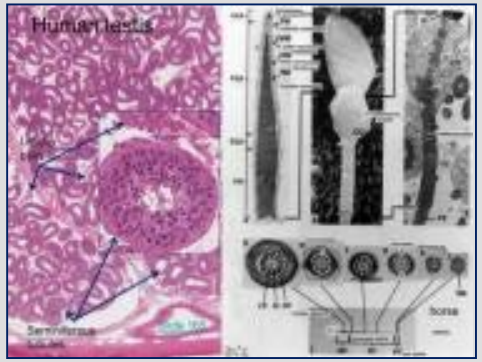
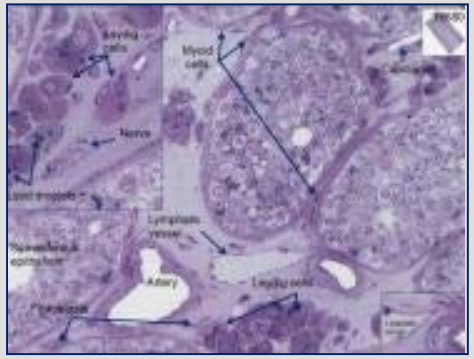
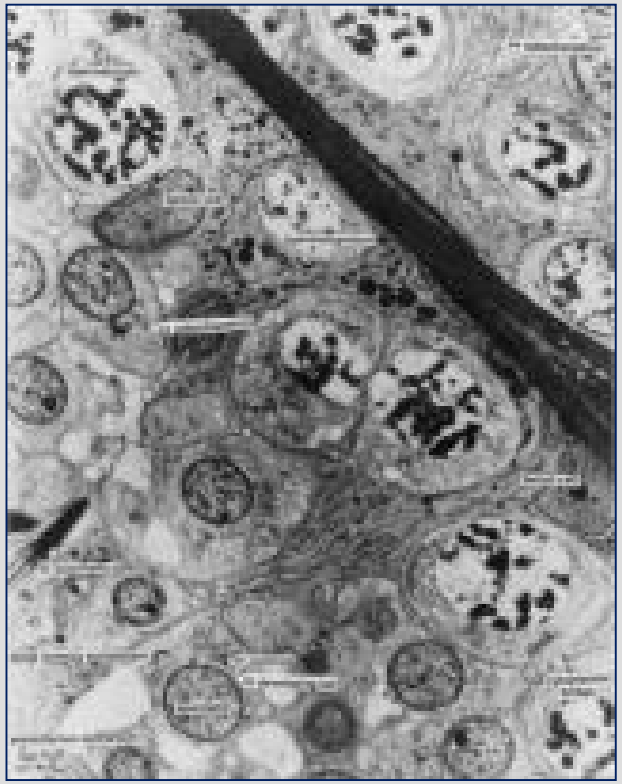
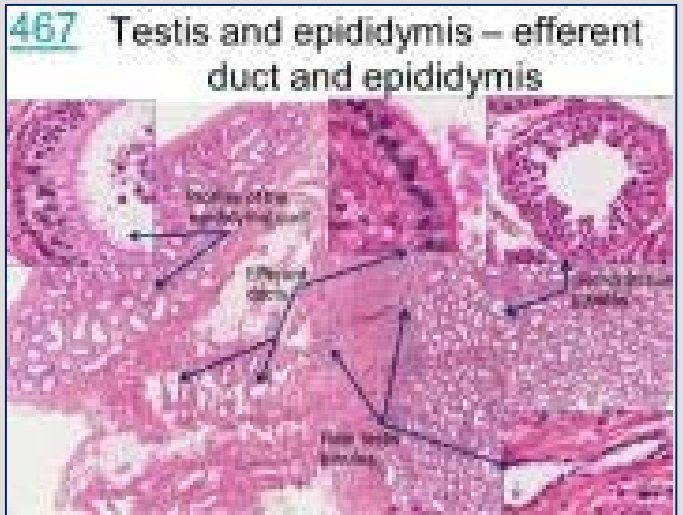
Medical School Histology Basics
Male Reproductive System

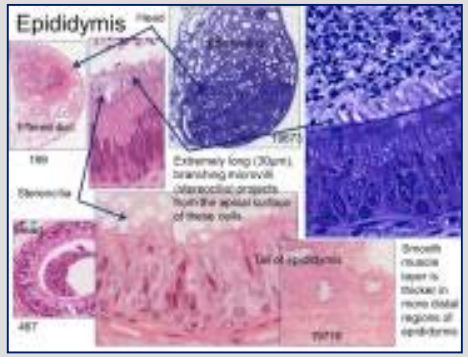
VIBS 243 lab

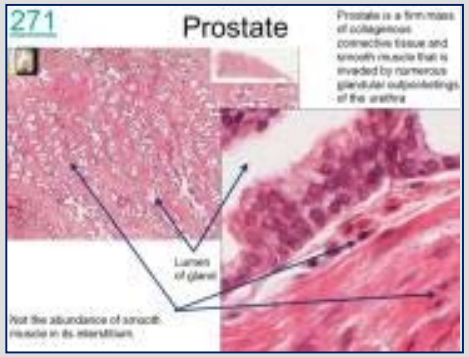


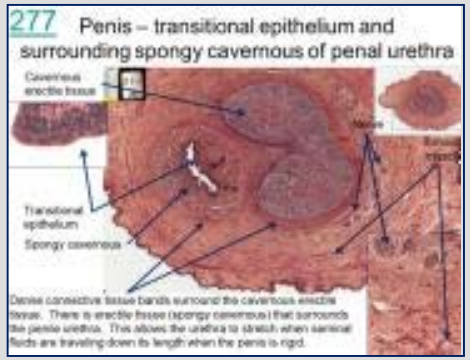












Larry Johnson

Texas A&M University

OBJECTIVE

To conduct a histologic examination of the testis (which produce spermatozoa),
excretory ducts (which transport and mature spermatozoa),
and accessory glands (whose secretions support the viability of sperm) of the male reproductive system.

