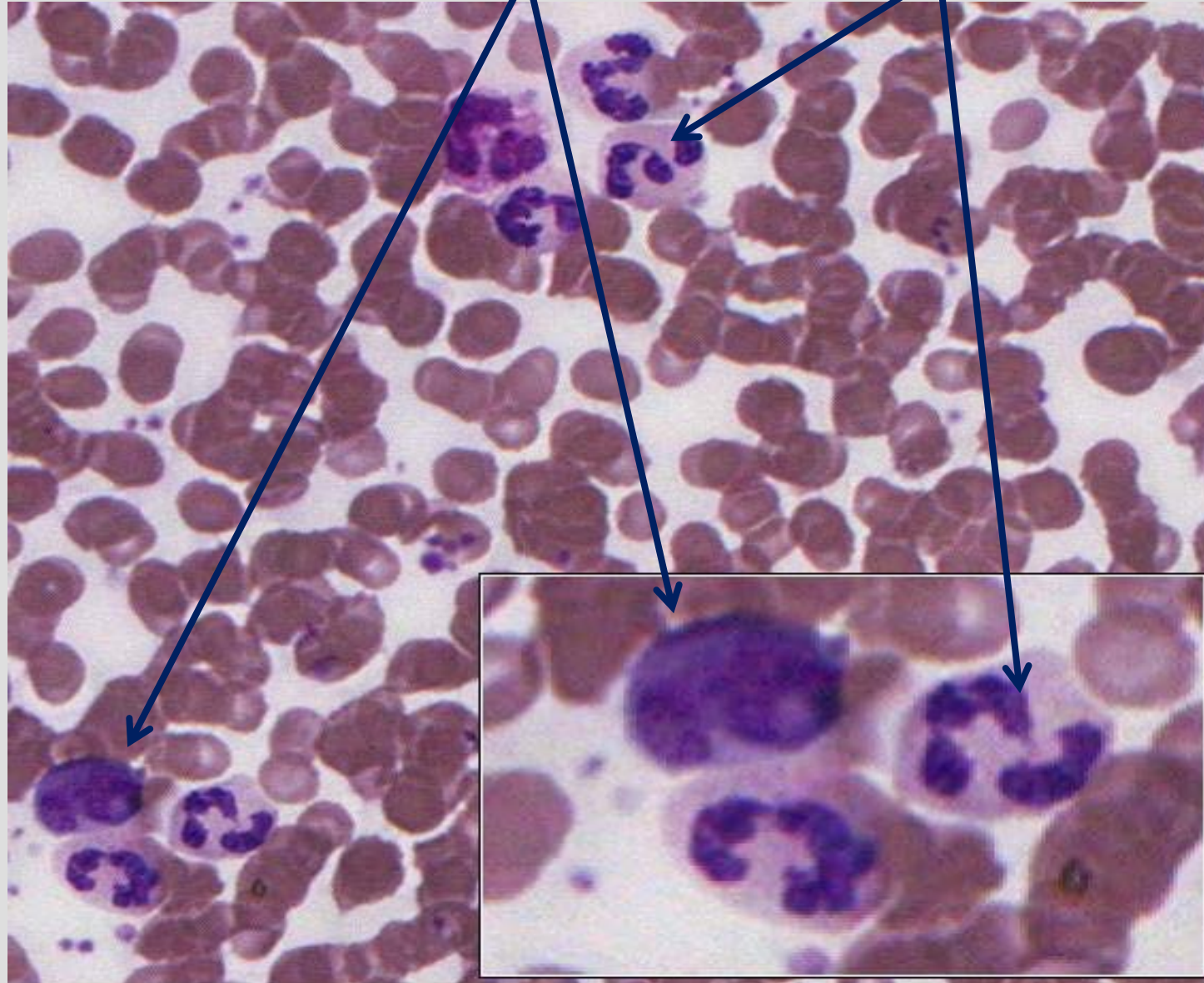
Peripheral blood smear (Leishman-Giemsa)

110

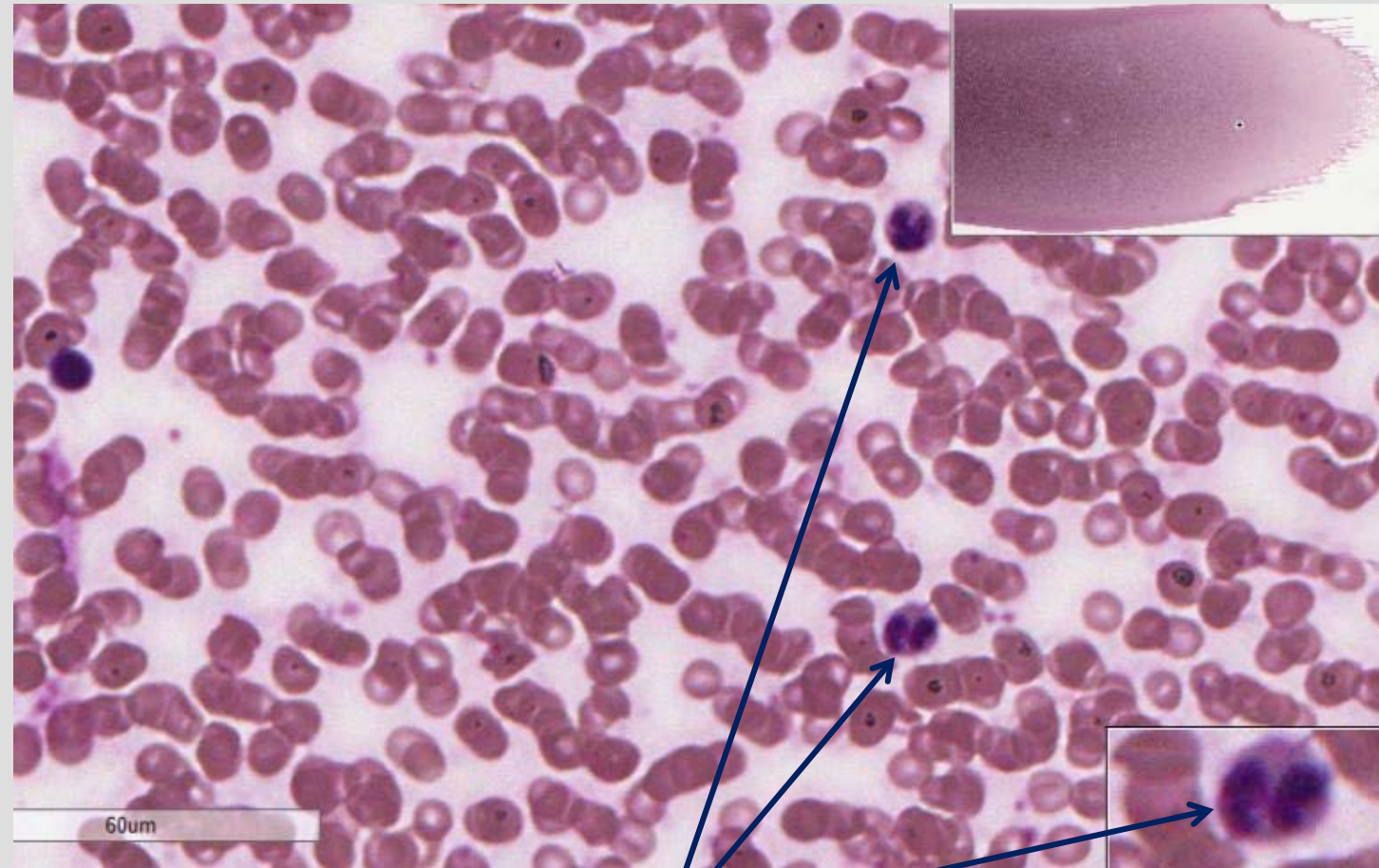


110

Peripheral blood smear (Leishman-Giemsa)
basophil, and neutrophils

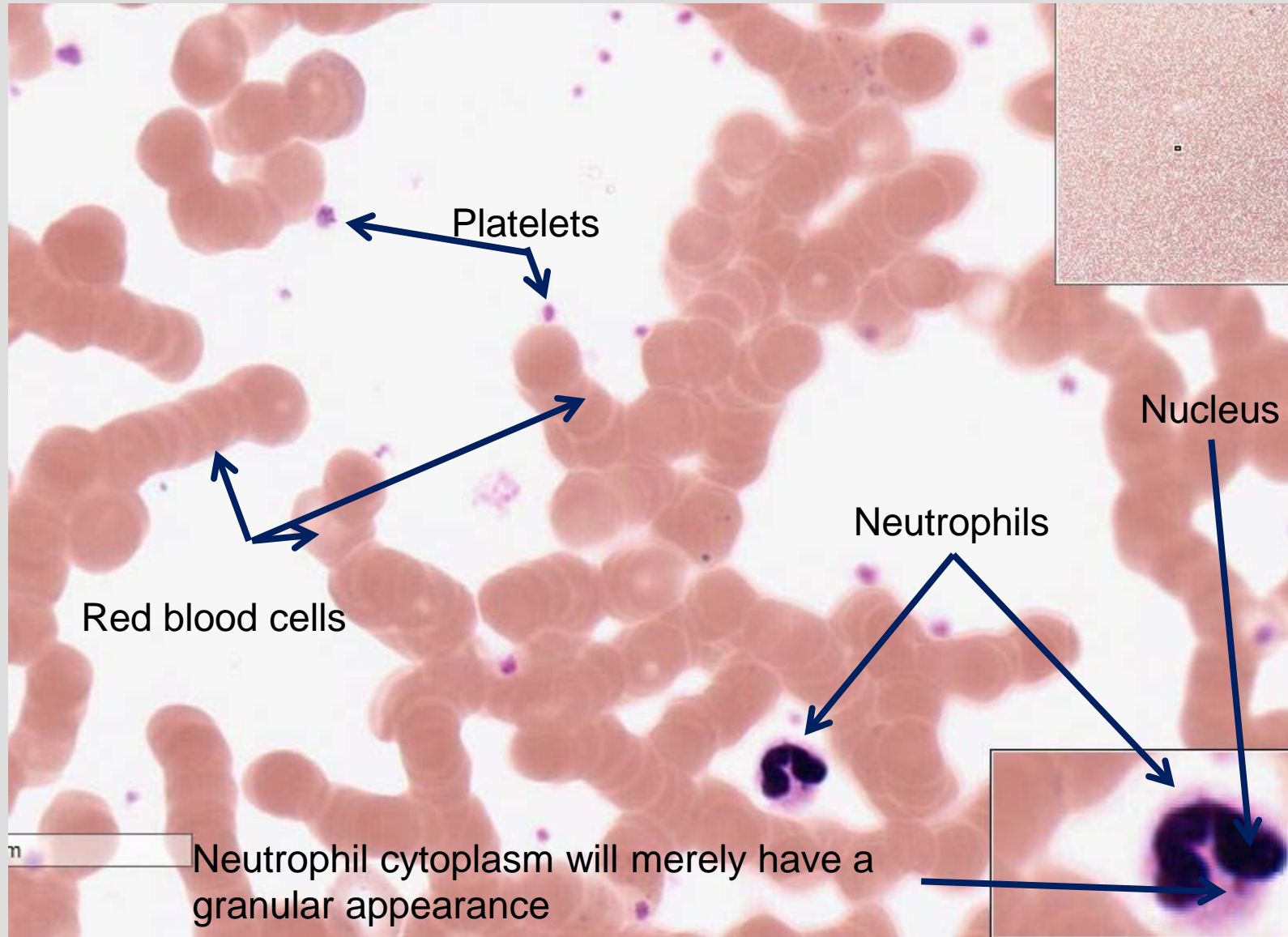


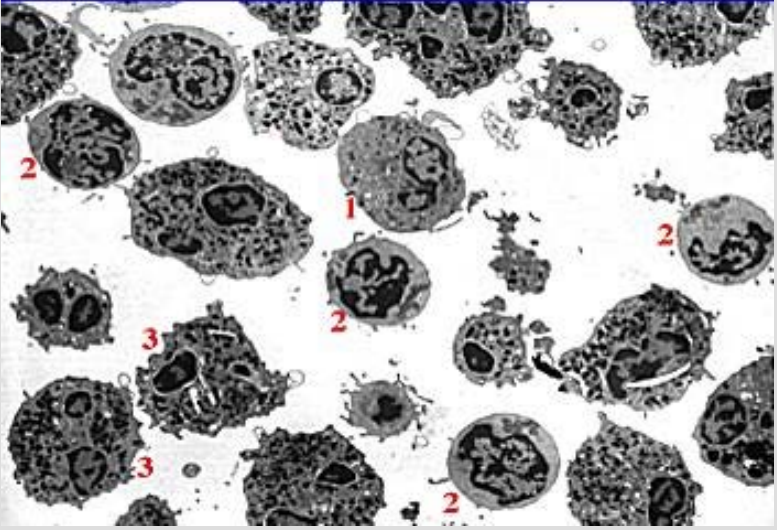
Slide 113 human blood



Neutrophils

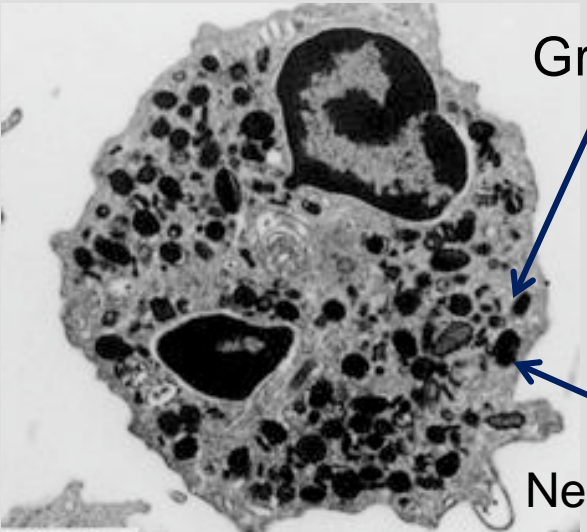
Slide Histo021 human blood





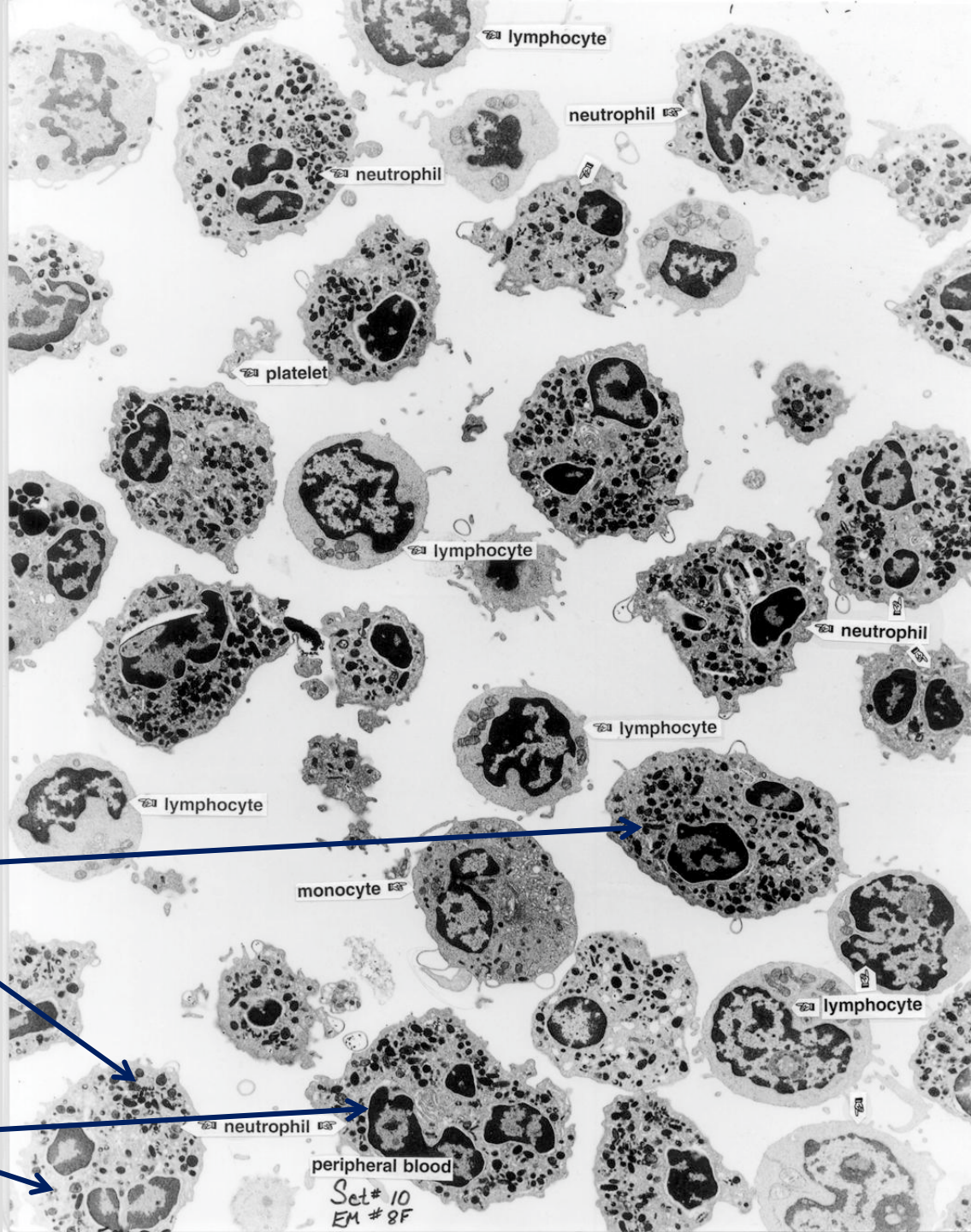
EM 8f: Peripheral blood cells;
9,000x

1. Monocyte
2. Lymphocyte
3. Neutrophil



Granules

Neutrophils



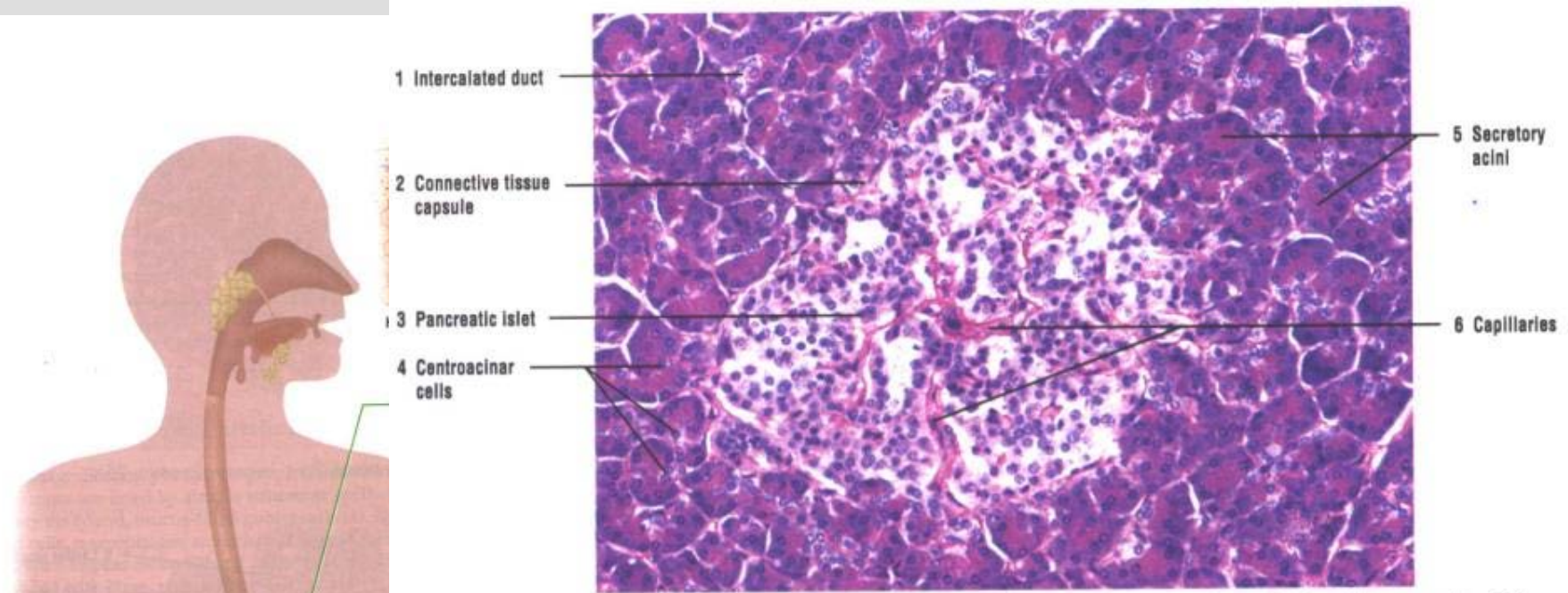
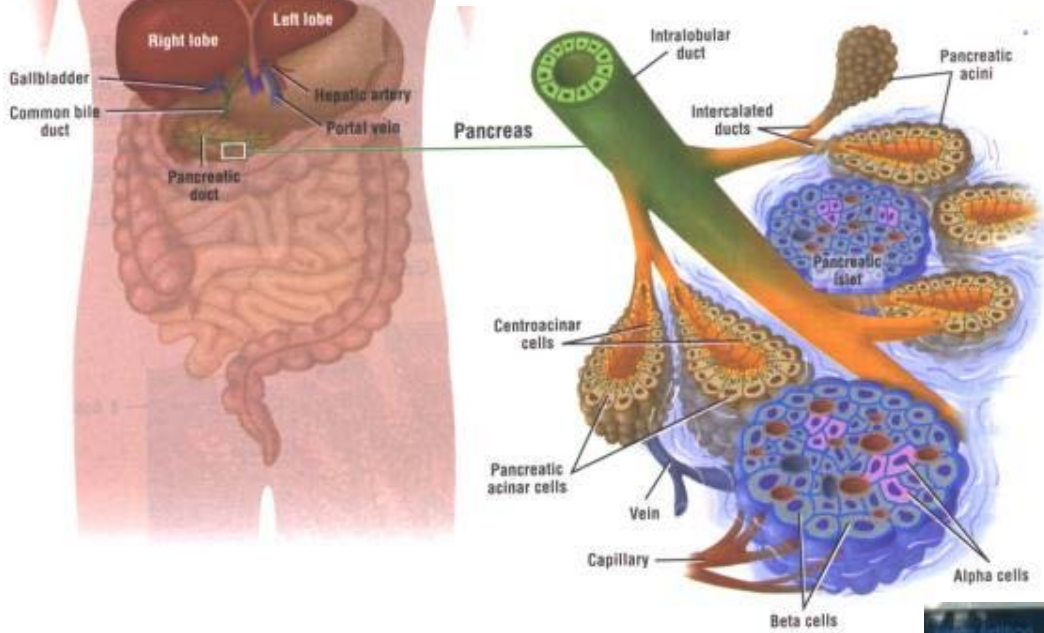