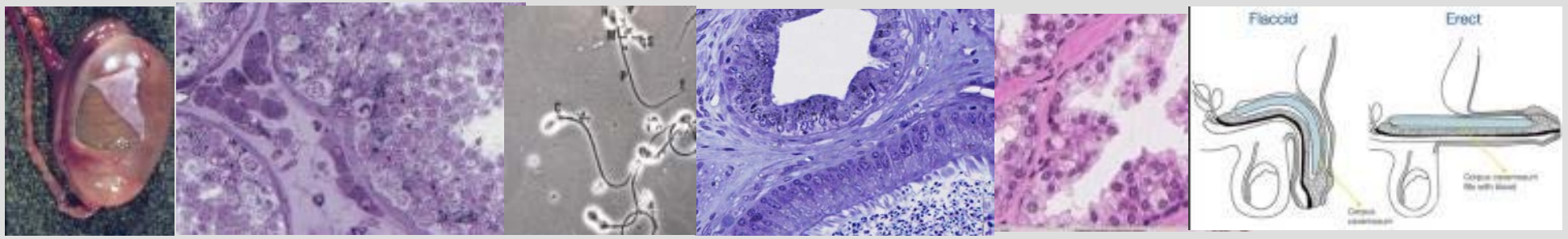
To learn what structures facilitate the male gonad to produce an exocrine secretion (the spermatozoon) and an endocrine secretion (testosterone).

Outline

Spermatozoon
Spermatogenesis
Sertoli cells and Leydig cells
Hormonal control
Epididymal function
Accessory glands

Function of Male Reproductive System

The testis produces both spermatozoa, an exocrine secretion, and testosterone, an endocrine secretion.



The function of the male reproductive system are to:

- produce, maintain, and transport spermatozoa (the male gametes) and protective fluid (semen) and
- discharge the spermatozoa-containing semen within the female reproductive tract during mating.

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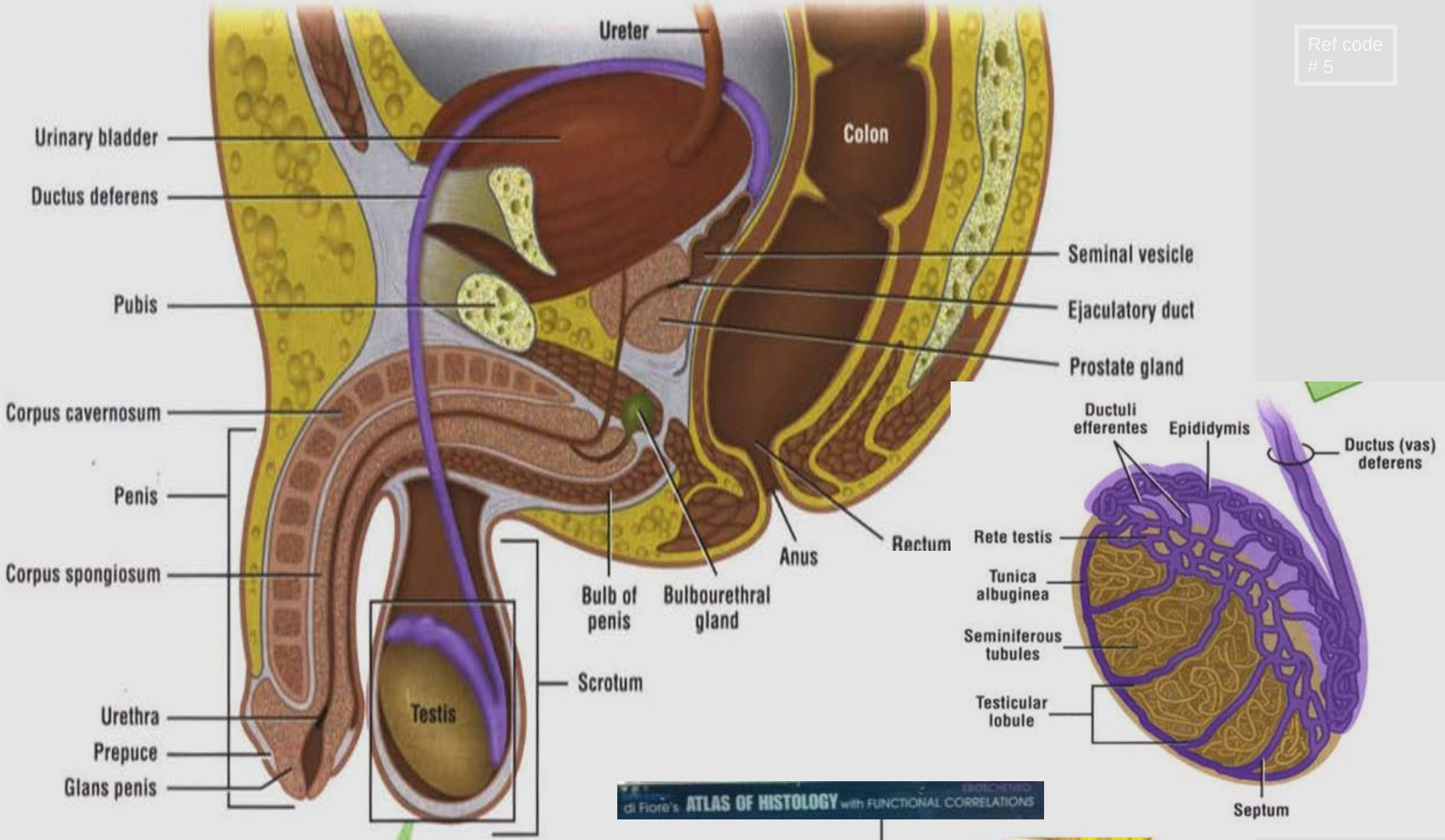
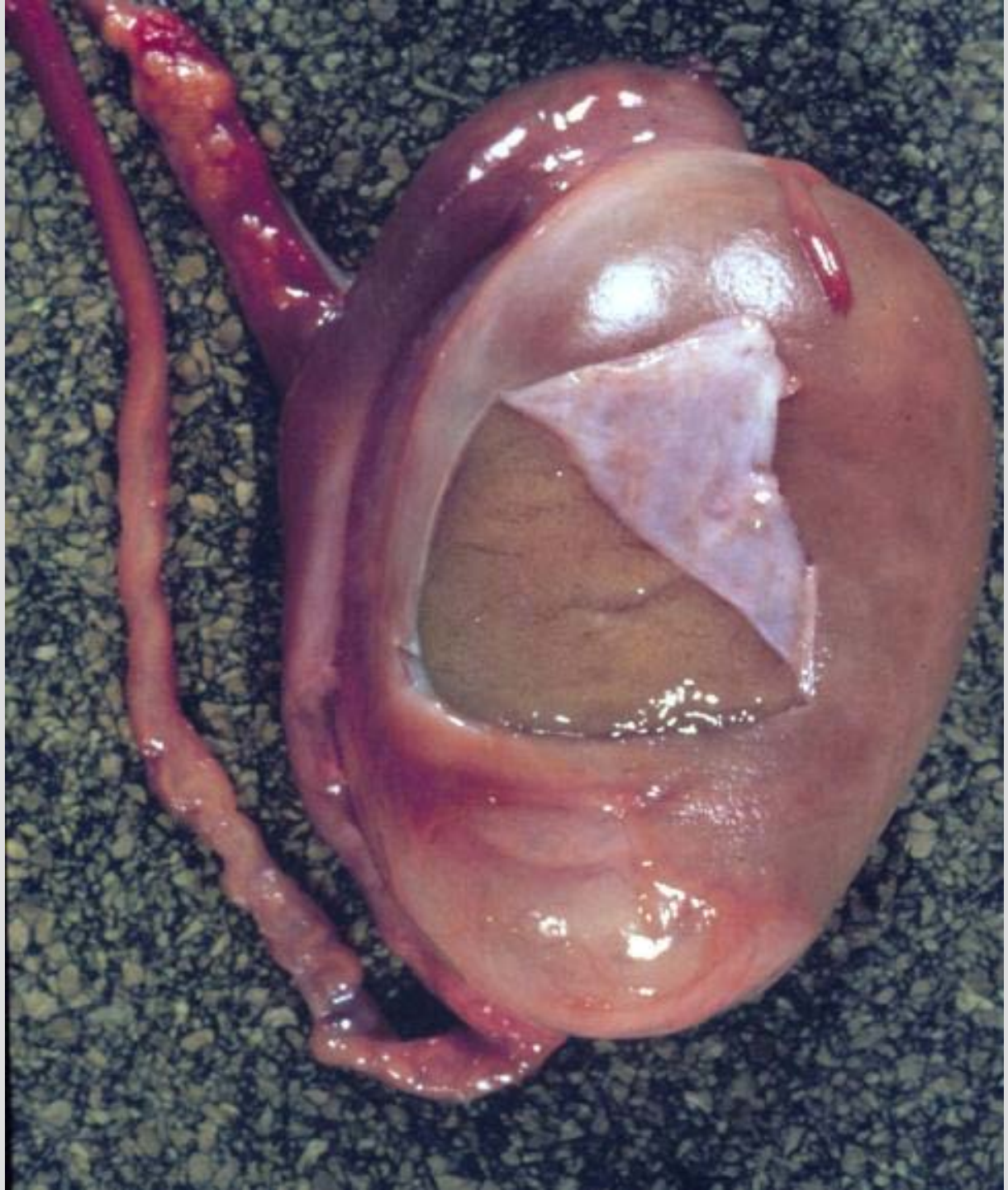
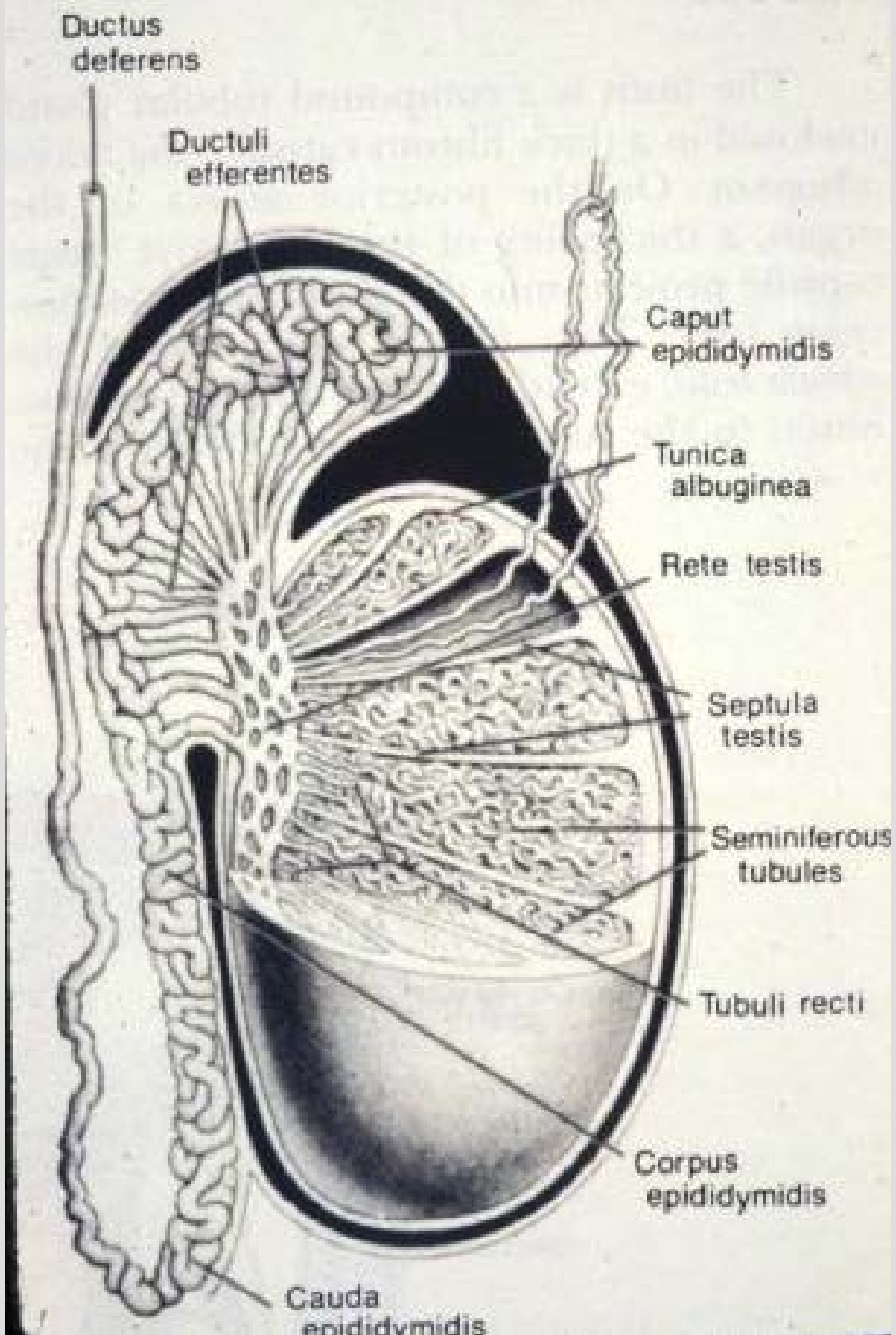
5