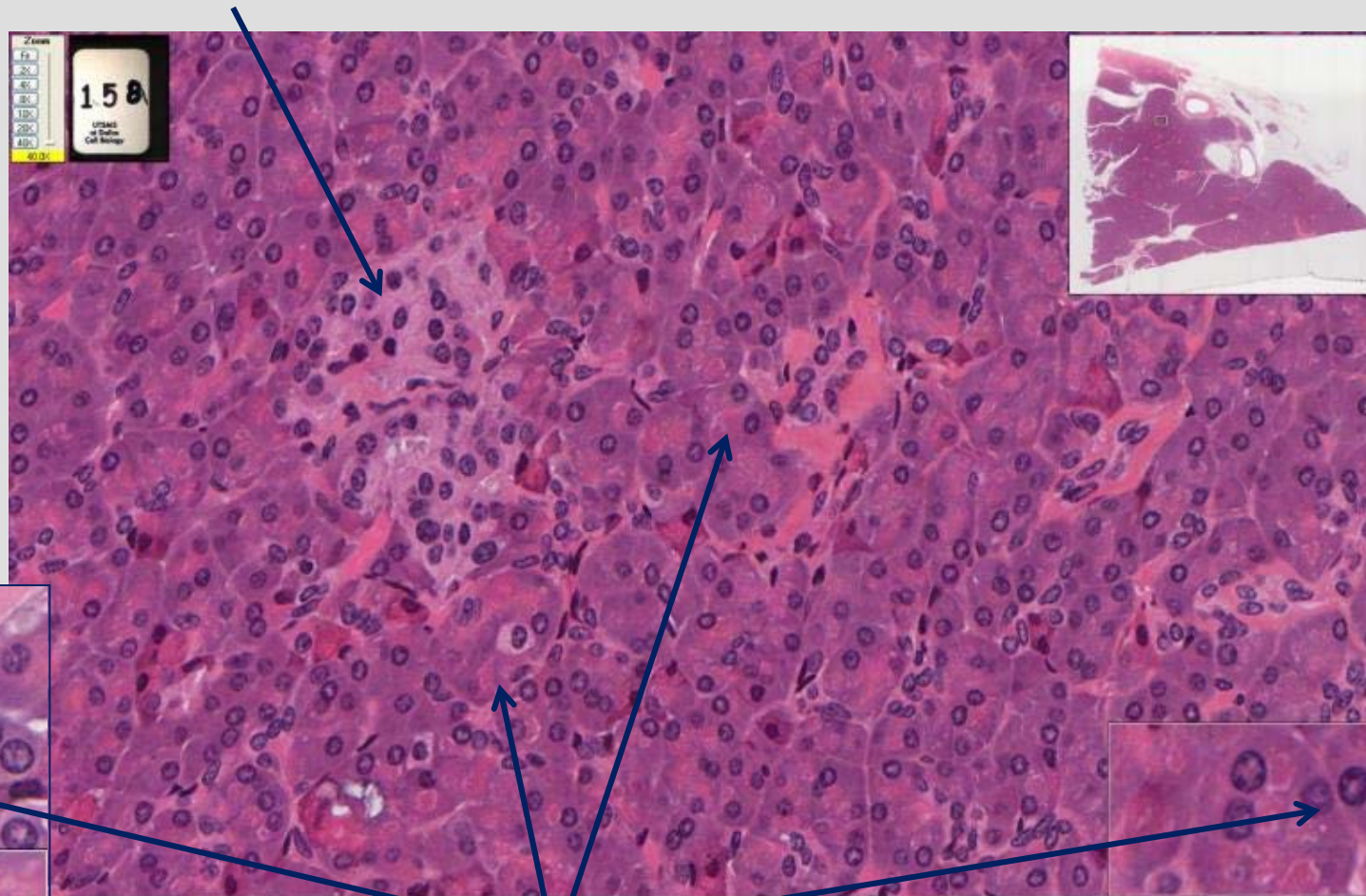
Fig. 13-14 Pancreas: Endocrine (Pancreatic Islet) and Exocrine Regions. Stain: PAS and hematoxylin. 80x



158 Pancreas

In H&E staining, the acid dye is eosin (stains proteins red) and the basic dye is a completed form of hematoxylin (stains ribosomes and nuclei blue). Hence, color provides distinguishing characteristics.

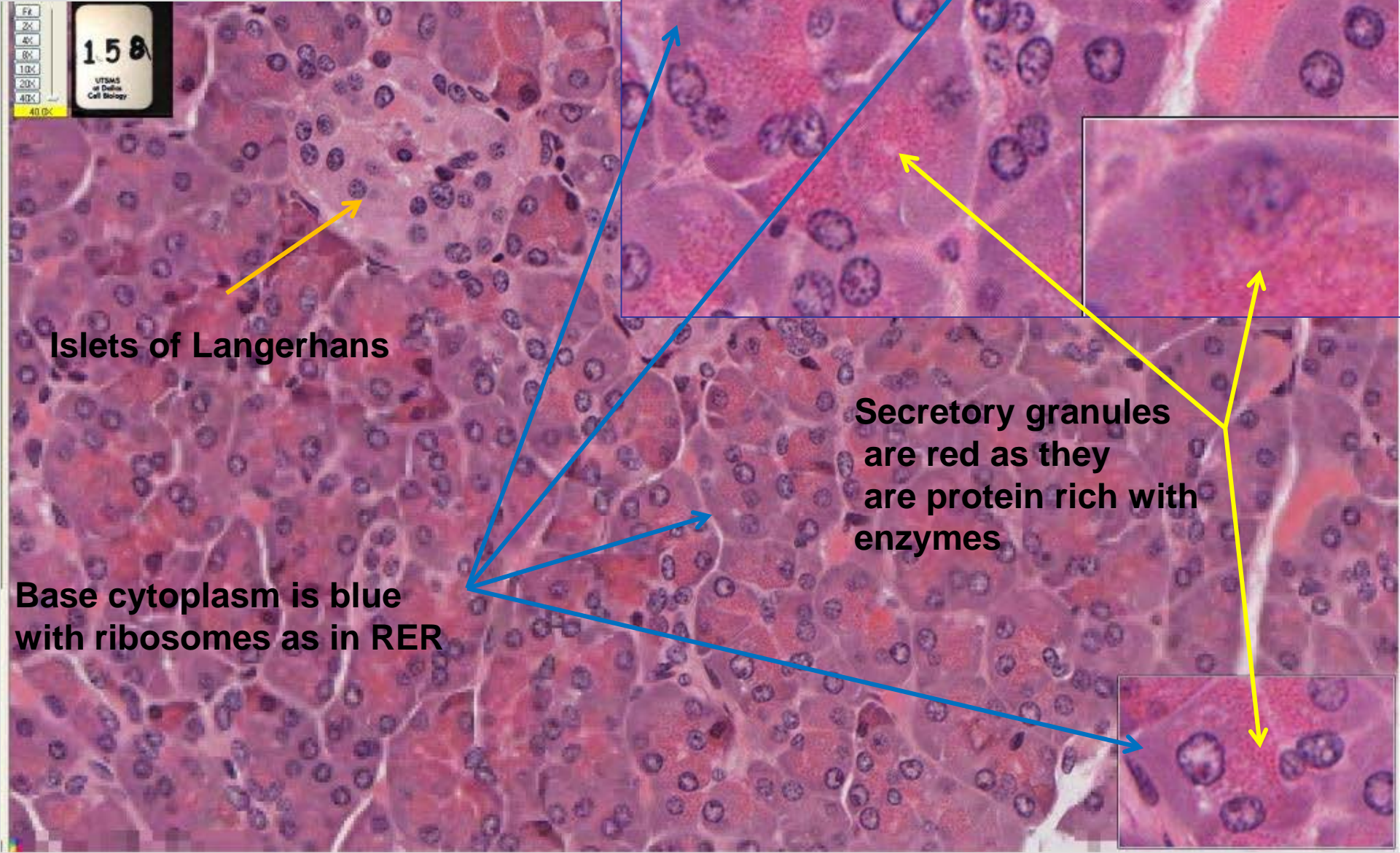
Islets of Langerhans = light-staining endocrine portion produces insulin



Acinar cells = exocrine produces pancreatic enzymes

158

Pancreas



Islets of Langerhans

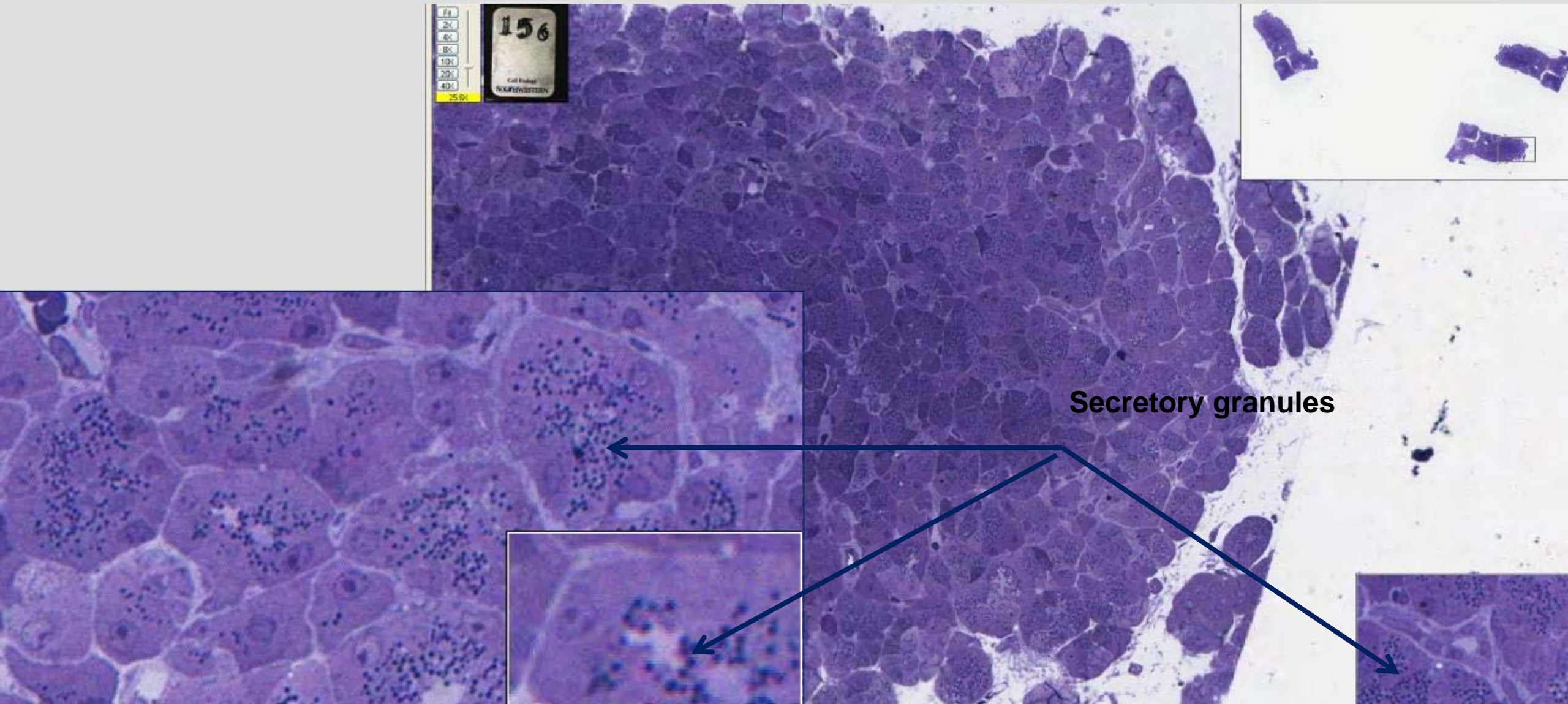
Base cytoplasm is blue with ribosomes as in RER

Secretory granules are red as they are protein rich with enzymes

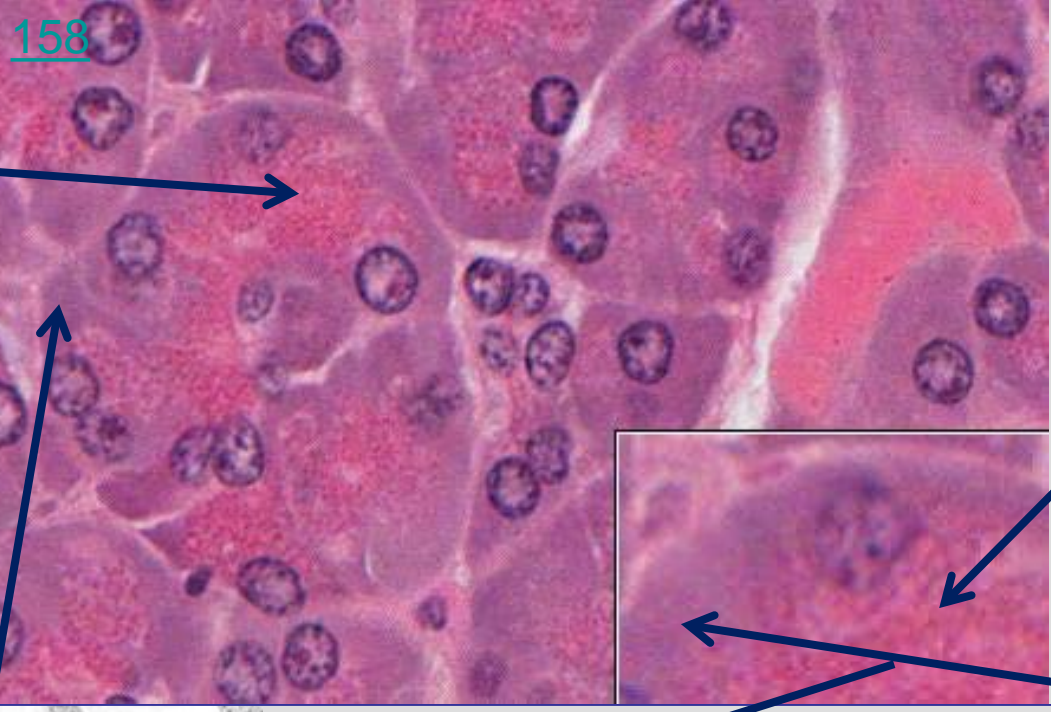
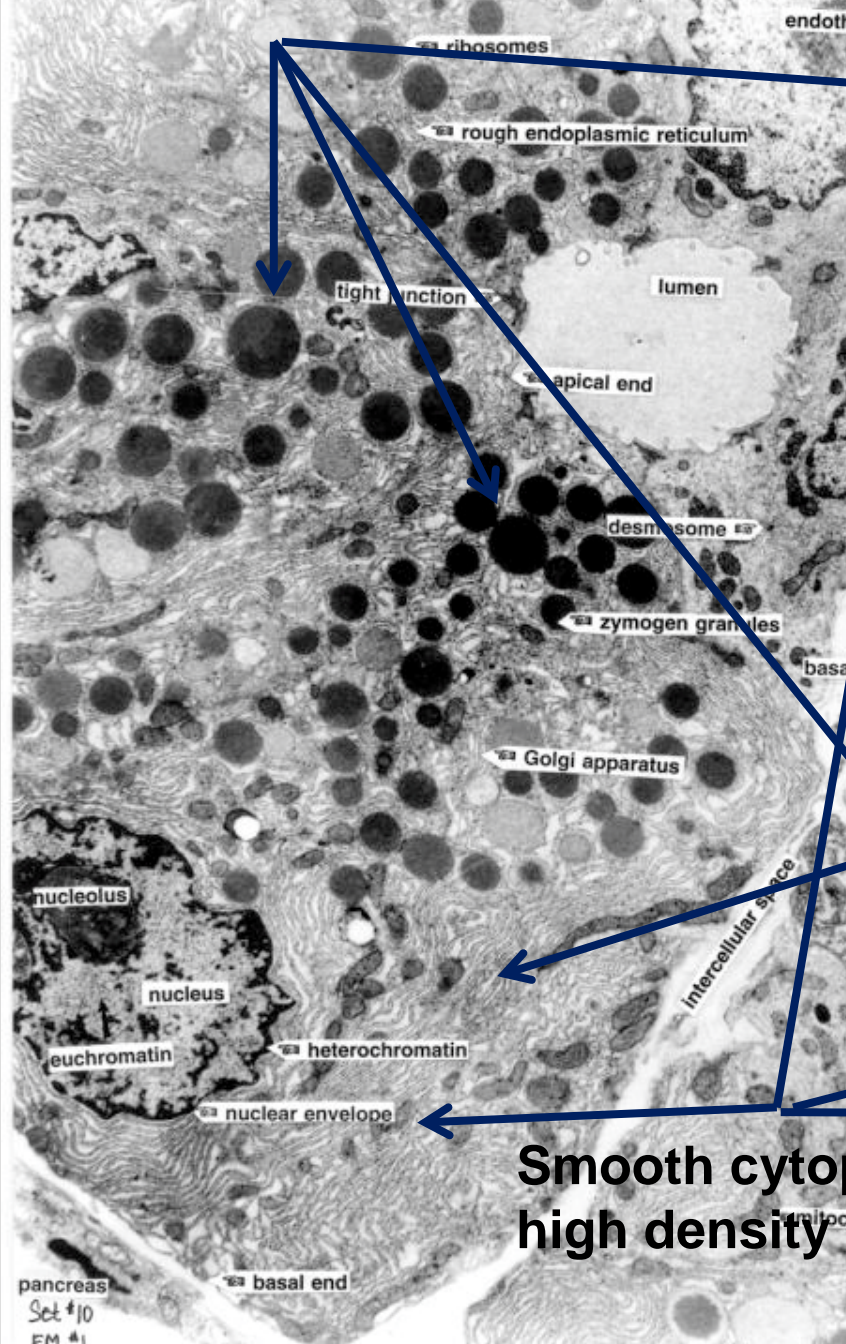
156

Pancreas, monkey (toluidine blue)

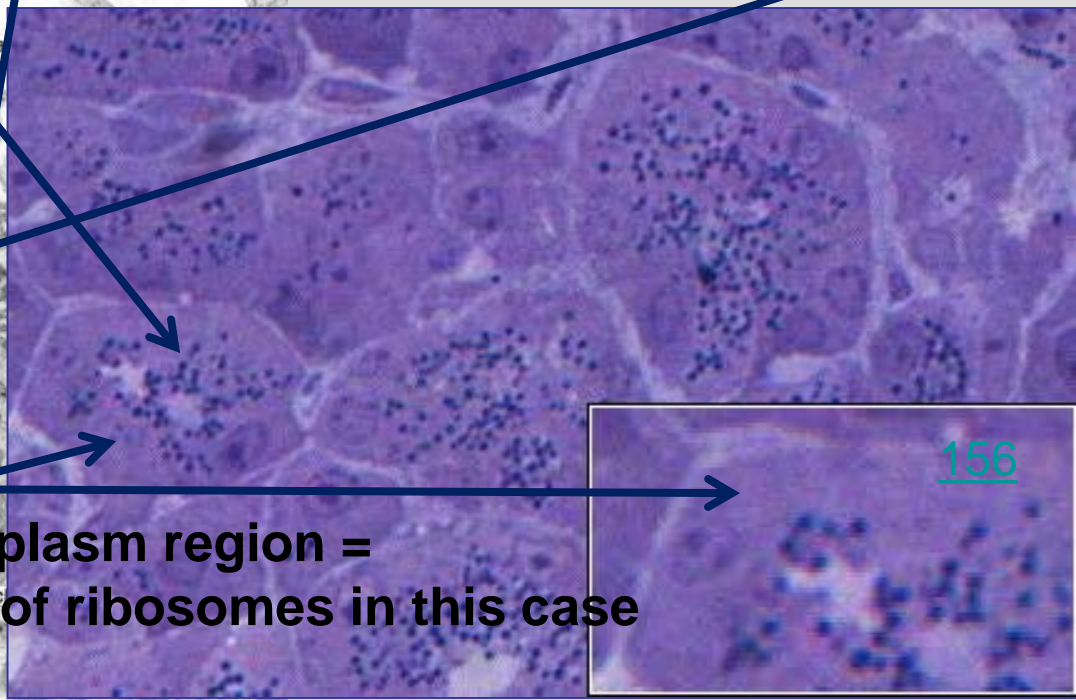
The entire pancreatic acinar cell is blue with varying intensities depending on the density of structures. Shape, size, and darkness are used to identify structures.



Secretory granules



Secretory granules are red as they are protein rich



Base cytoplasm is blue with ribosomes as in RER

Smooth cytoplasm region = high density of ribosomes in this case

Ref code # 5

Mucosa of stomach

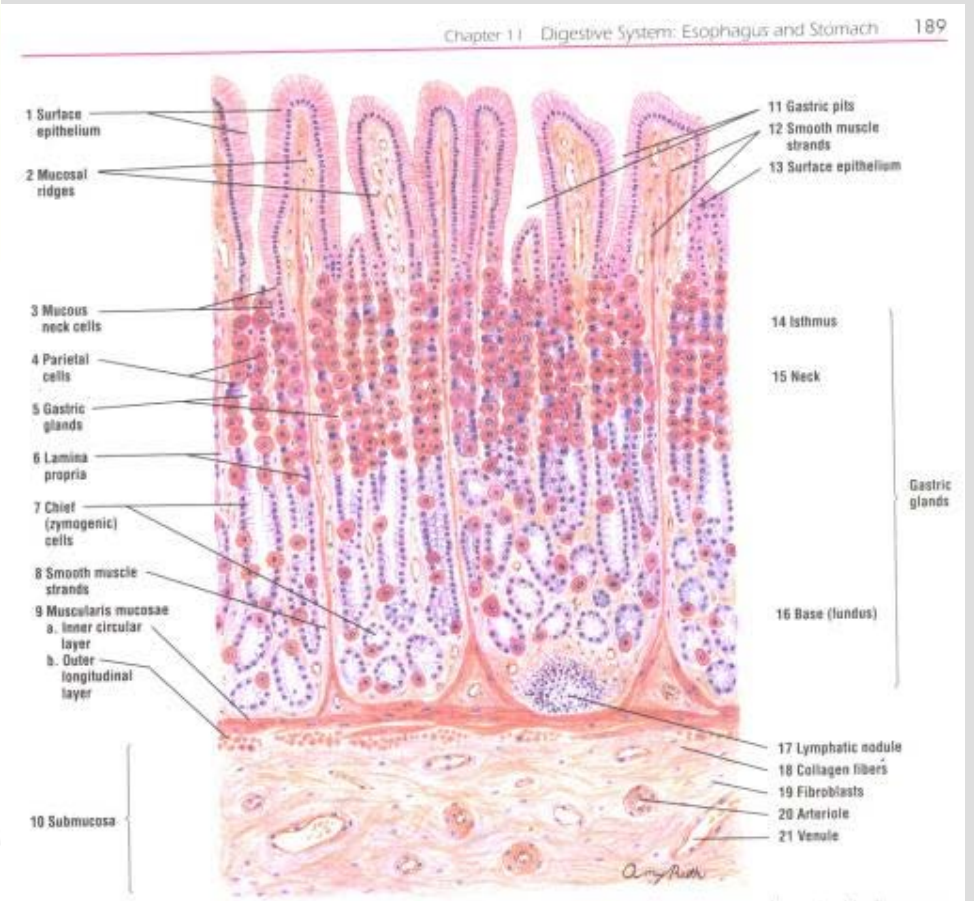
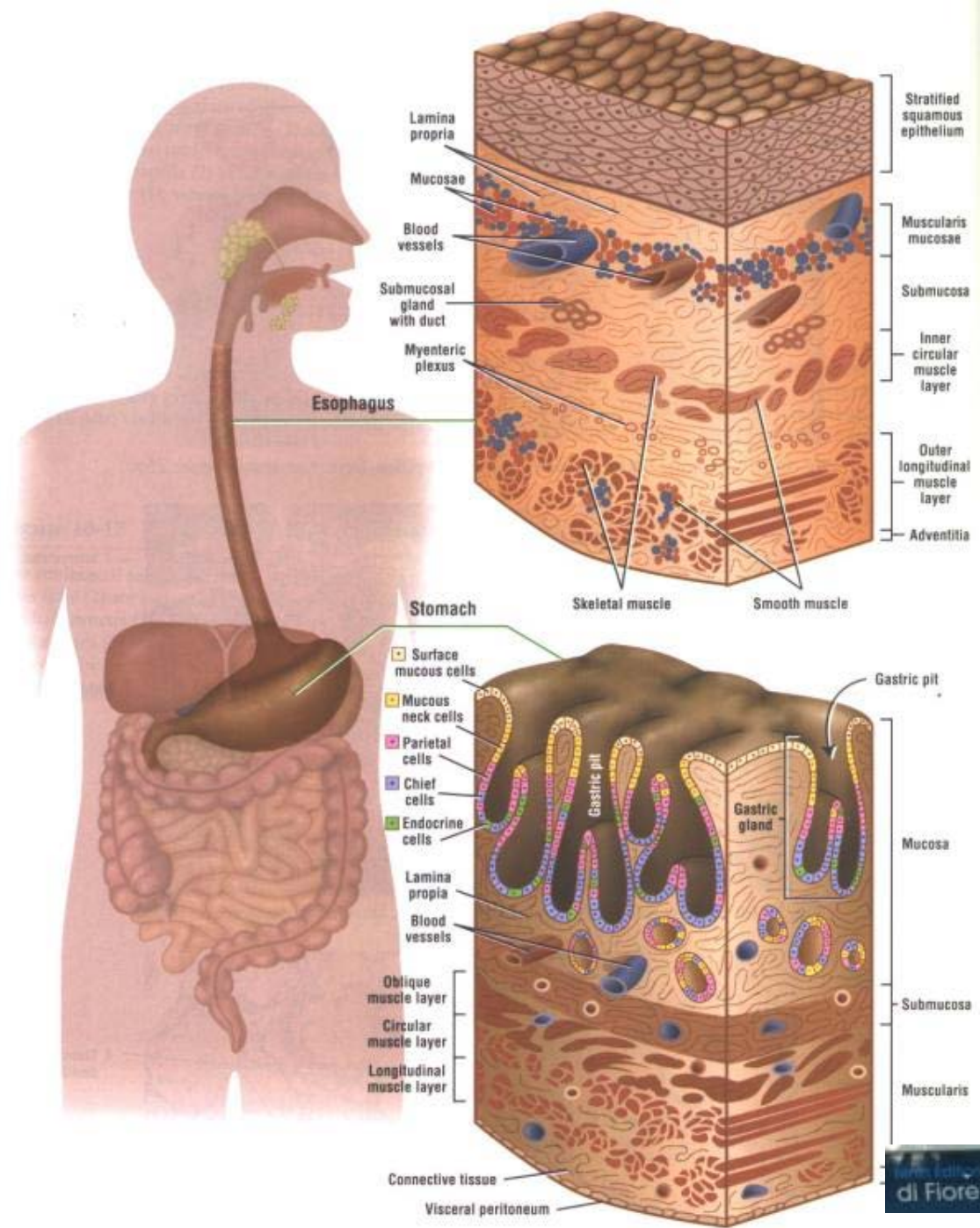
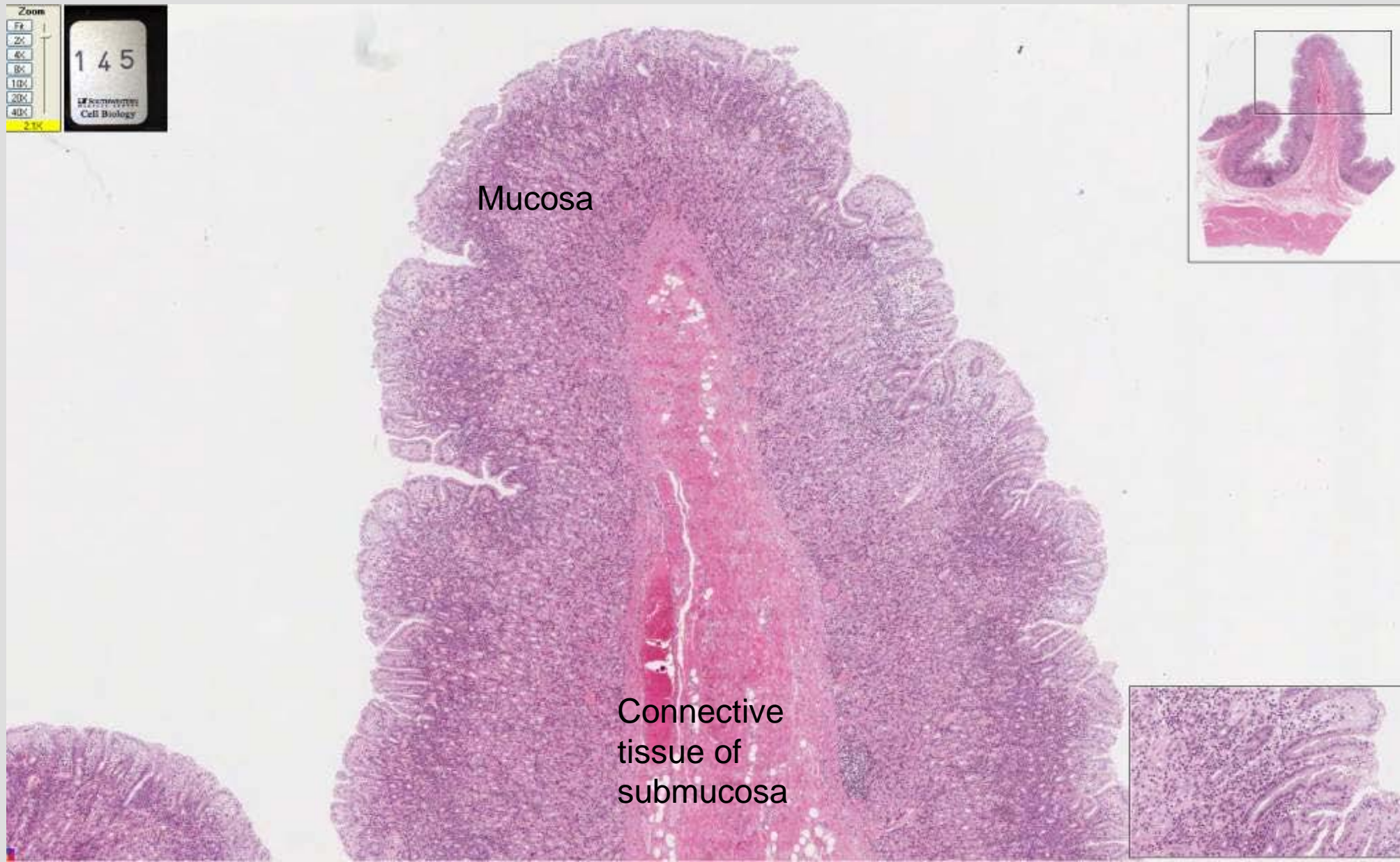


Fig. 11-7 Stomach: Mucosa of the Fundus and Body (transverse section). Stain: hematoxylin-eosin. Medium magnification.

145

Fundic stomach



Mucosa

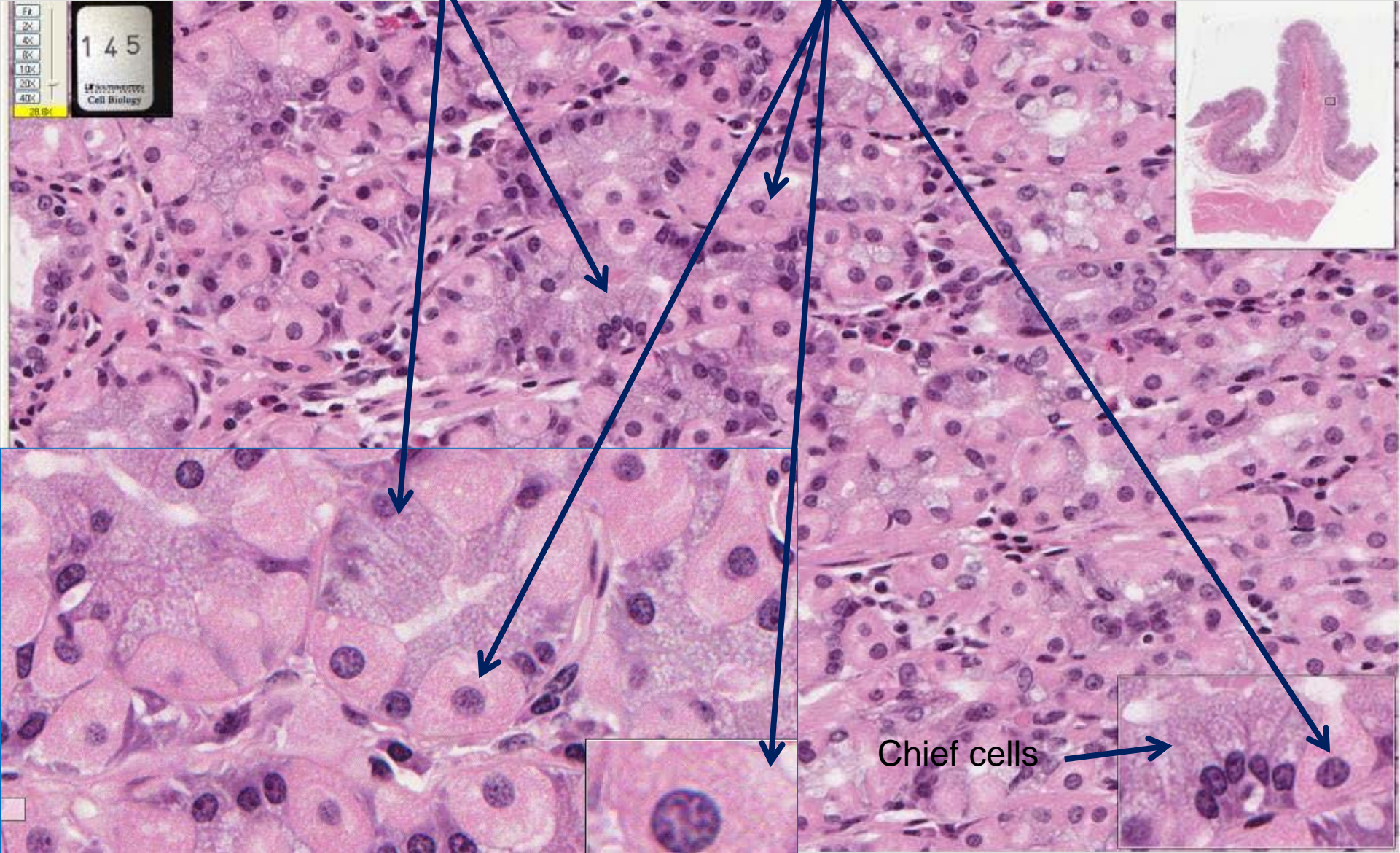
Connective
tissue of
submucosa

145

Fundic stomach: mucosa

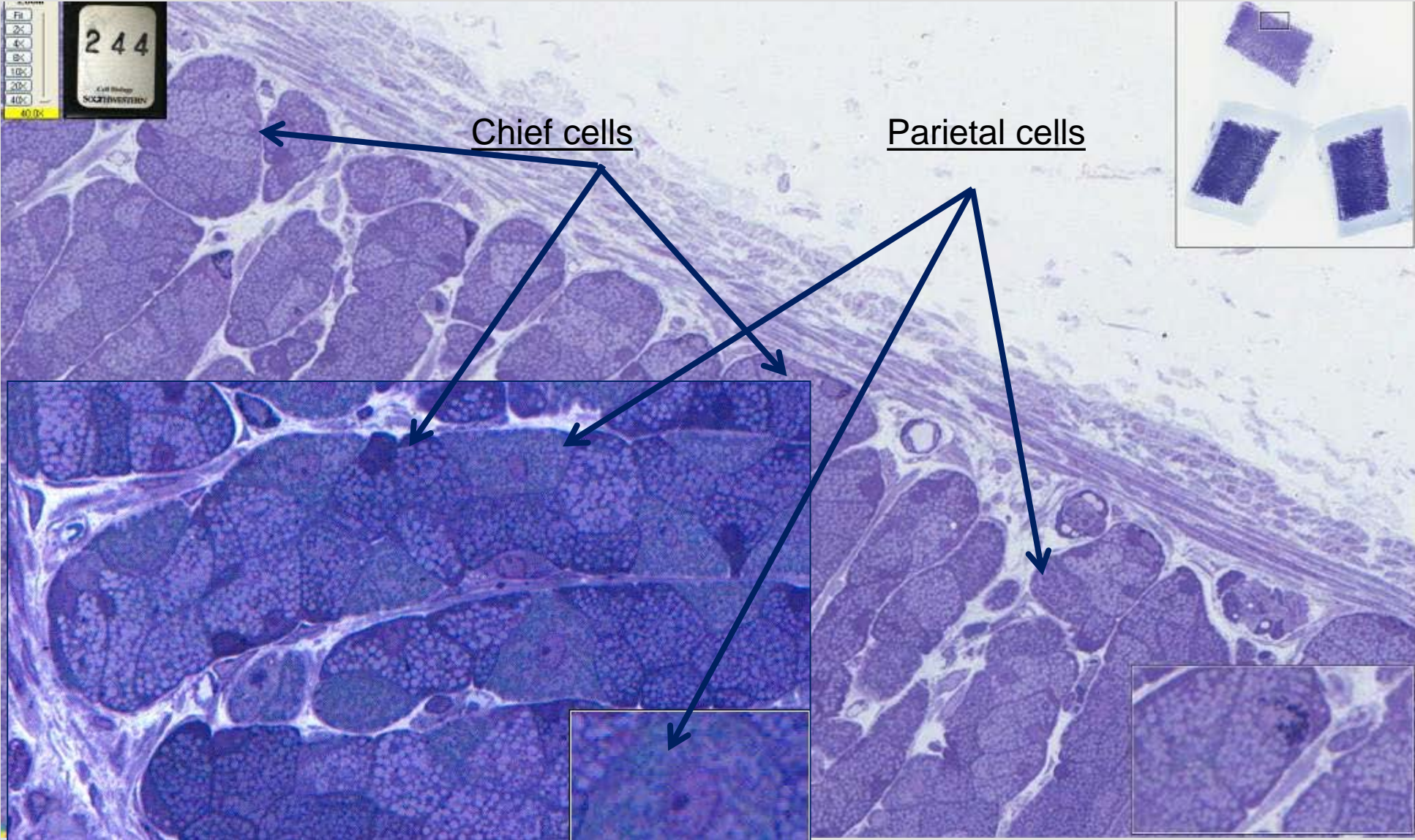
Chief cells

Parietal cells



244

Fundic stomach, rabbit (toluidine blue)



244

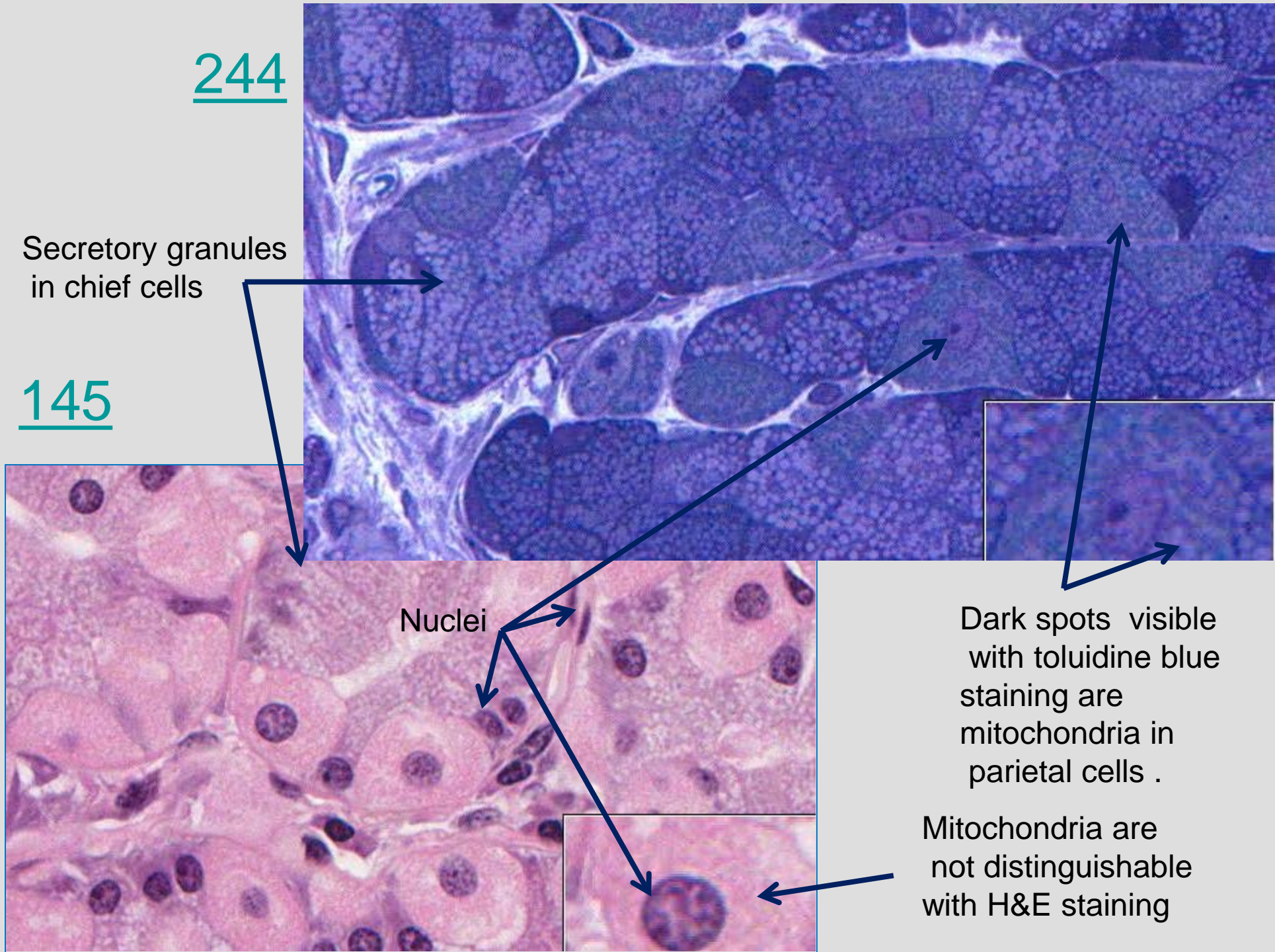
Secretory granules
in chief cells

145

Nuclei

Dark spots visible
with toluidine blue
staining are
mitochondria in
parietal cells .