Ureter
Urinary bladder
Ductus deferens
Colon
Seminal vesicle
Pubis
Ejaculatory duct
Prostate gland
Corpus cavernosum
Penis
Corpus spongiosum
Rectum
Anus
Bulb of penis
Bulbourethral gland
Scrotum
Testis
Urethra
Prepuce
Glans penis
Ductuli efferentes
Epididymis
Ductus (vas) deferens
Rete testis
Tunica albuginea
Seminiferous tubules
Testicular lobule
Septum
di Fiore's ATLAS OF HISTOLOGY with FUNCTIONAL CORRELATIONS




Ductus deferens
Ductuli efferentes
Caput epididymidis
Tunica albuginea
Rete testis
Septula testis
Seminiferous tubules
Tubuli recti
Corpus epididymidis
Cauda epididymidis

Ref code
6

Ref code
5

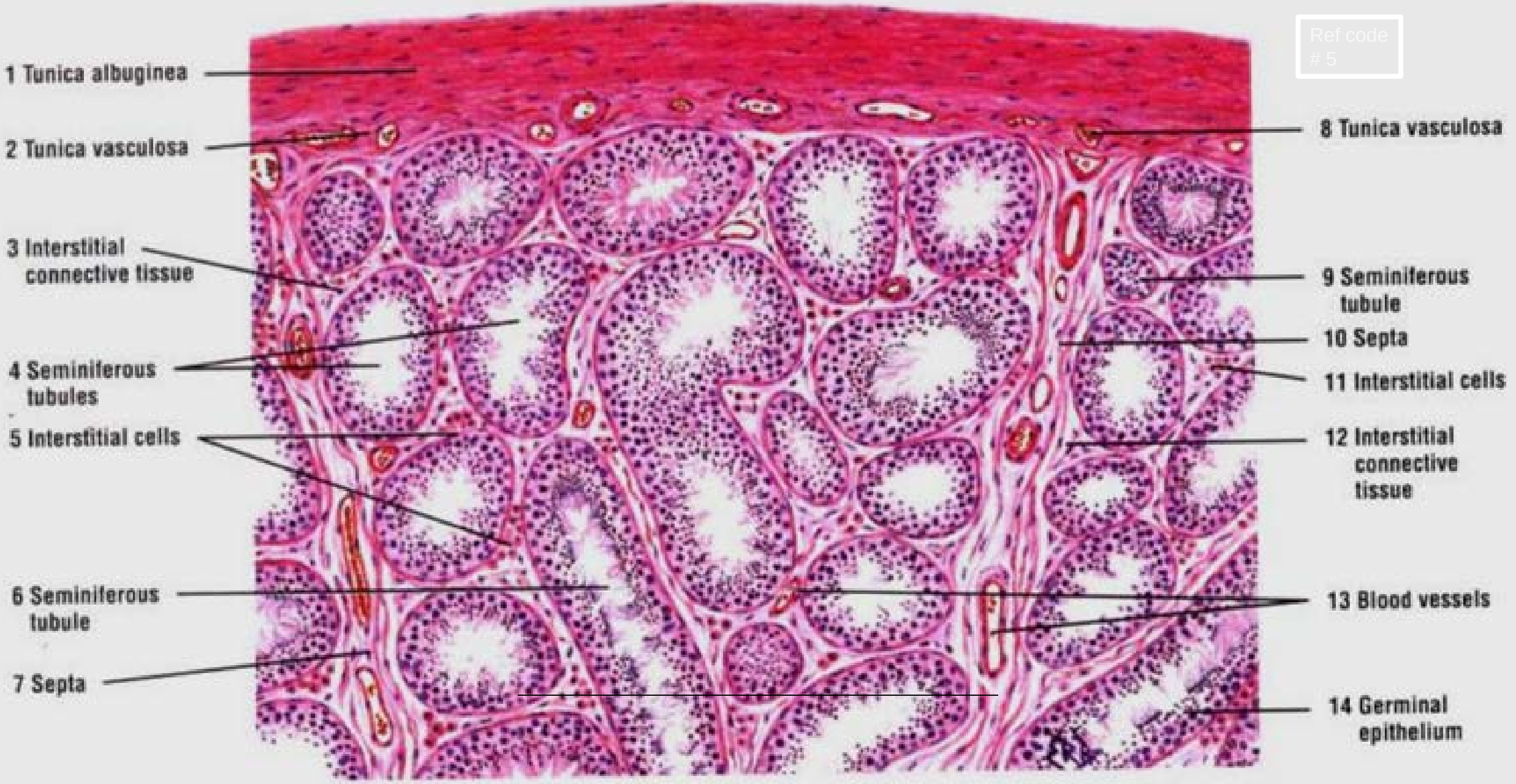
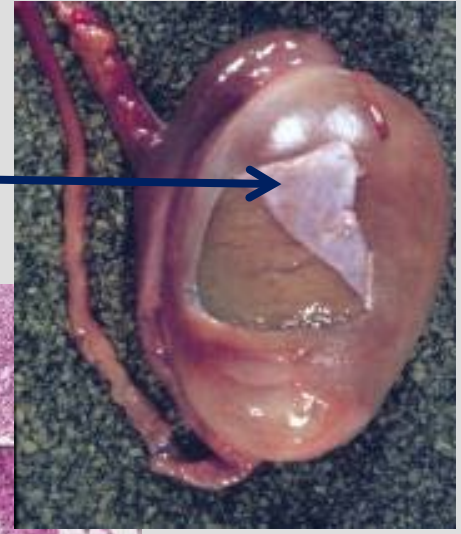
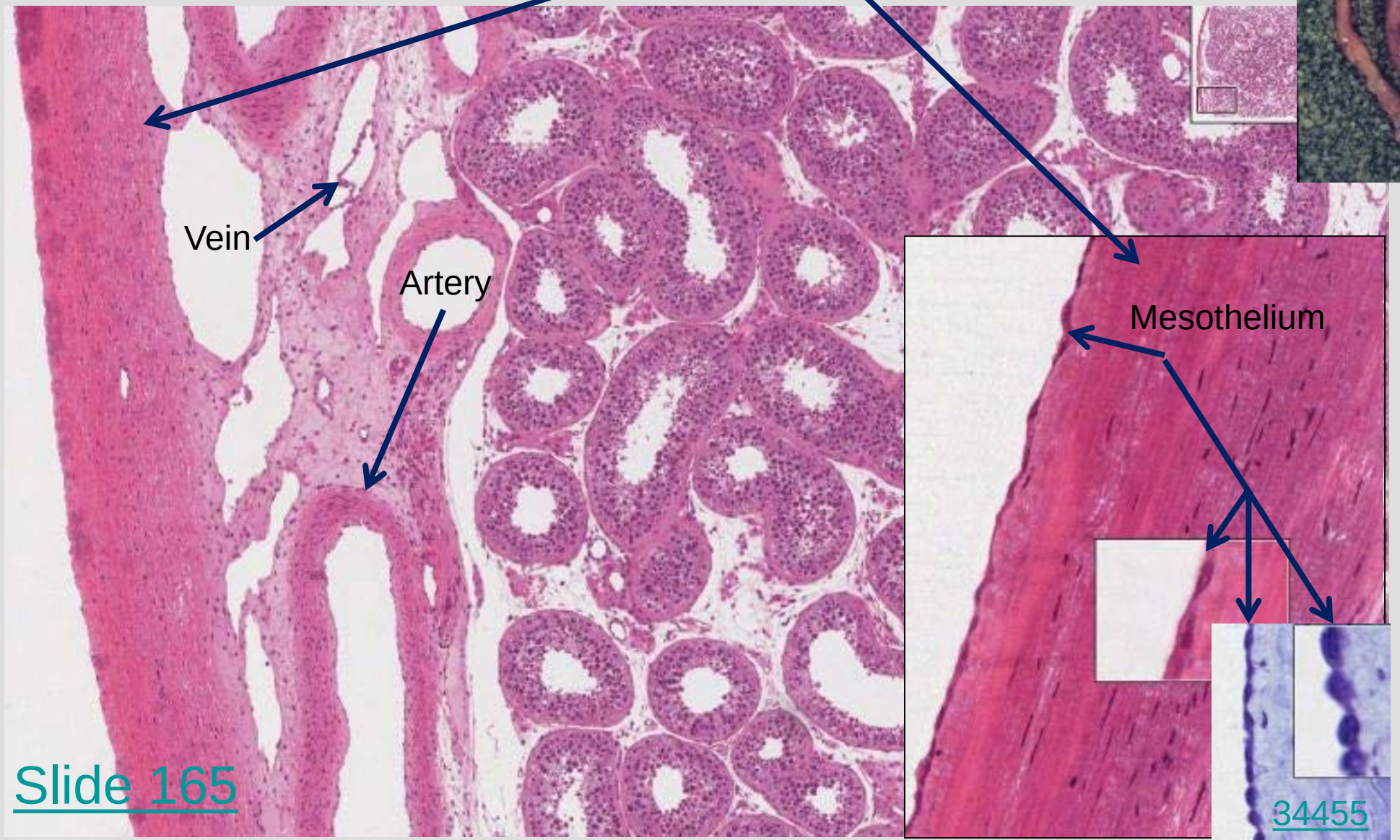
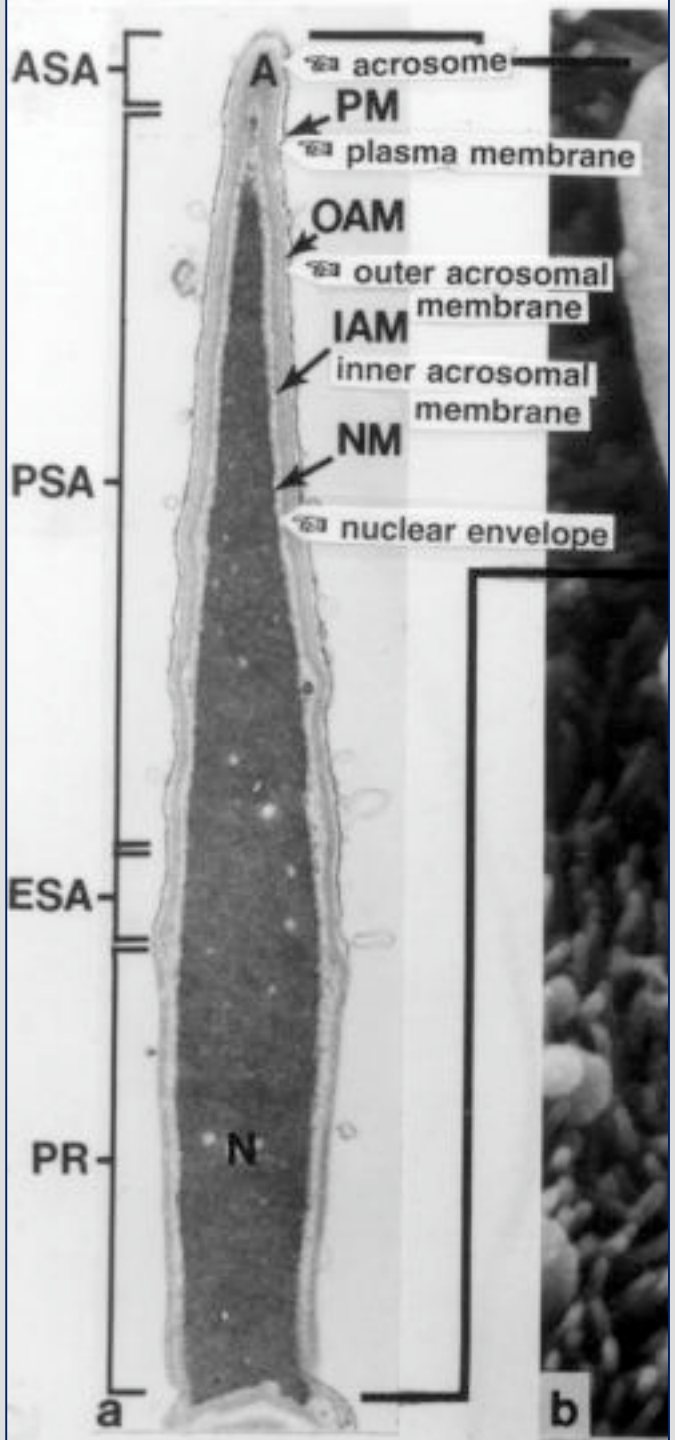