Mitochondria are
not distinguishable
with H&E staining



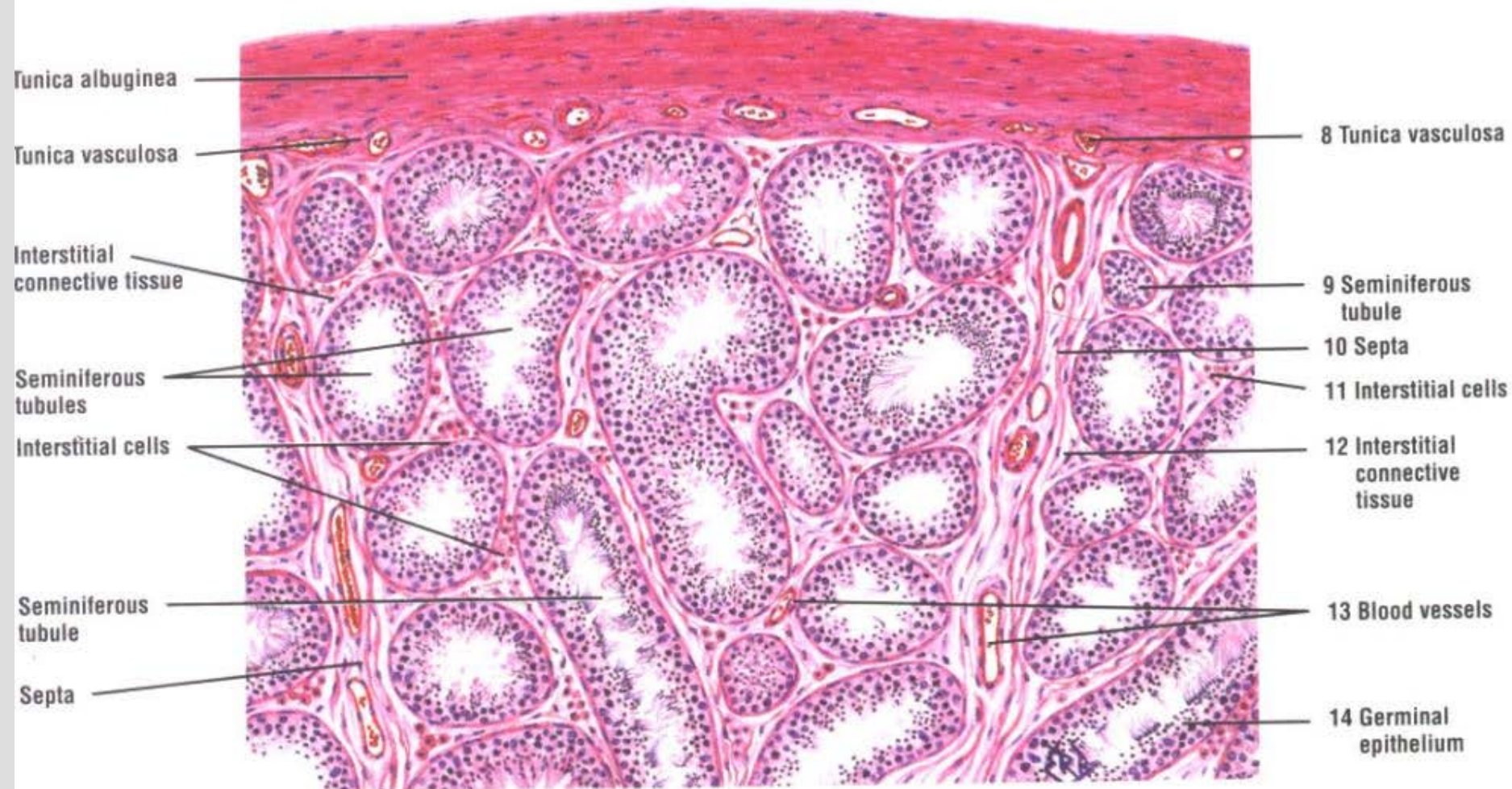
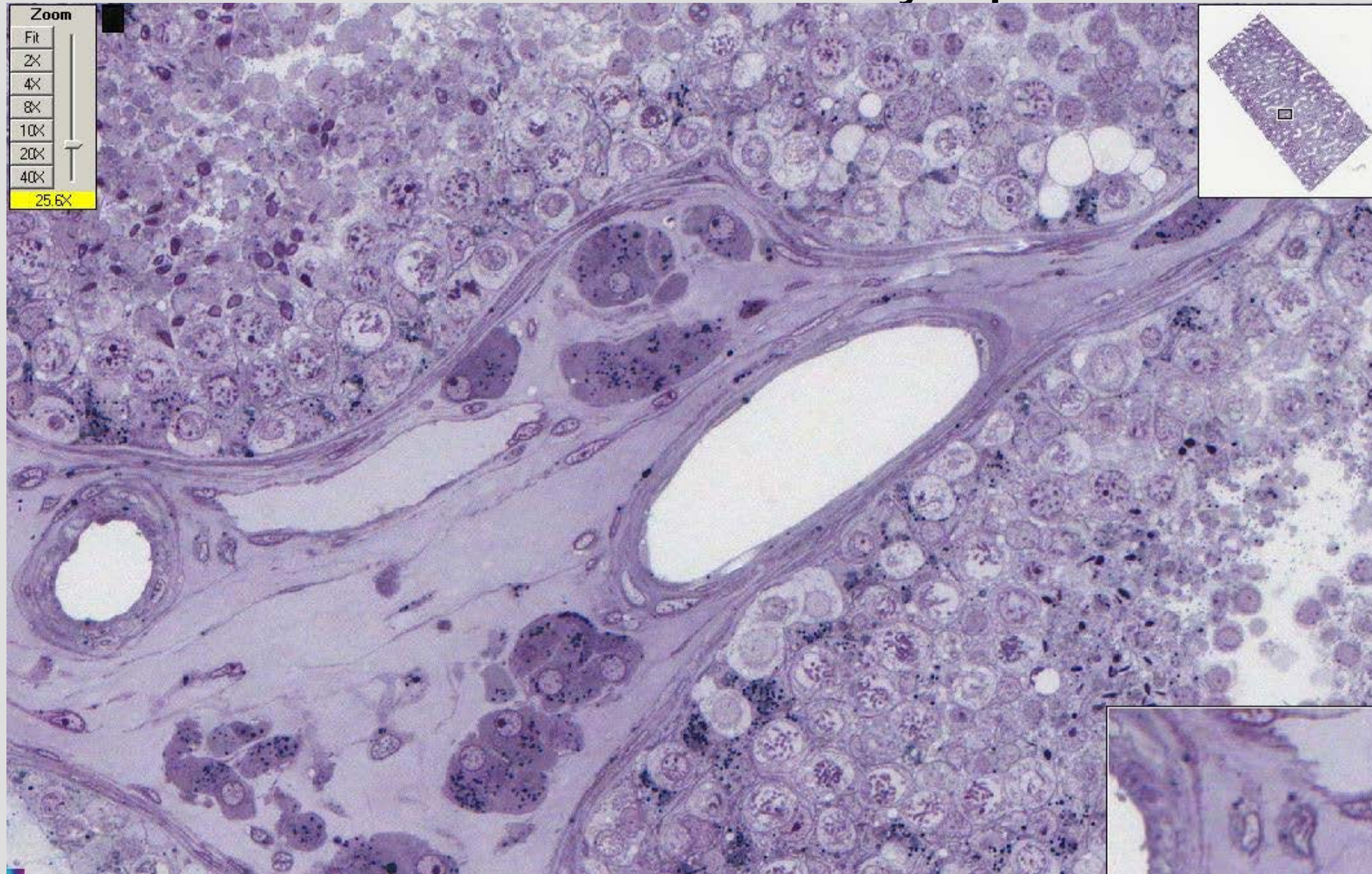


Fig. 17-1 Testis (sectional view). Stain: hematoxylin-eosin. Low magnification.

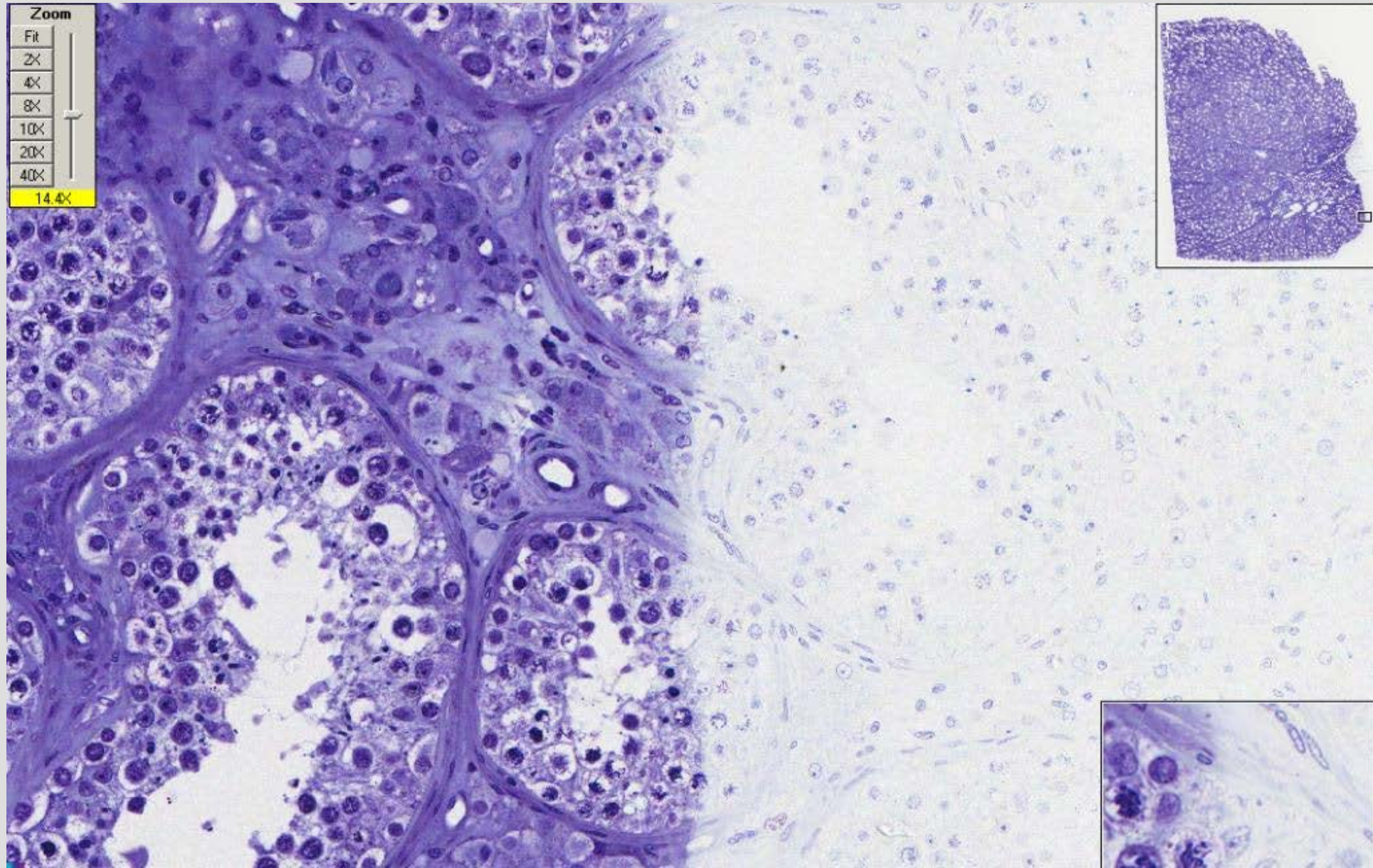
19680

Toluidine blue staining

Human testis - blood and lymph vessels



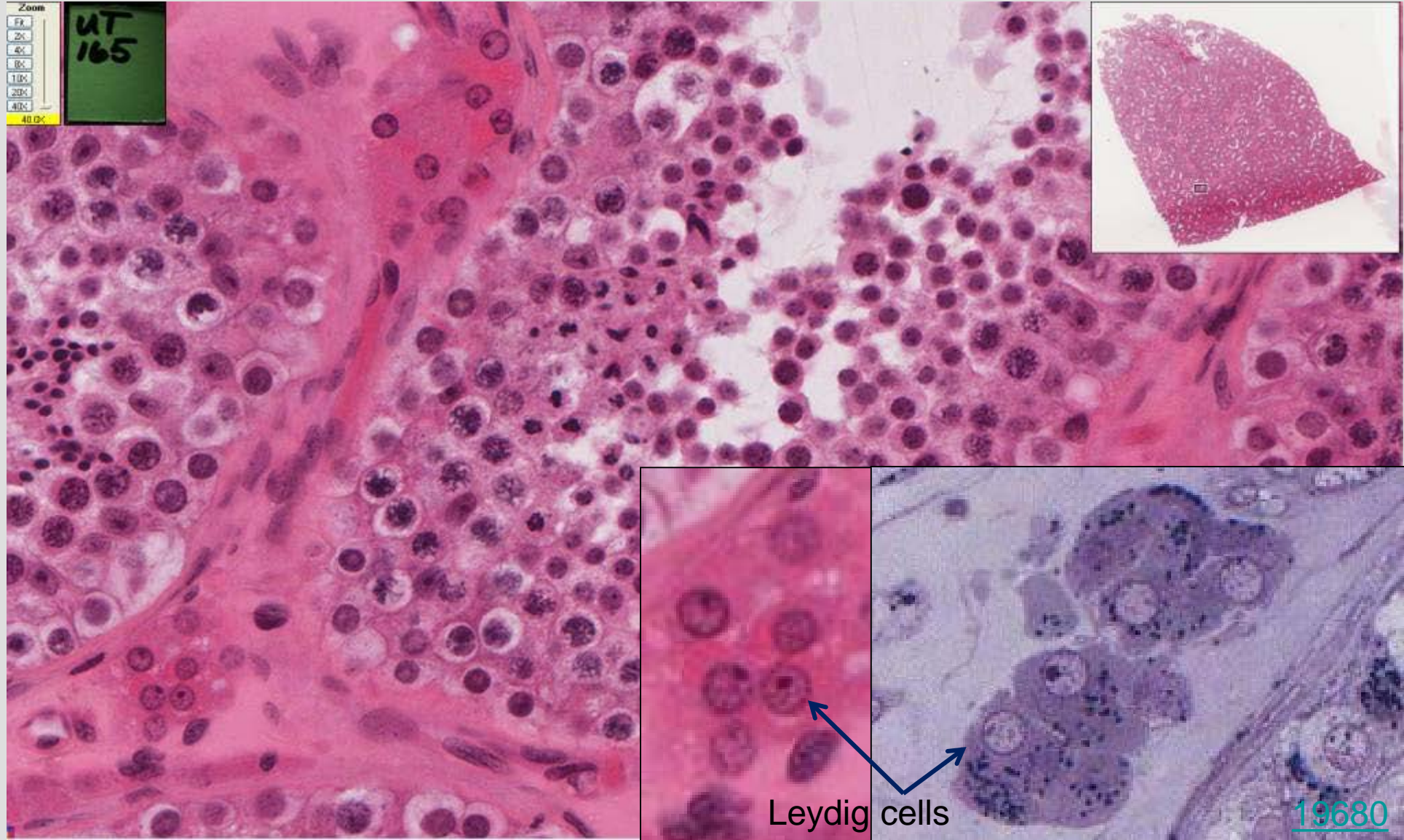
19709 Transparency of unstained tissue

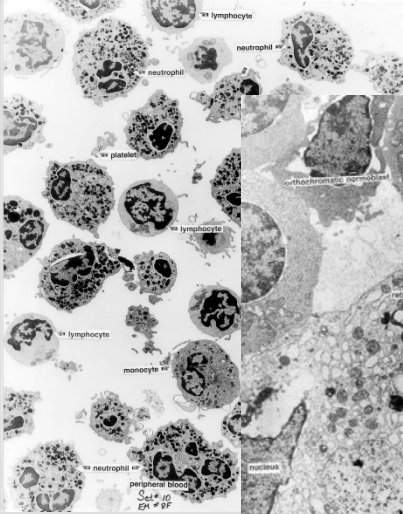


165

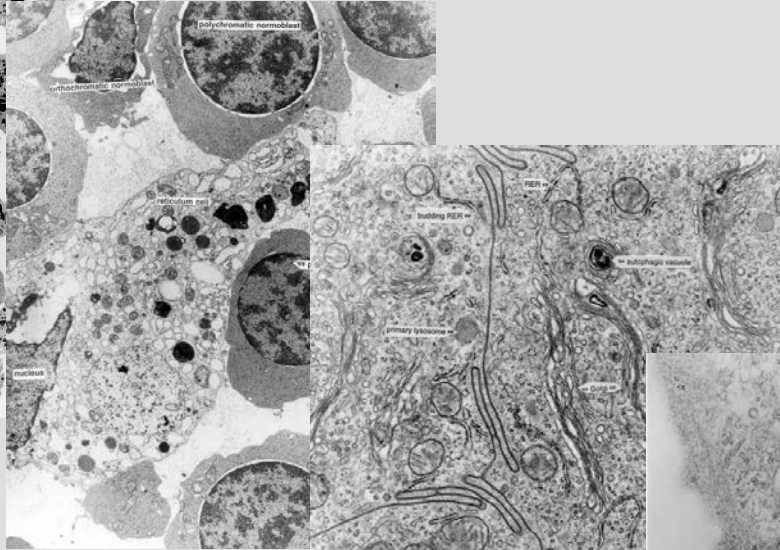
UT165 human testis

H & E staining and right insert
toluidine blue staining – note
differences in details of cytoplasm