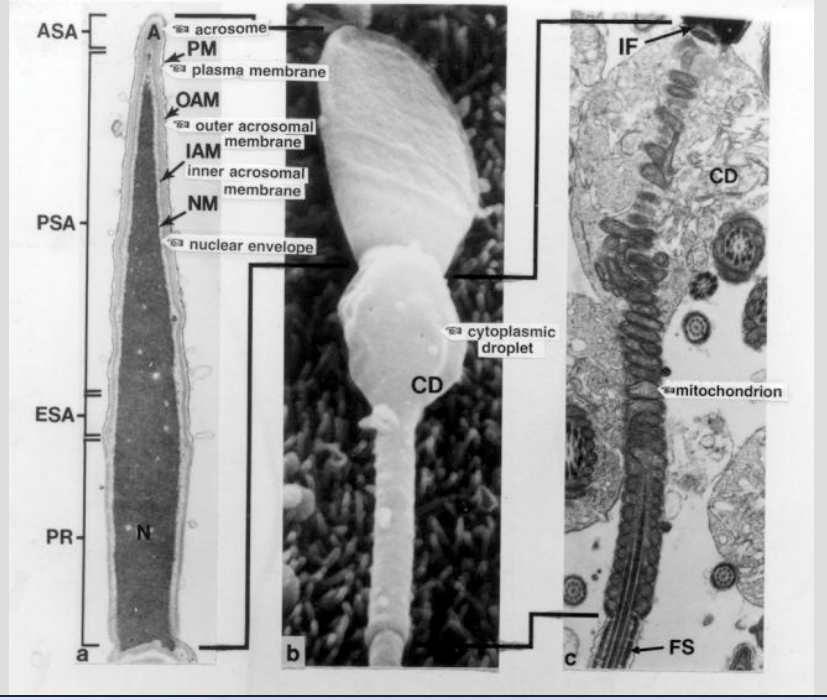
Fig. 17-1 Testis (sectional view). Stain: hematoxylin-eosin. Low magnification.