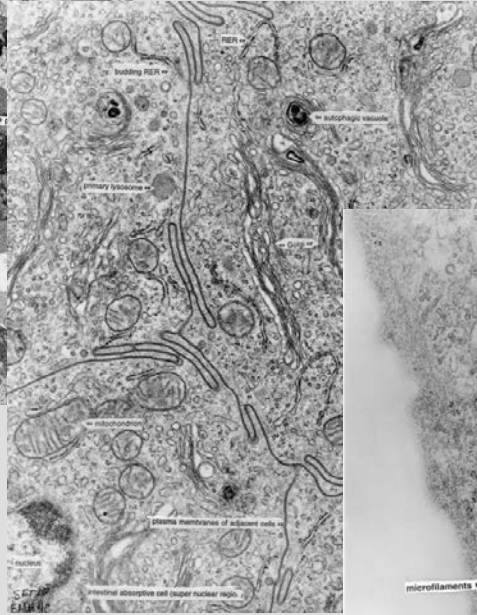




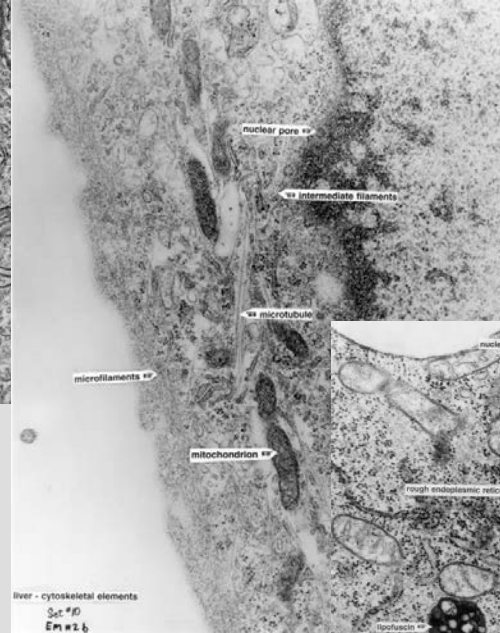
EM 8f



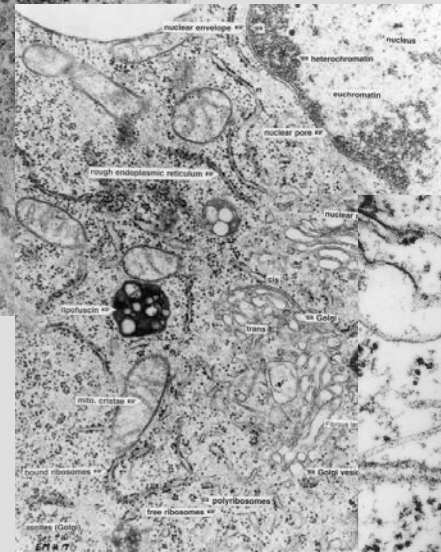
EM 12a



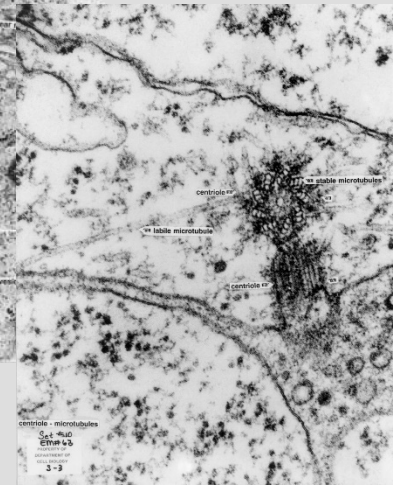
EM 4c



EM 2b

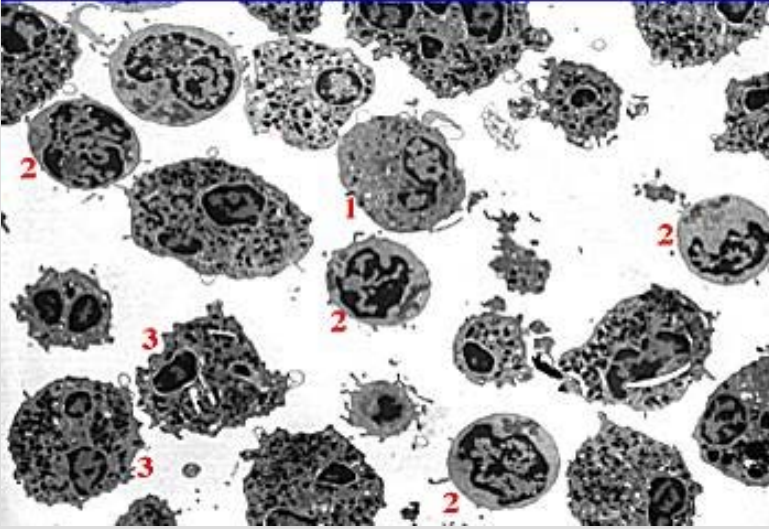


EM 7



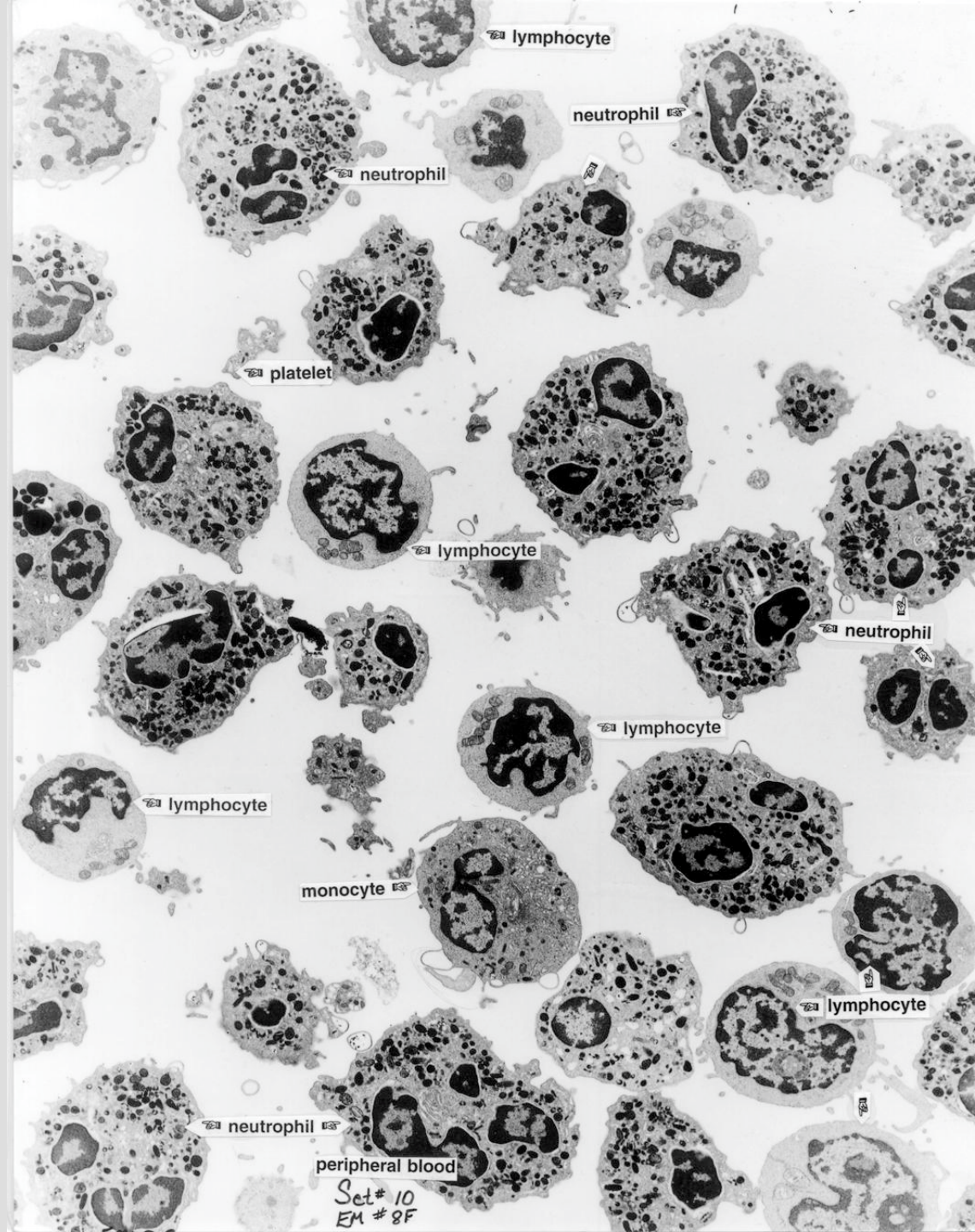
EM 6a

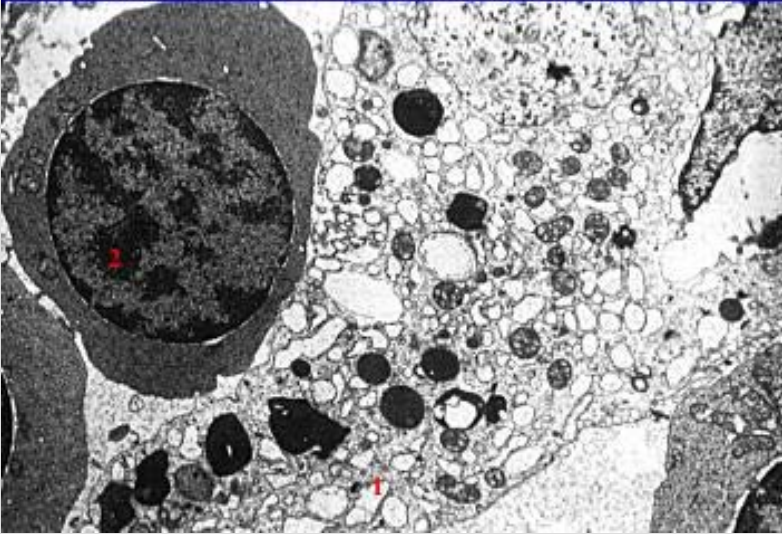
Compare sizes of
 membranes
 ribosomes
 mitochondria
 as transmission electron microscopy
 (TEM) provides more cellular detail
 than light microscopy



EM 8f: Peripheral blood cells;
9,000x

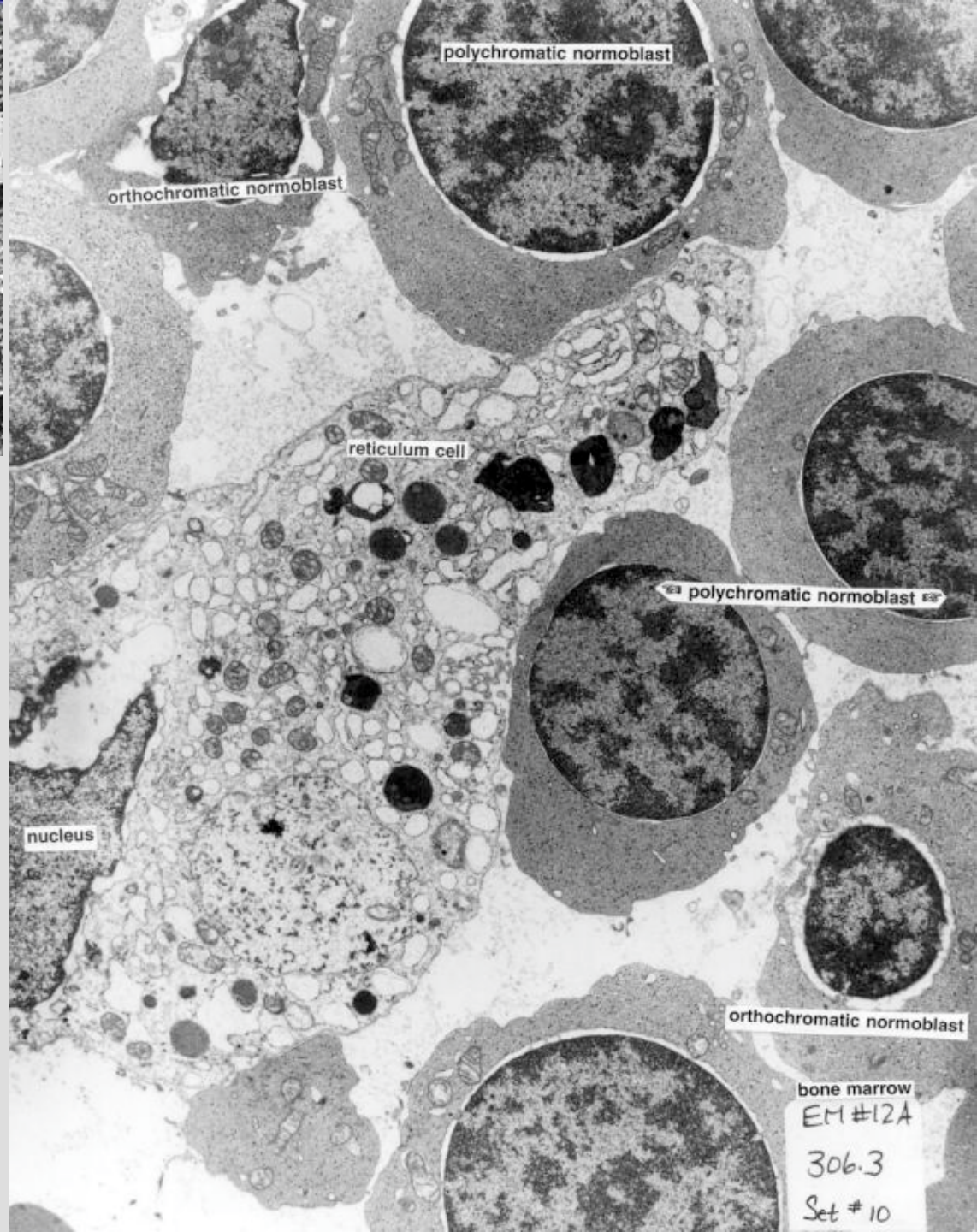
1. Monocyte
2. Lymphocyte
3. Neutrophil

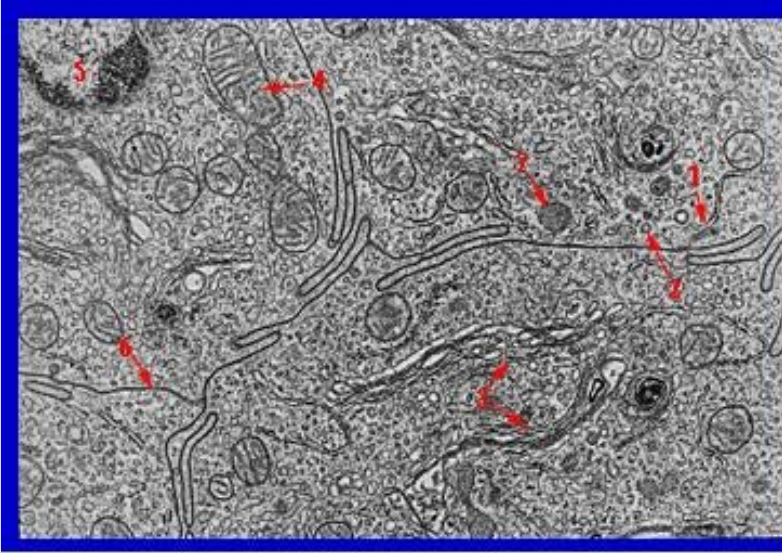




EM 12a: Bone marrow;
13,200x. Note the
reticular cell and
developing red blood
cells.

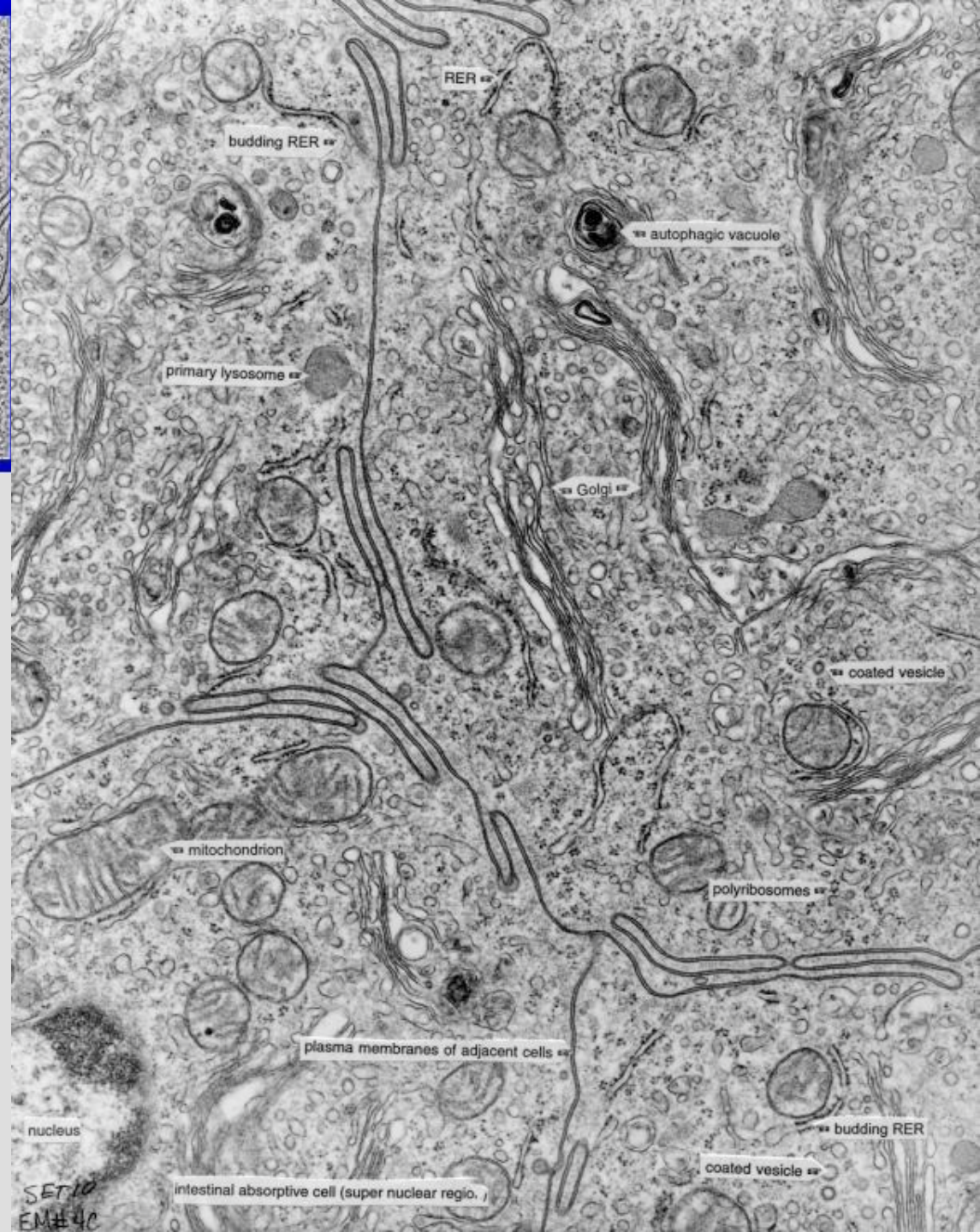
1. Reticular cell
2. Developing red blood cell

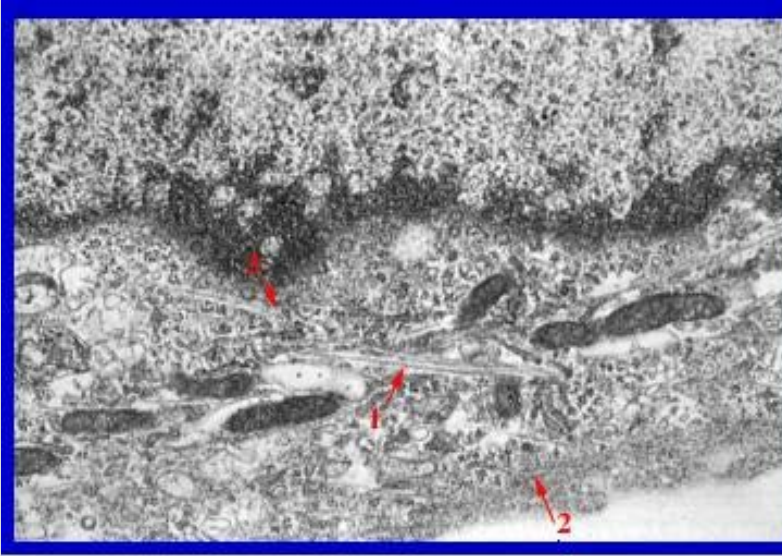




EM 4c: Intestinal absorption cell;
60,000x

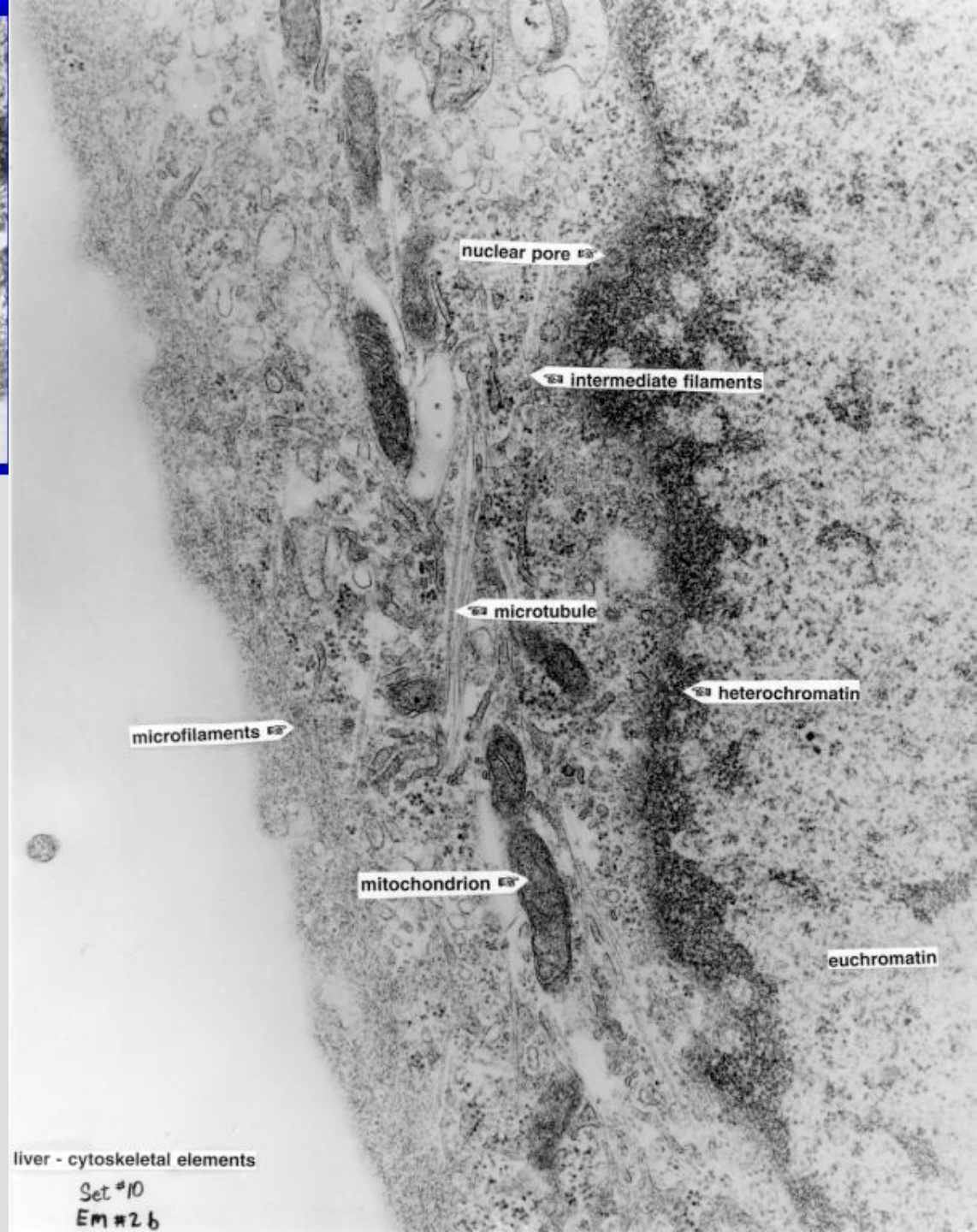
1. Budding RER
2. Coated vesicle
3. Golgi
4. Mitochondria
5. Nucleus
6. Plasma membrane
7. Primary lysosome

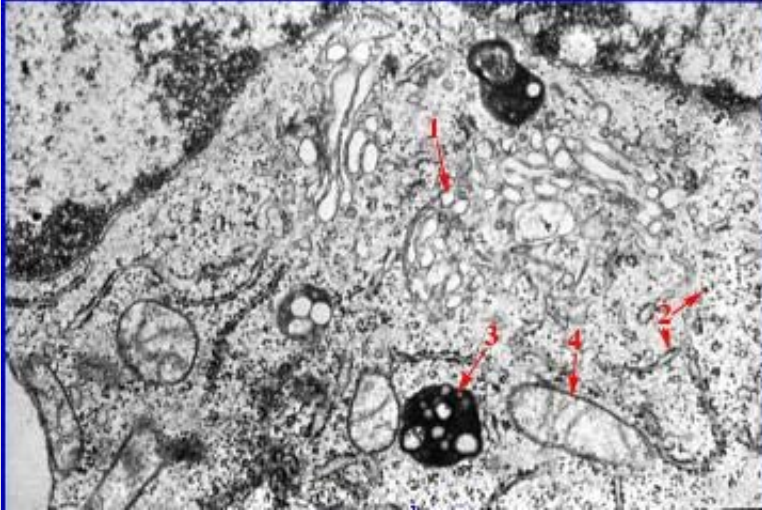




EM 2b: Liver; 60,000x; cytoskeletal elements. Microtubules, microfilaments, and intermediate filaments can be compared in this cell, which has a high concentration of cortical microfilaments.

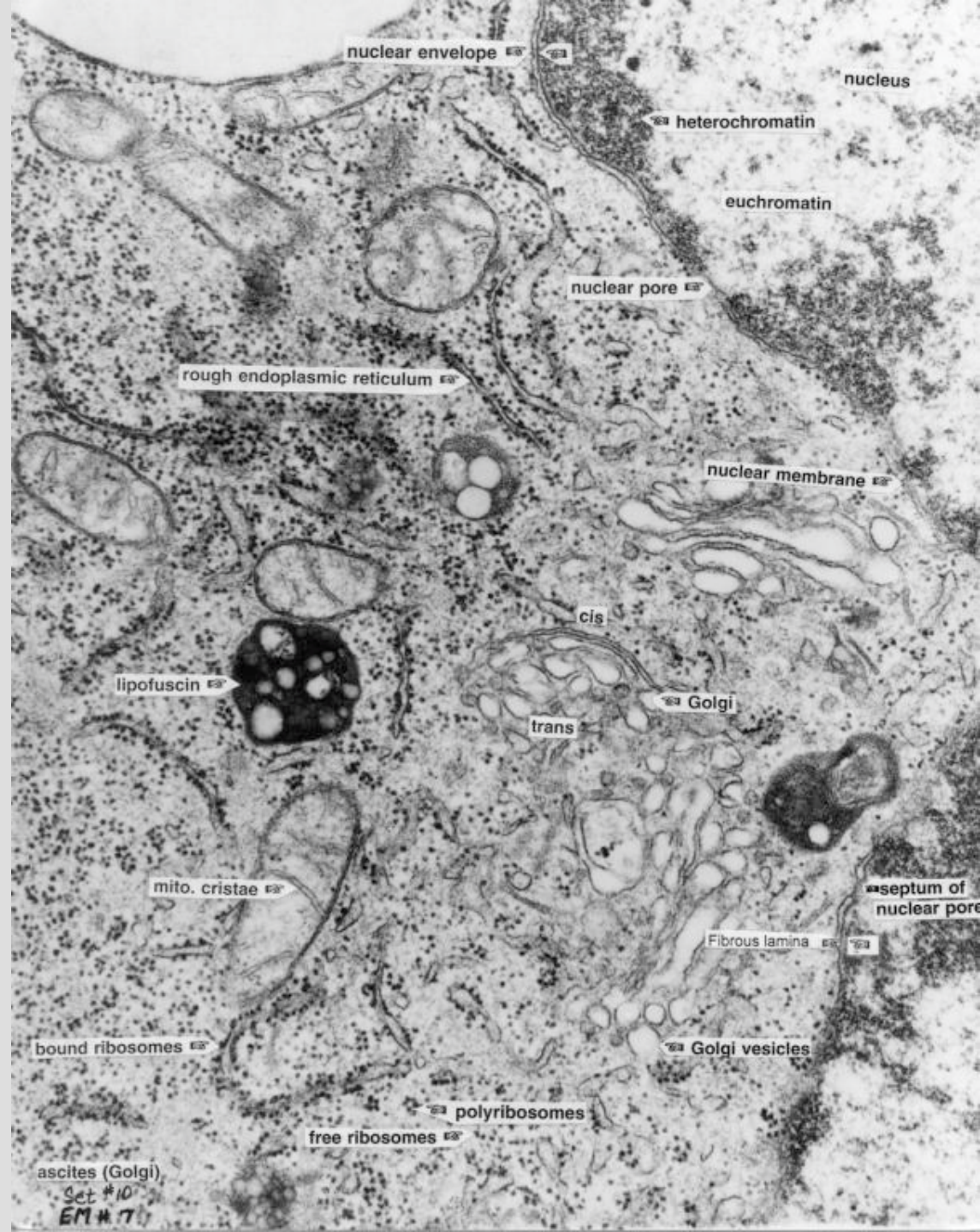
1. Microtubule
2. Microfilaments
3. Intermediate filaments

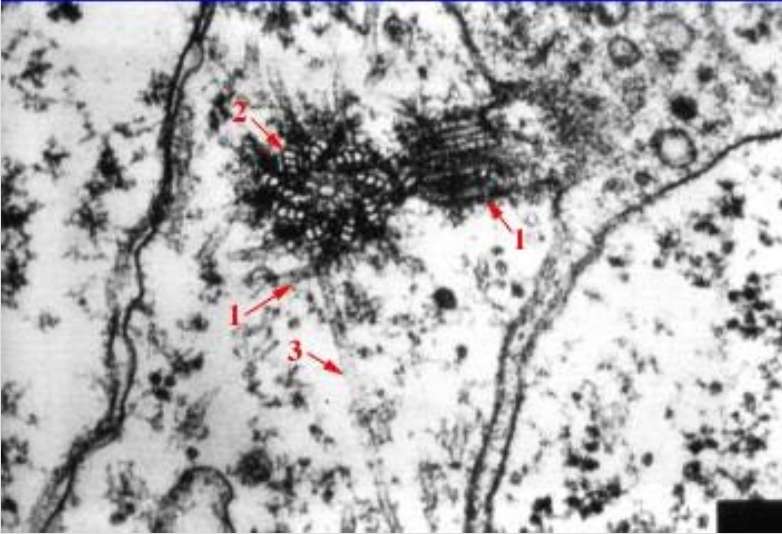




EM 7: Ascites fluid;
80,000x. Clear
examples of Golgi
apparatuses with their
cisternae and vesicles
are present in this cell

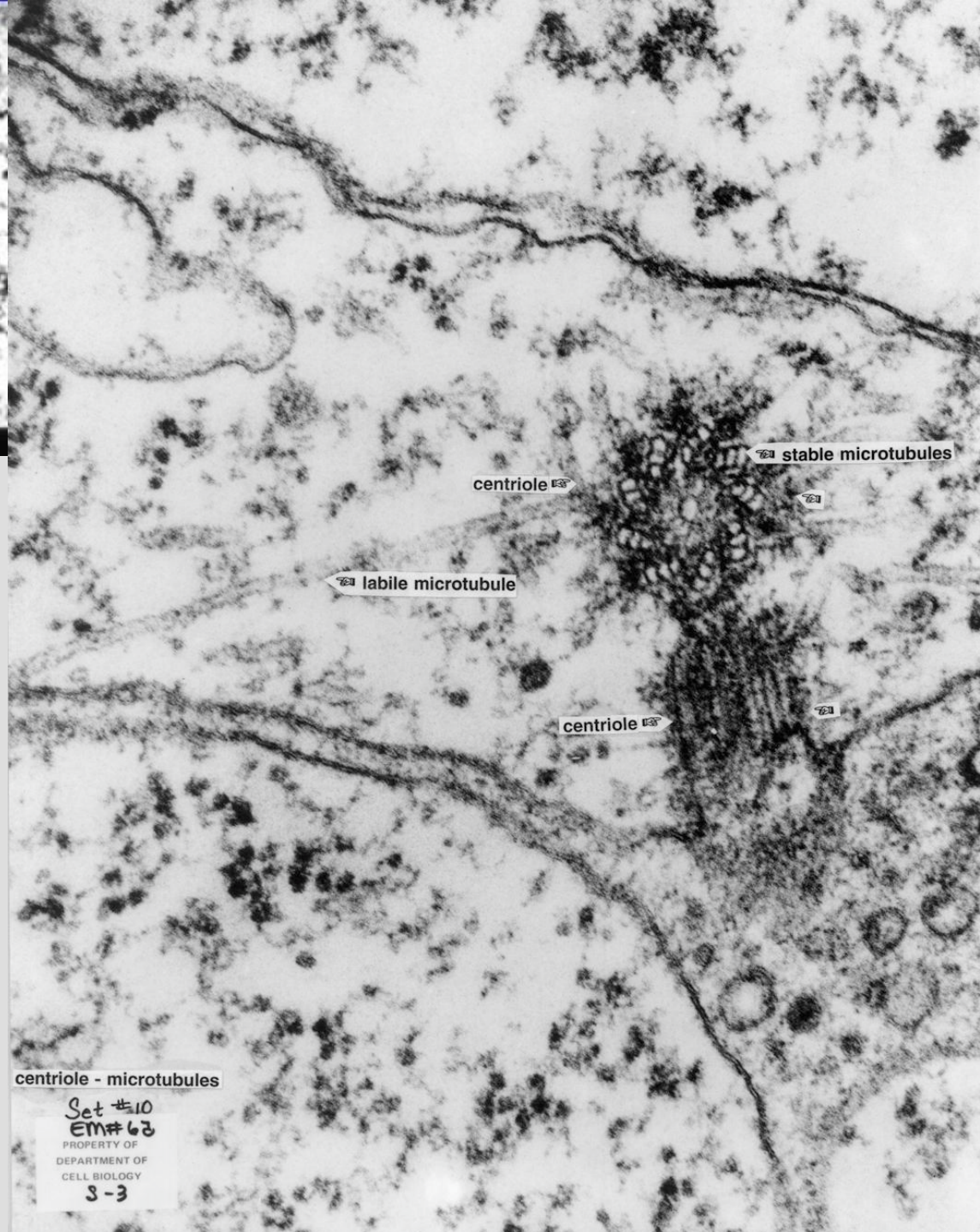
1. Golgi apparatus
2. Ribosomes
3. Lipofuscin
4. Mitochondrion





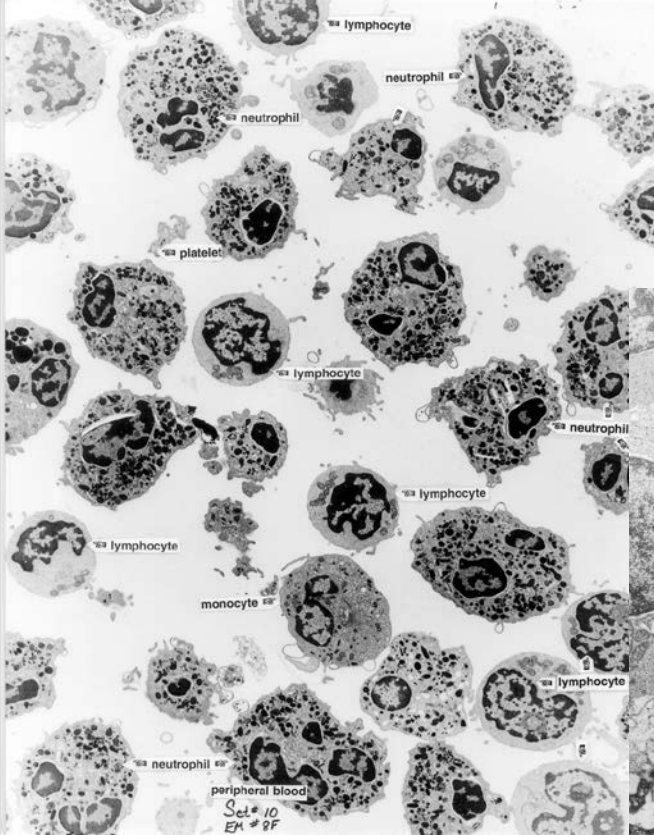
EM 6a: Centriole-microtubules;
200,000x. Centriolar region
of a cell showing both the
stable, triplet microtubule
arrays within the centriole,
and the labile, individual
microtubules originating
from pericentriolar material.

1. Centriole
2. Stable microtubule
3. Labile microtubule



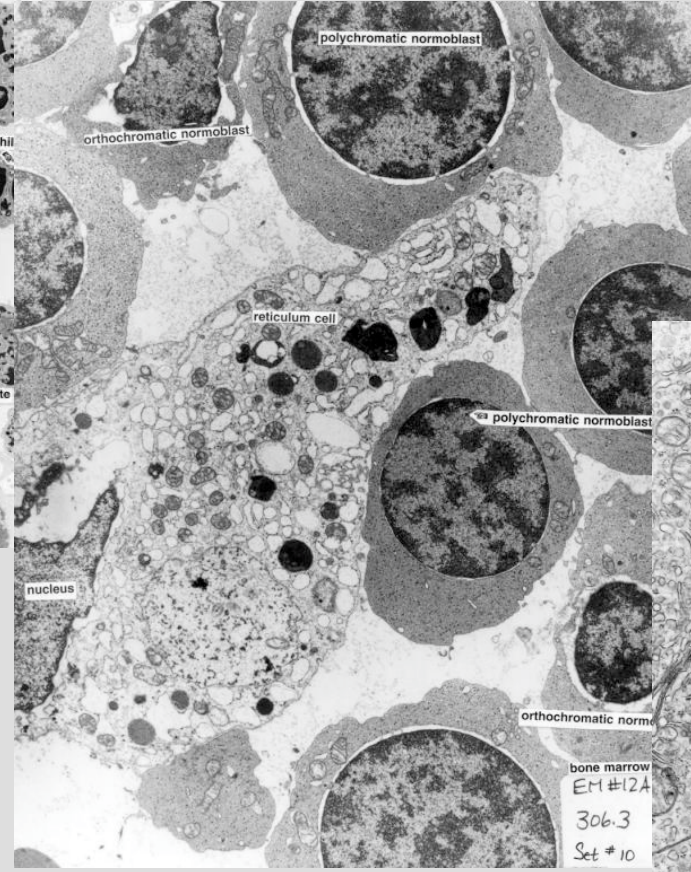
centriole - microtubules

Set #10
EM#62
PROPERTY OF
DEPARTMENT OF
CELL BIOLOGY
3-3



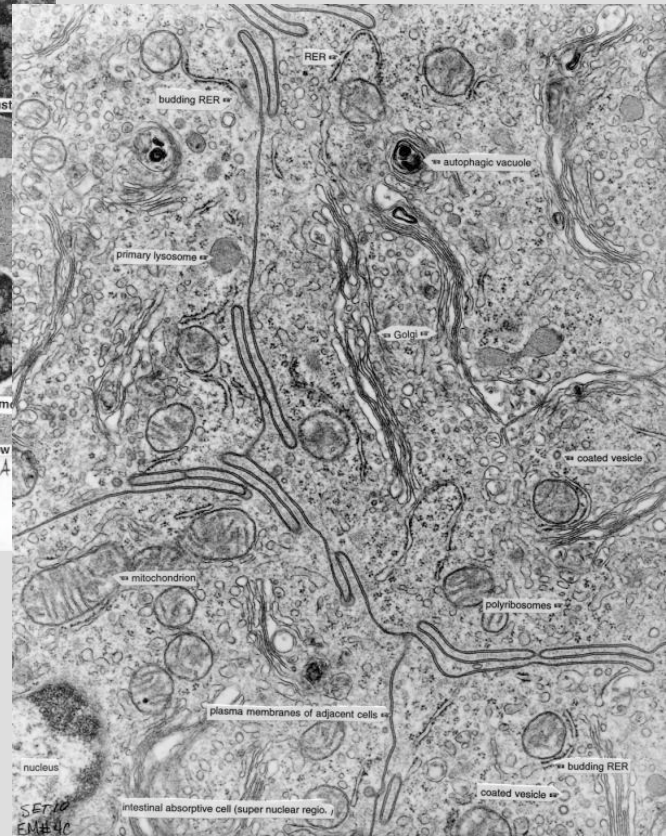
EM 8f 9,000x

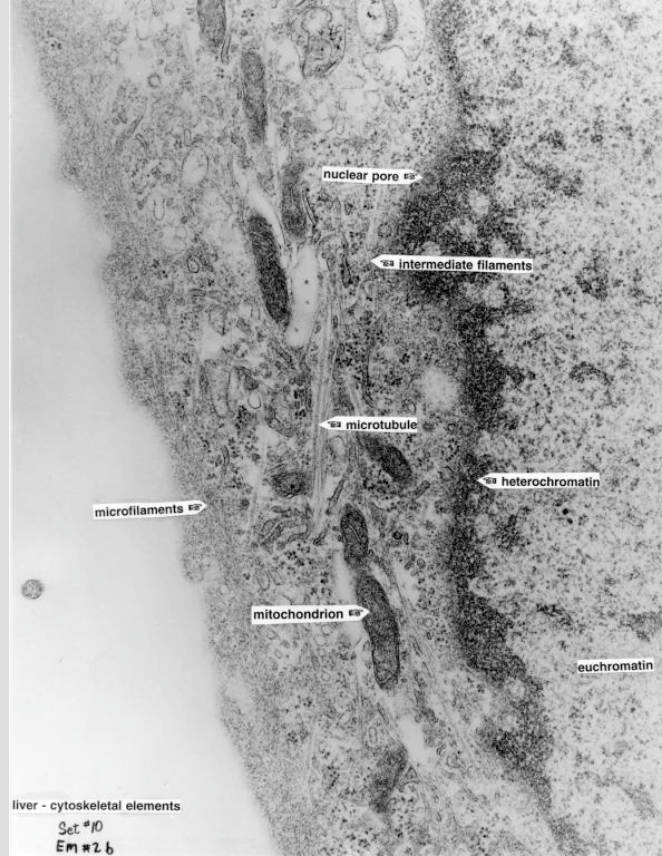
Compare sizes of
membranes
ribosomes
mitochondria