Human testicular capsule









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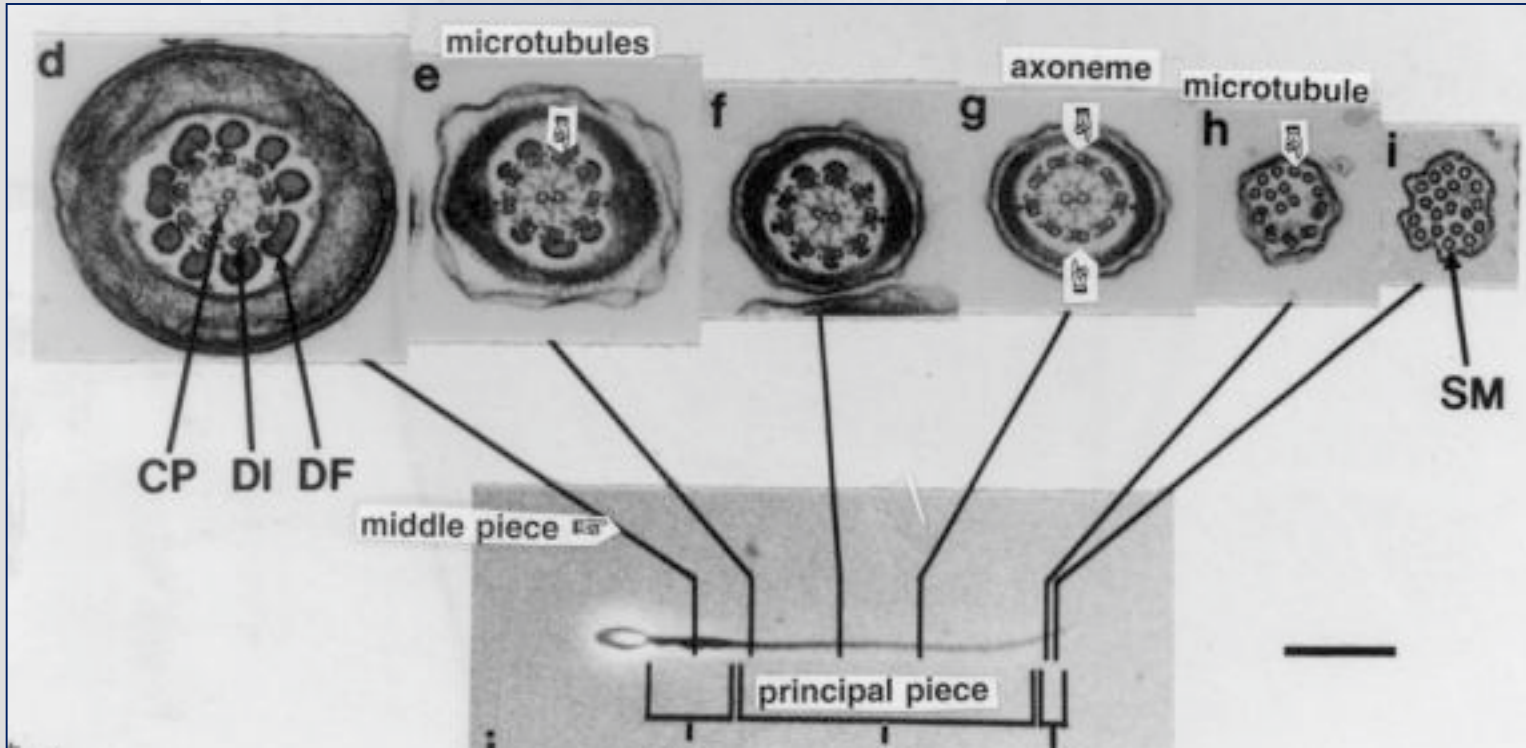
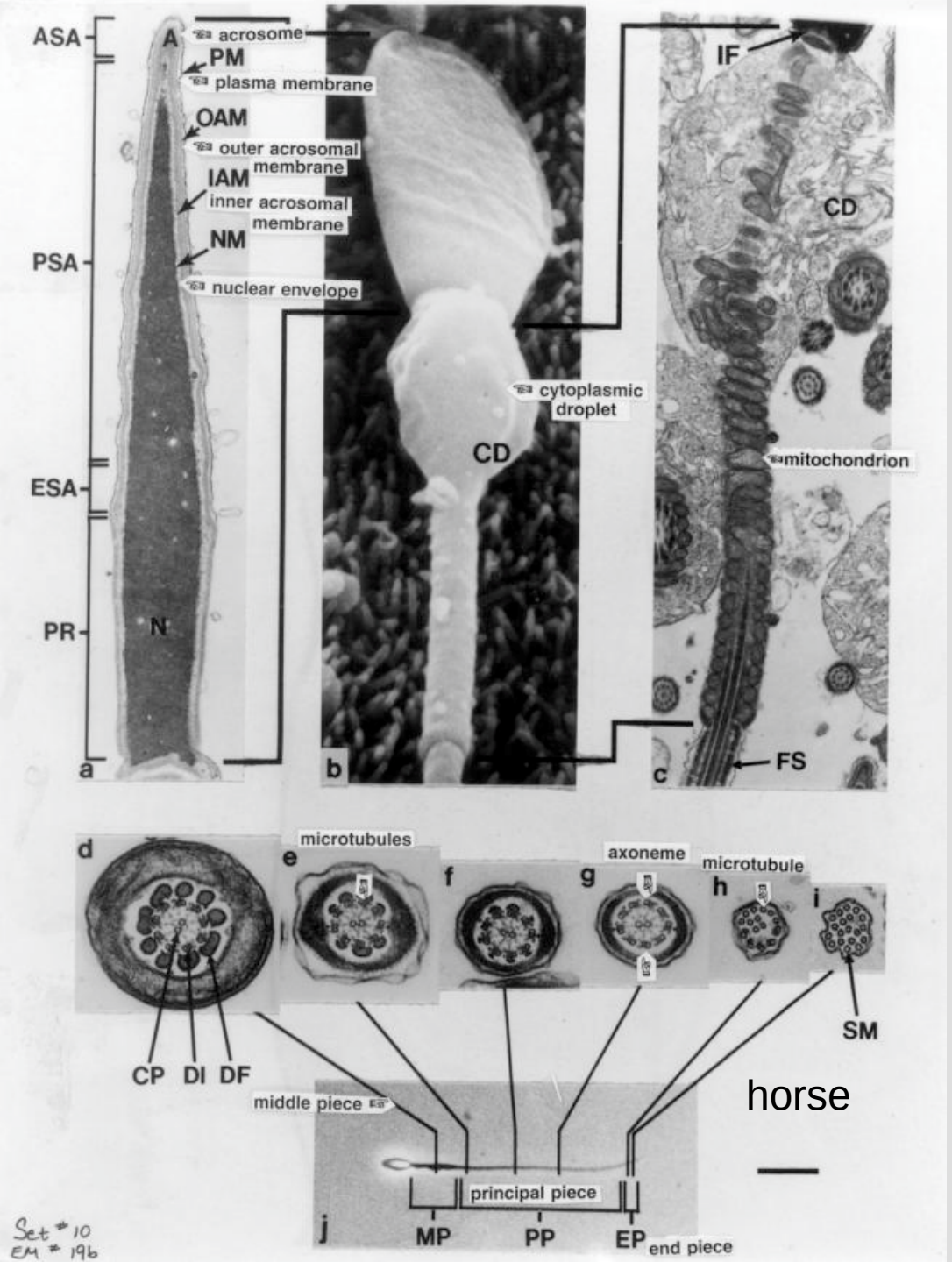
17