EM 12a 13,200x

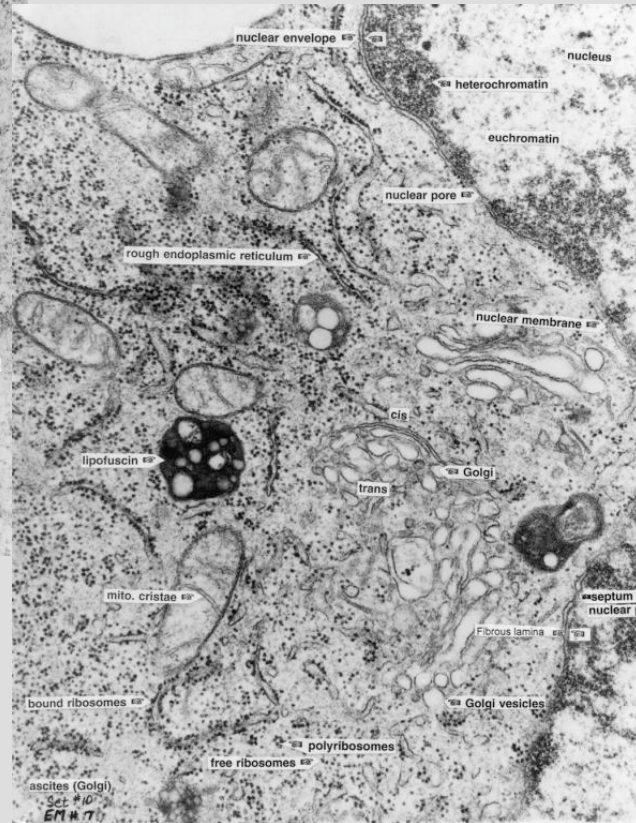
EM 4c 60,000x



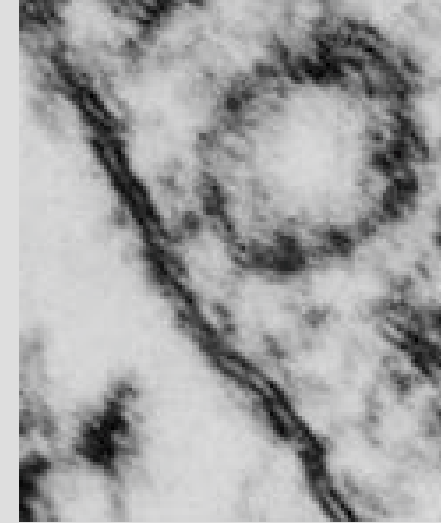


EM 2b 60,000x

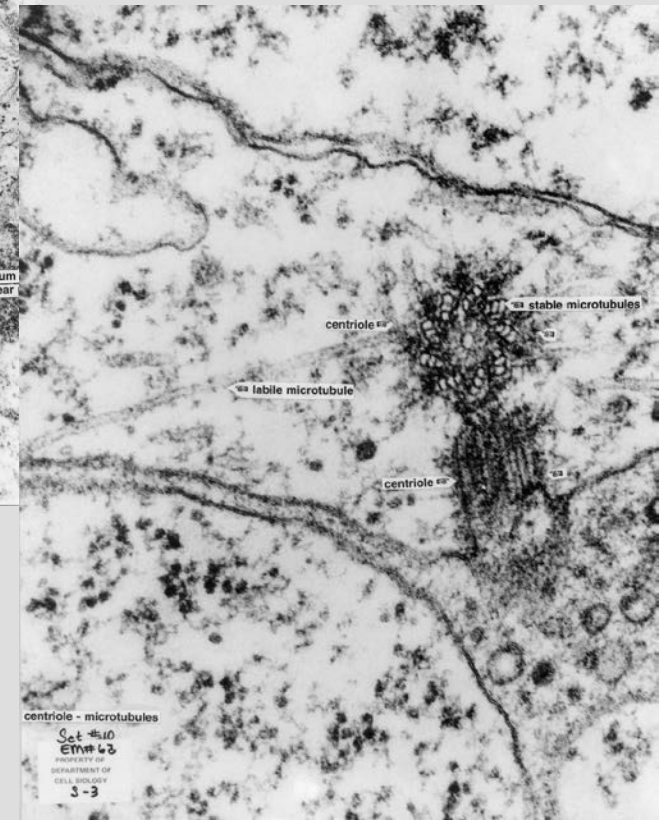
Compare sizes of
membranes
ribosomes
mitochondria



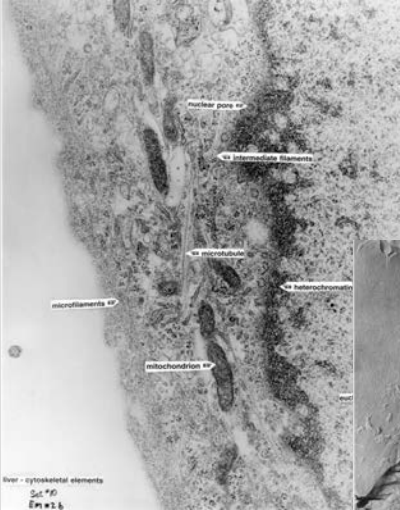
EM 7 80,000x



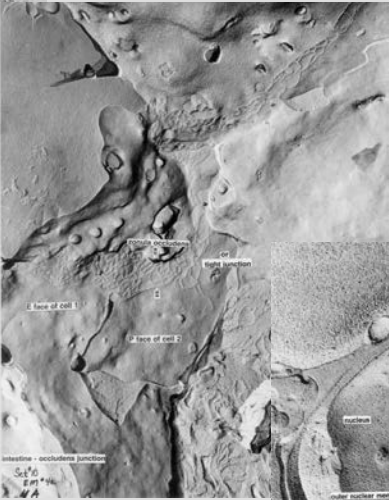
EM 6a 200,000x



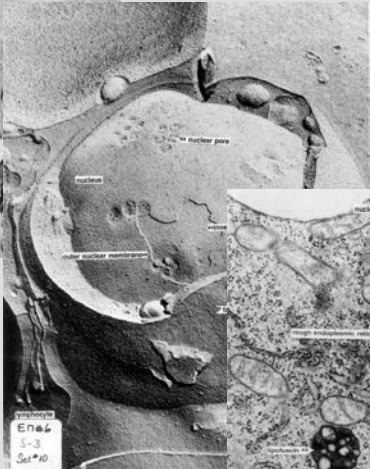
Conventional TEM,
SEM
carbon replica TEM



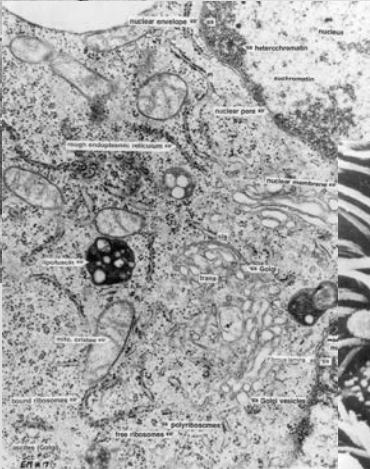
EM 2b



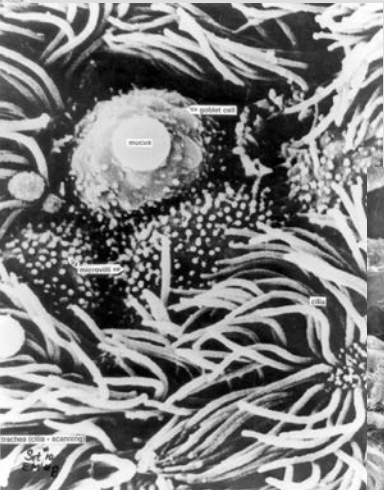
EM 4a



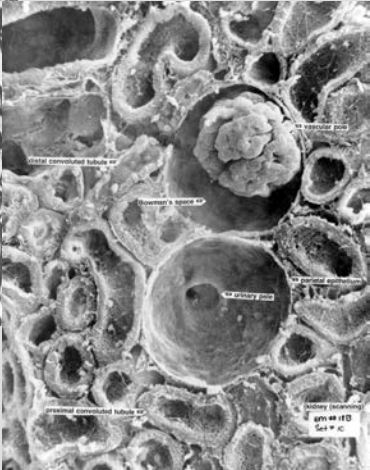
EM 6



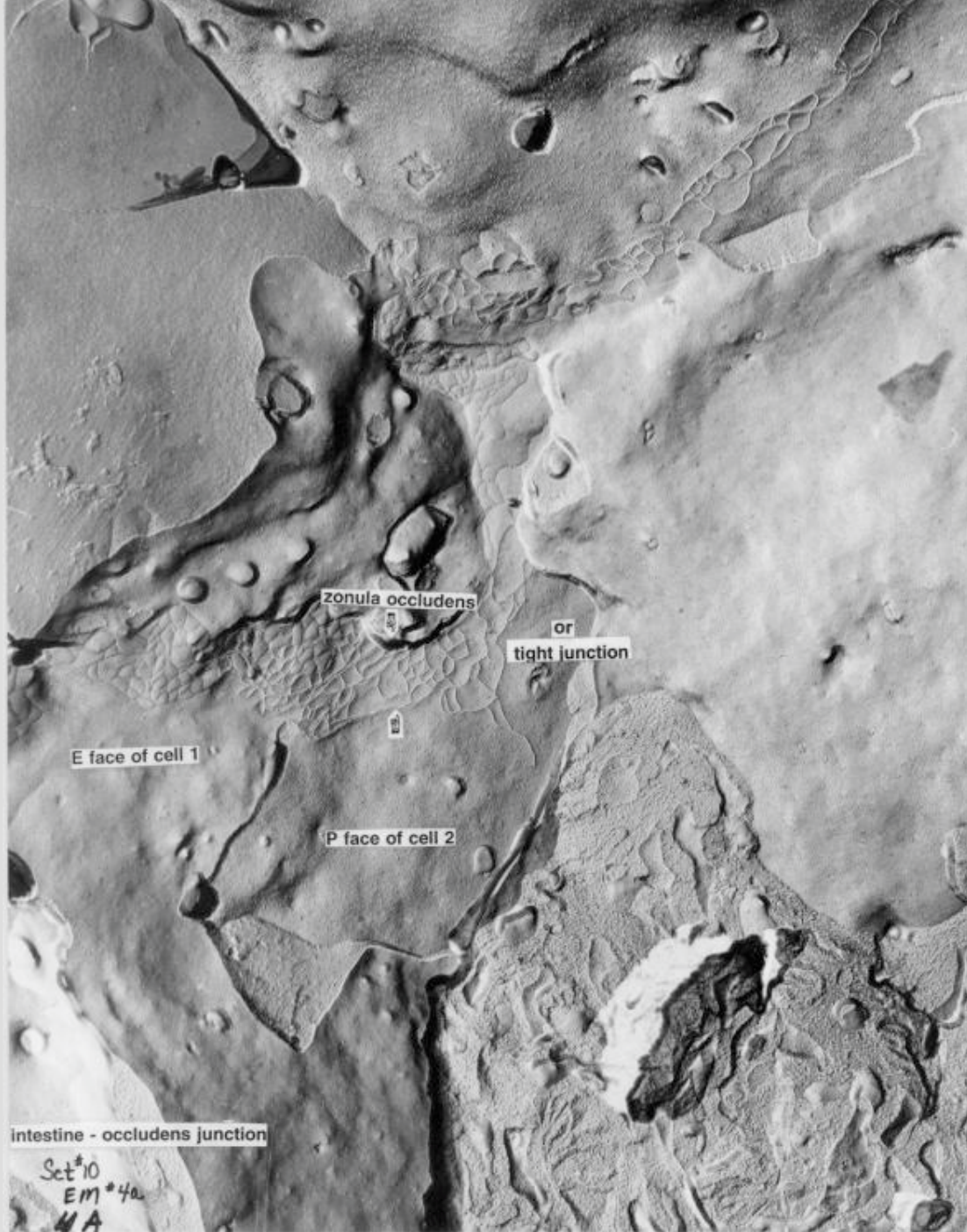
EM 7



EM 8



EM 18b



zonula occludens

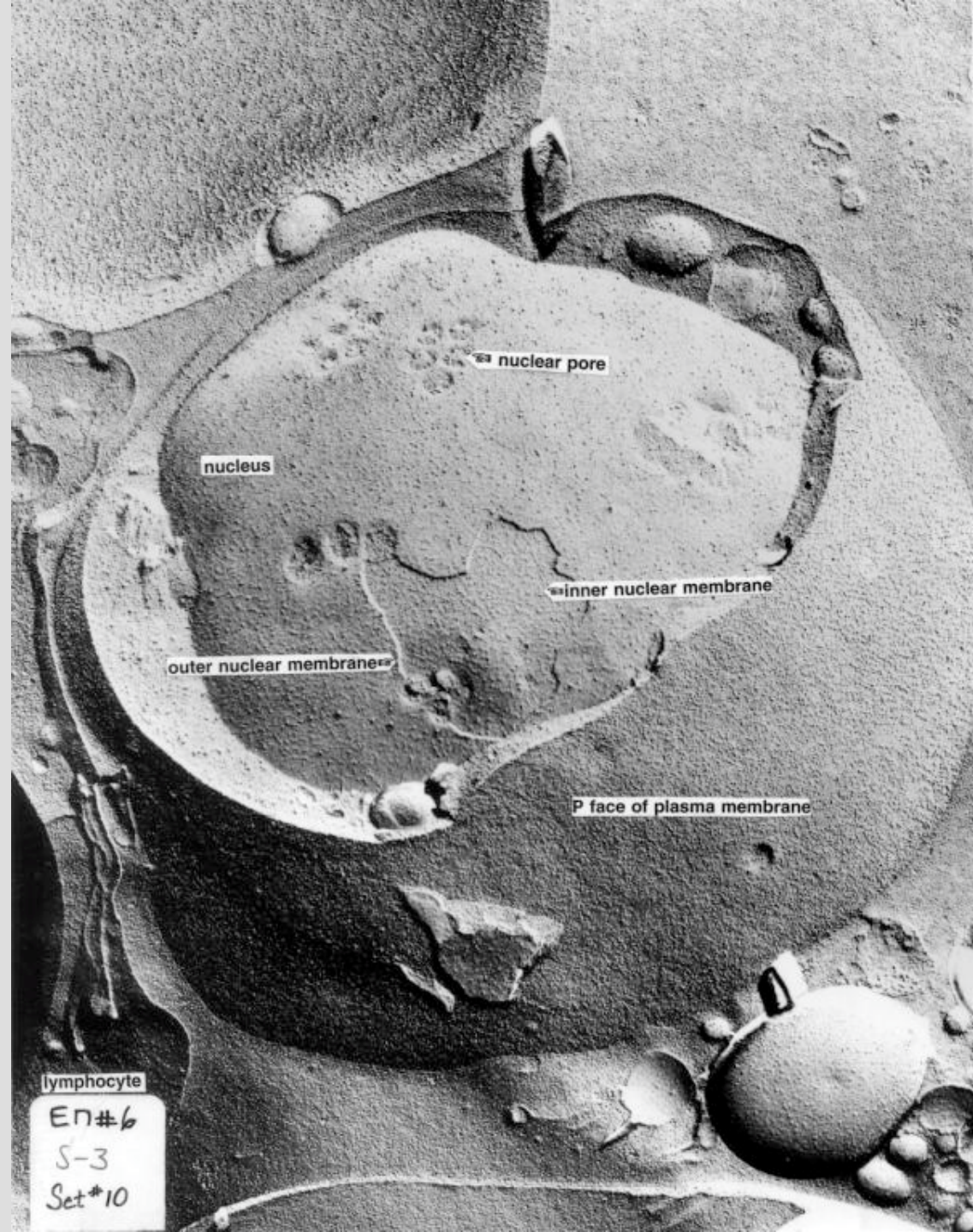
or
tight junction

E face of cell 1

P face of cell 2

intestine - occludens junction

Set #10
EM #40
HA



nuclear pore

nucleus

inner nuclear membrane

outer nuclear membrane

P face of plasma membrane

lymphocyte

EN#6

S-3

Set#10



goblet cell

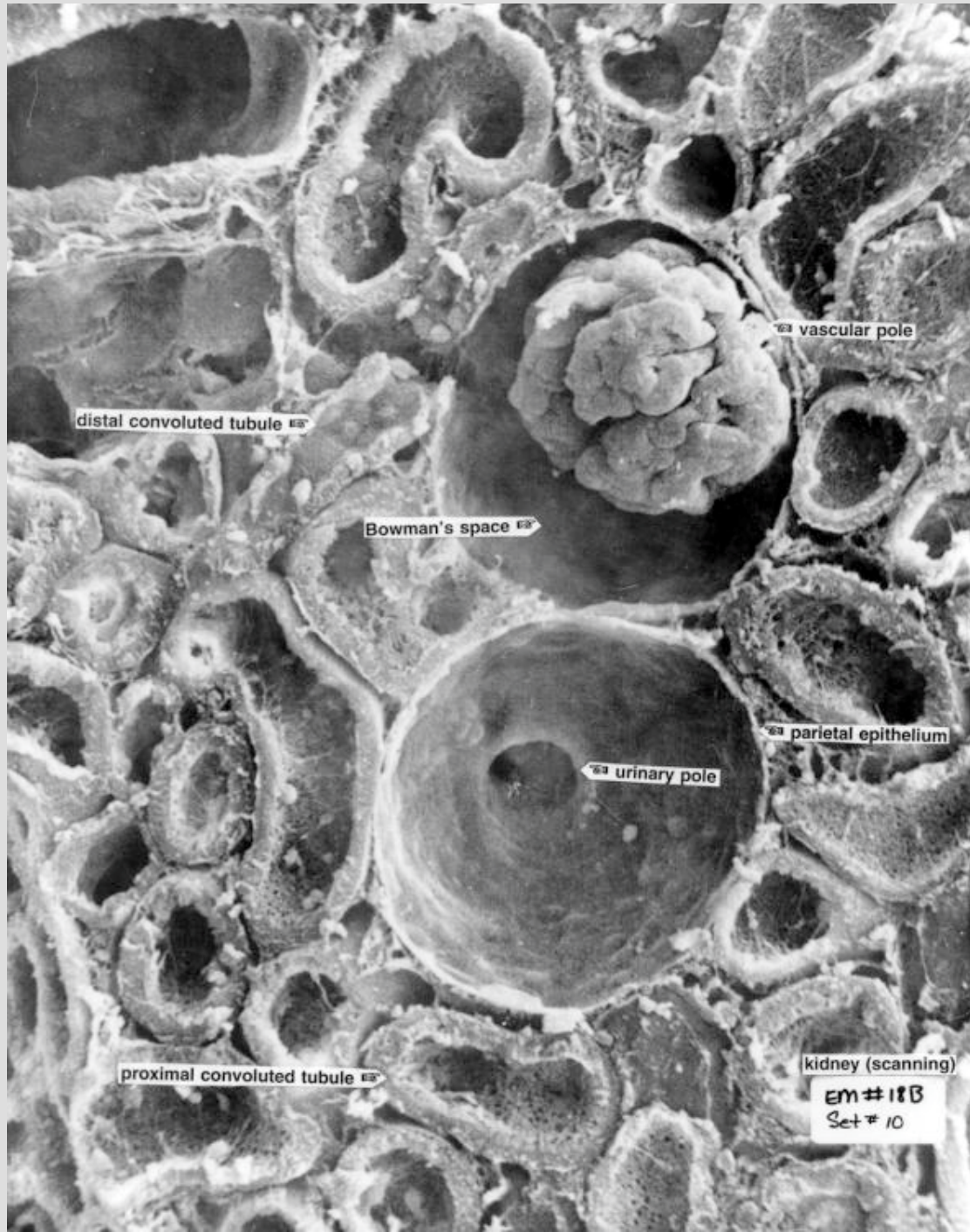
mucus

microvilli

cilia

trachea (cilia - scanning)

Set 10
EM #8



vascular pole

distal convoluted tubule

Bowman's space

parietal epithelium

urinary pole

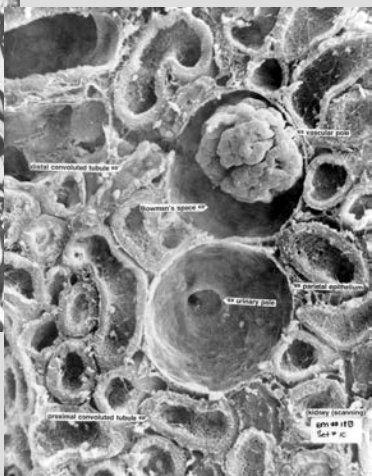
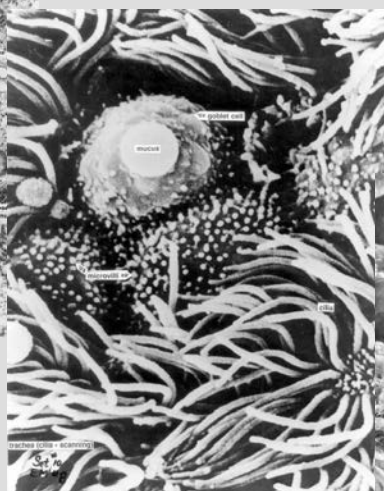
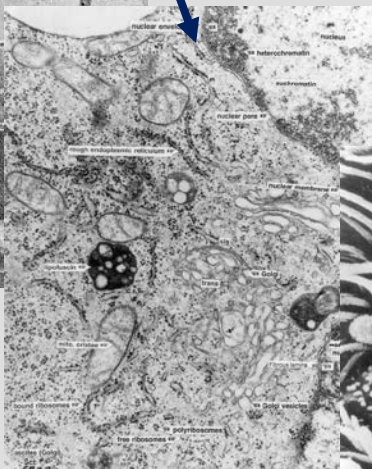
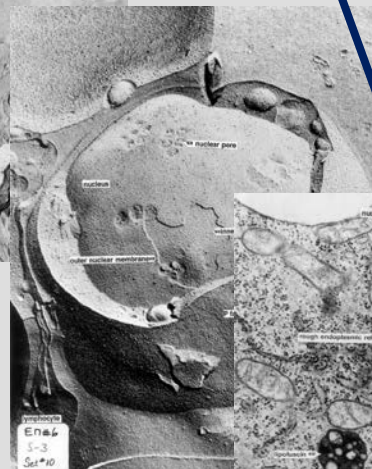
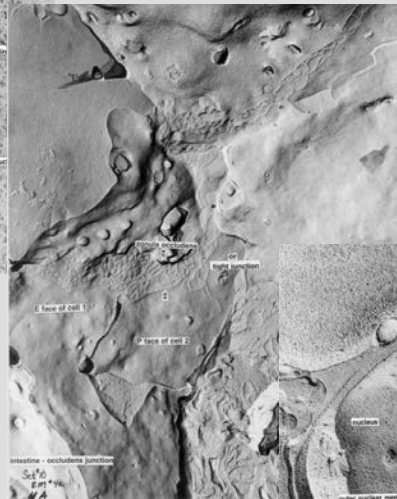
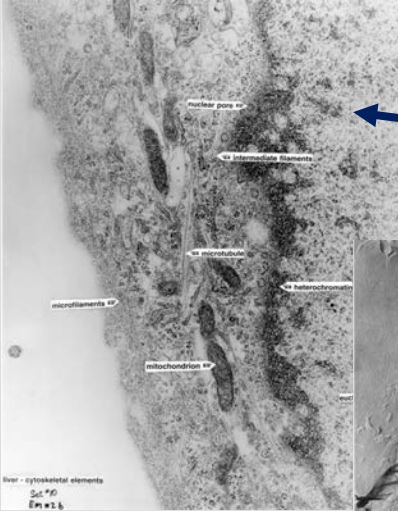
proximal convoluted tubule

kidney (scanning)

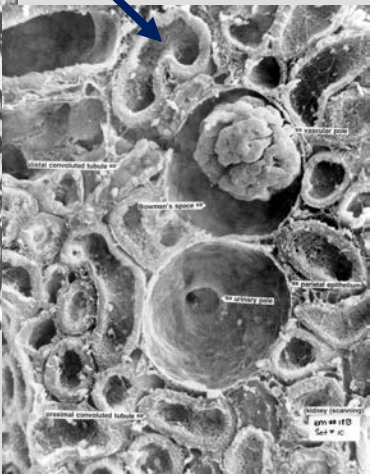
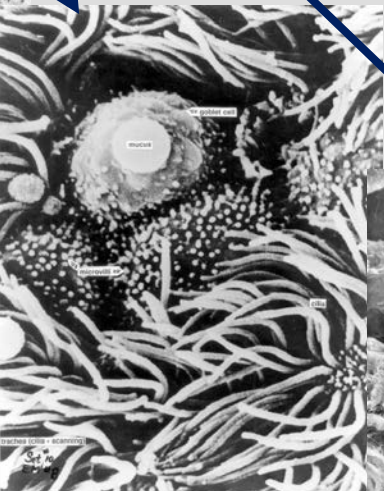
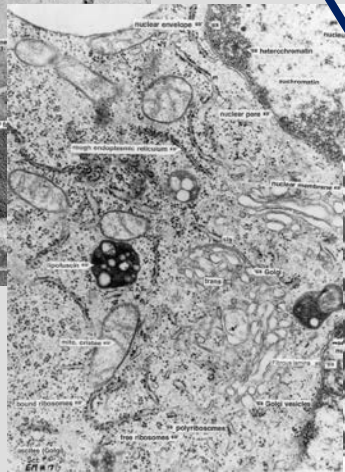
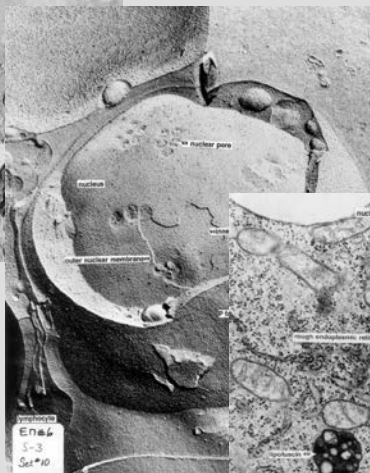
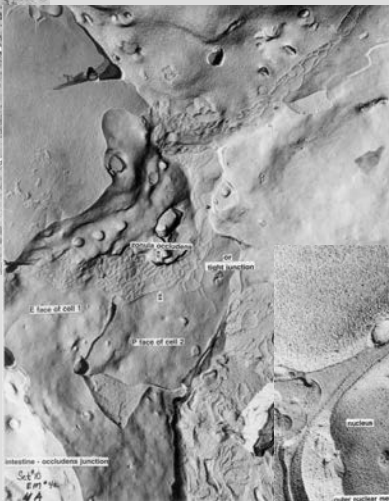
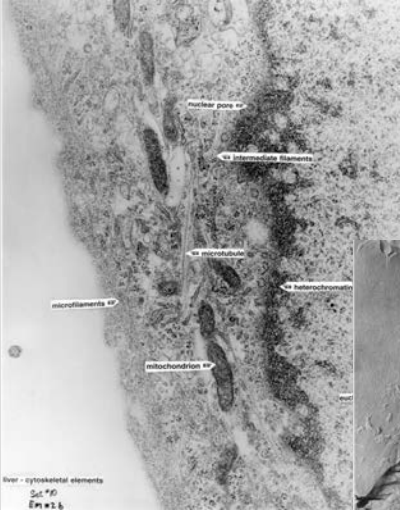
em # 118

Set # 10

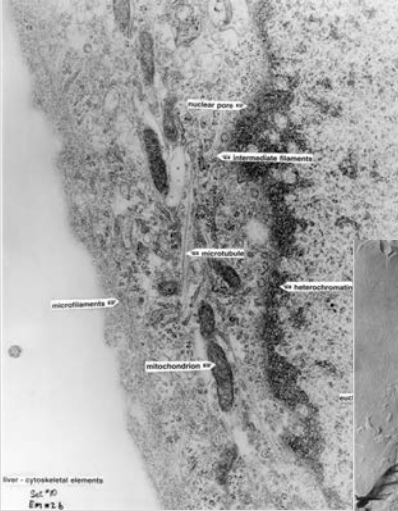
Conventional TEM,
SEM
carbon replica TEM



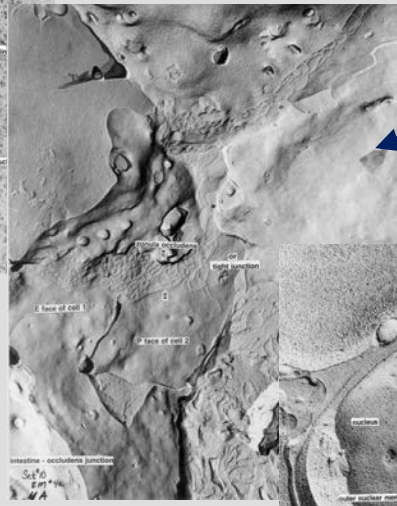
Conventional TEM,
SEM
carbon replica TEM



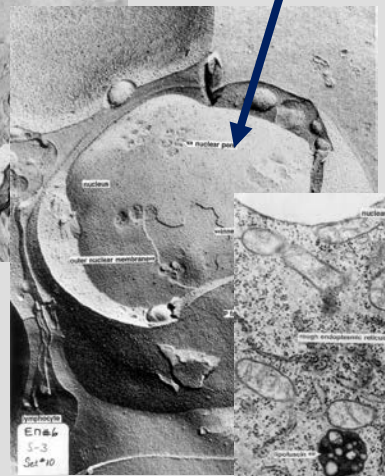
Conventional TEM,
SEM
carbon replica TEM



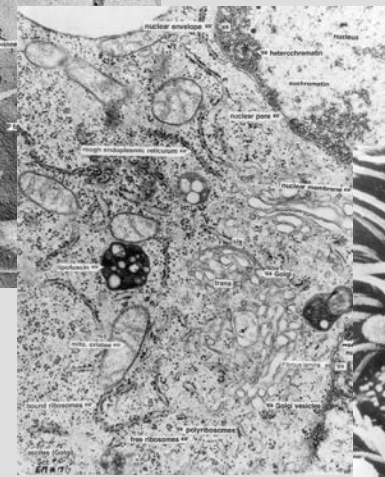
EM 2b



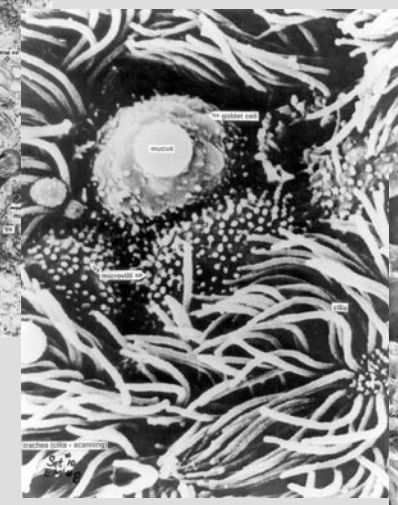
EM 4a



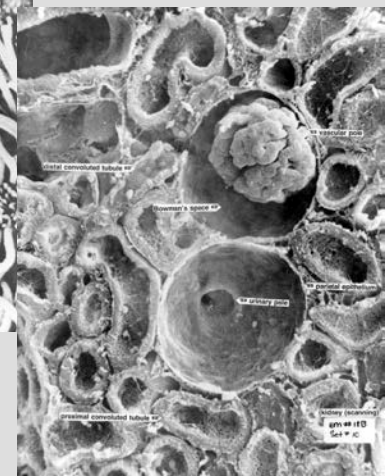
EM 6



EM 7



EM 8

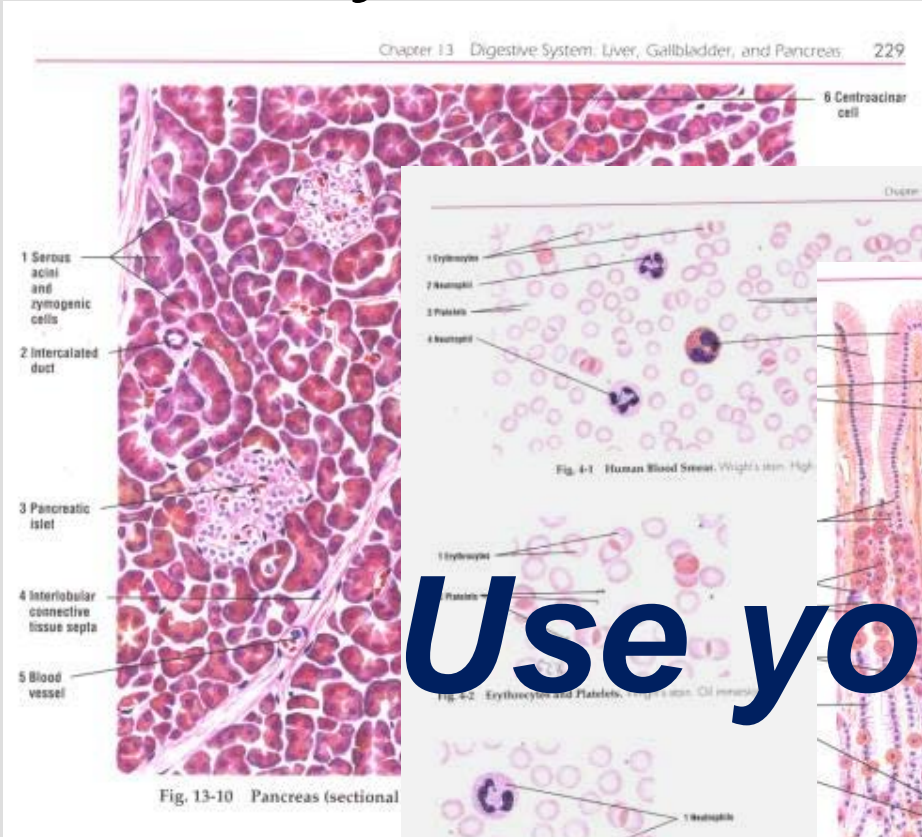


EM 18b

In summary

Ref code
5

Use your atlas!



pancreas



blood



stomach

testis

Many illustrations in these VIBS Histology YouTube videos were modified from the following books and sources: Many thanks to original sources!

1. Alberts, et al., 1989. Molecular Biology of the Cell. 2nd Edition. Garland Publishing, Inc. New York. ISBN 0-8240-3695-6.
2. Alberts, et al., 1994. Molecular Biology of the Cell. 3rd Edition. Garland Publishing, Inc. New York. ISBN 0-8153-1619-4.
3. Bloom, W. and Fawcett, D.W., 1968. A Textbook of Histology. 9th Edition. W.B. Saunders Company. Philadelphia. Library of Congress #67-17445.
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15. Mescher, A.L., 2010. Junqueira's Basic Histology Text and Atlas. 12th Edition. McGraw Hill Medical. New York. ISBN 978-0-07-160431-4.
16. Tuttle, W.W. and Schottelius, B.A. 1969. Textbook of Physiology. 16th Edition. The C.V. Mosby Company. Saint Louis. Library of Congress # 75-89848.
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19. Weiss, L. 1983. Histology: Cell and Tissue Biology. 5th Edition. Elsevier Biomedical. New York. ISBN 0-444-00716-4.
20. Weiss, L. and Greep, R. 1977. Histology. 4th Edition. McGraw-Hill Book Company. New York. ISBN 0-07-069091-X.

Questions

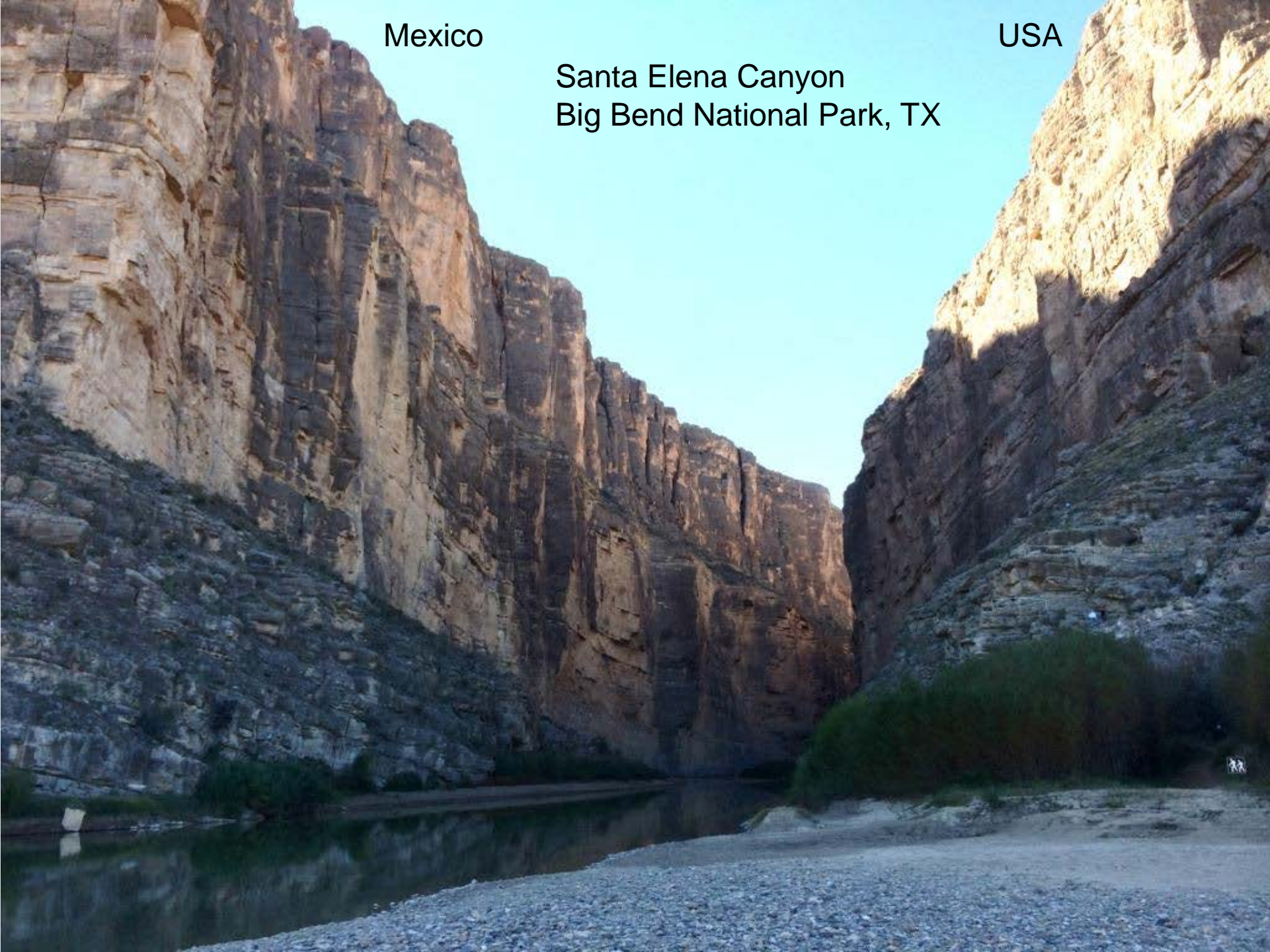
Which microscope type/staining is/are better for observing cellular details:

- a. Light microscopy/ H&E
- b. Light microscopy/ toluidine blue
- c. Transmission electron microscopy (TEM)/ typical EM staining**
- d. a and b
- e. a, b, and c

Mexico

USA

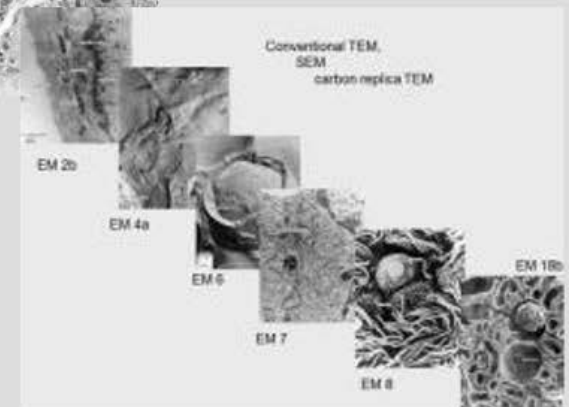
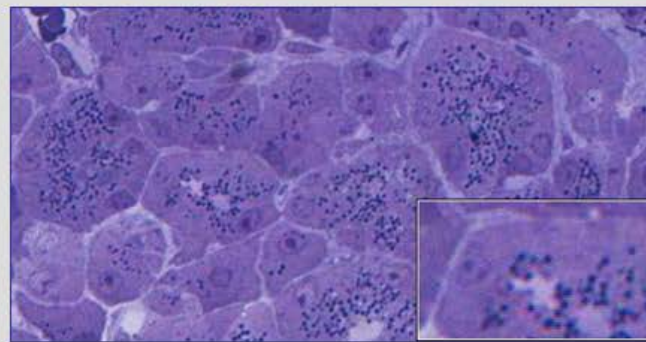
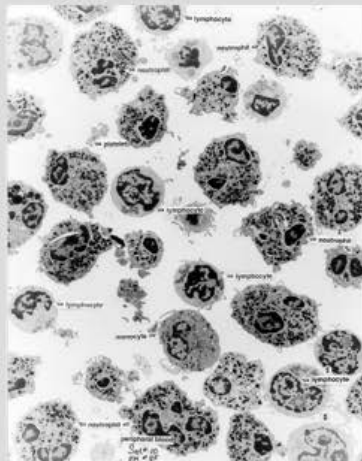
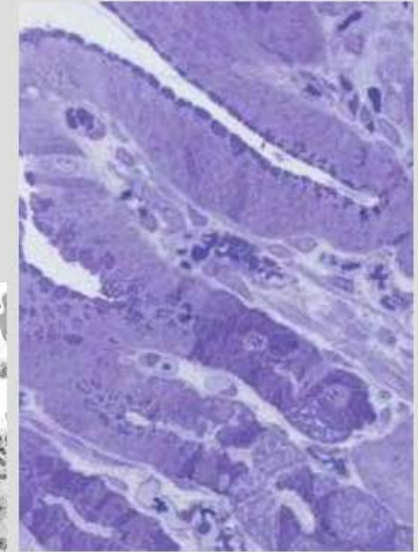
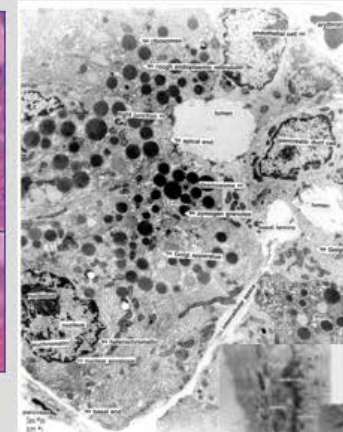
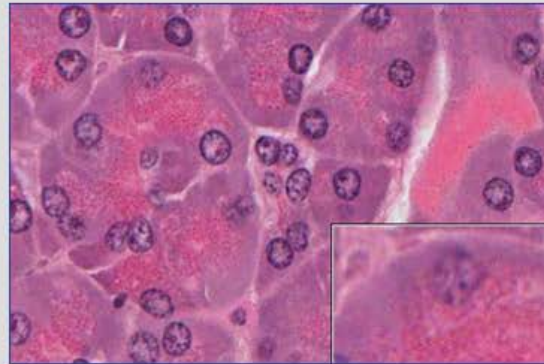
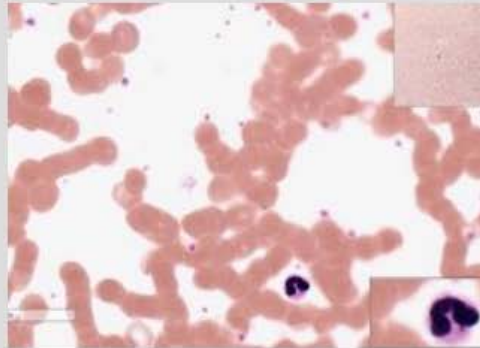
Santa Elena Canyon
Big Bend National Park, TX



END OF

Medical School Histology Basics Introduction to Microscopy

VIBS 243 lab



Larry Johnson

Texas A&M University