Horse spermatozoa



Human testis

Slide 165

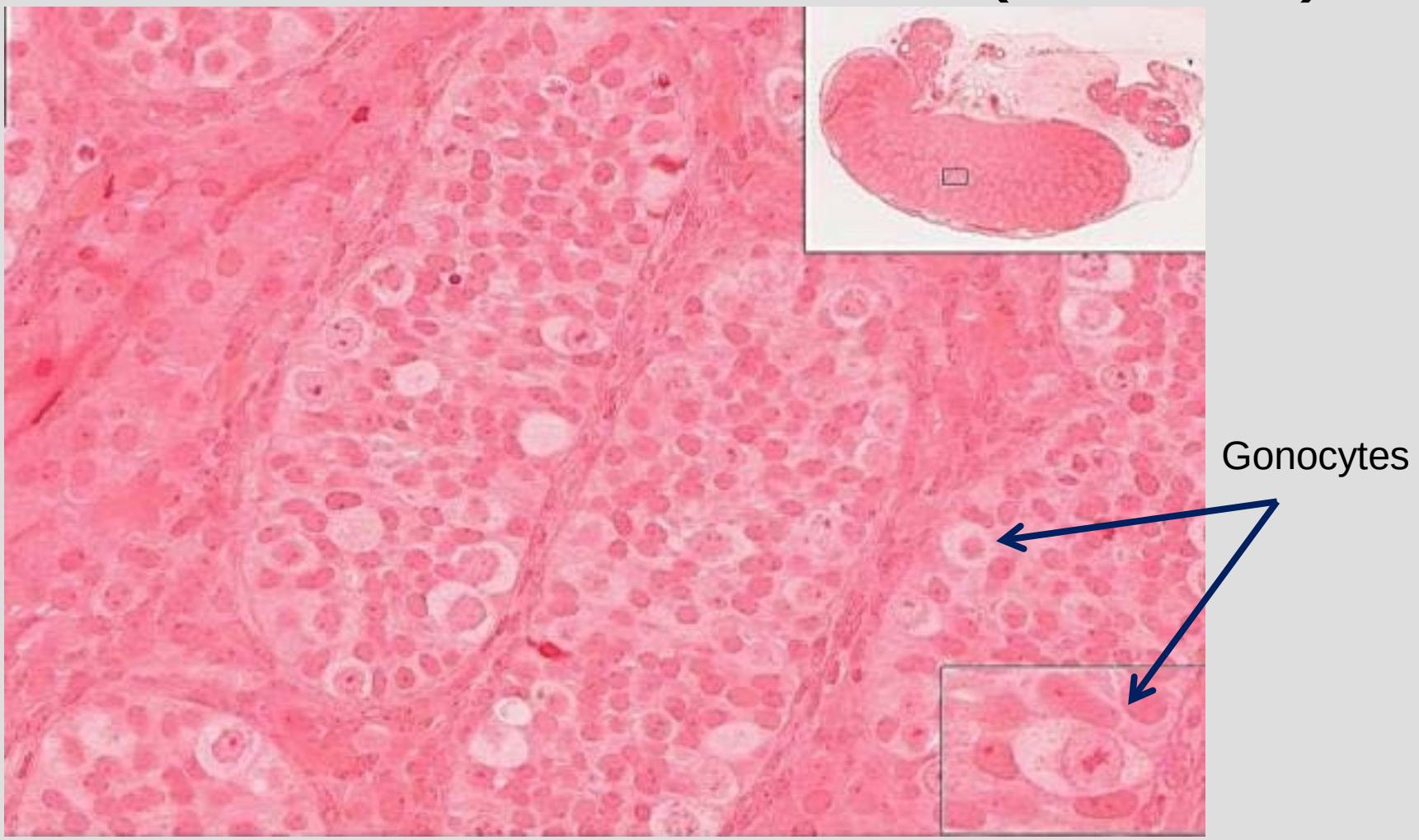


Set # 10
EM # 196

Ref code
17

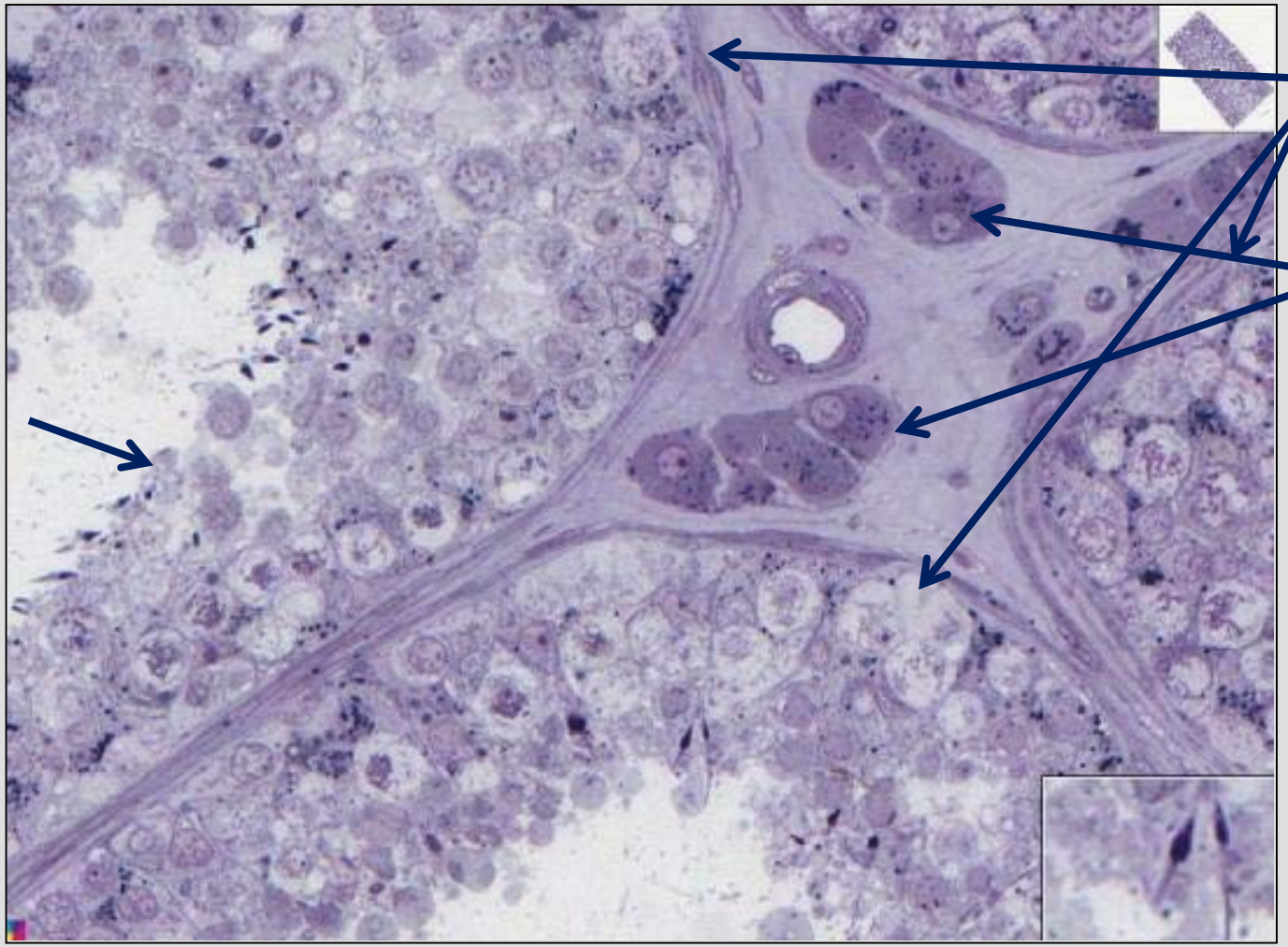
163

Fetal testis #19760 (UT163)



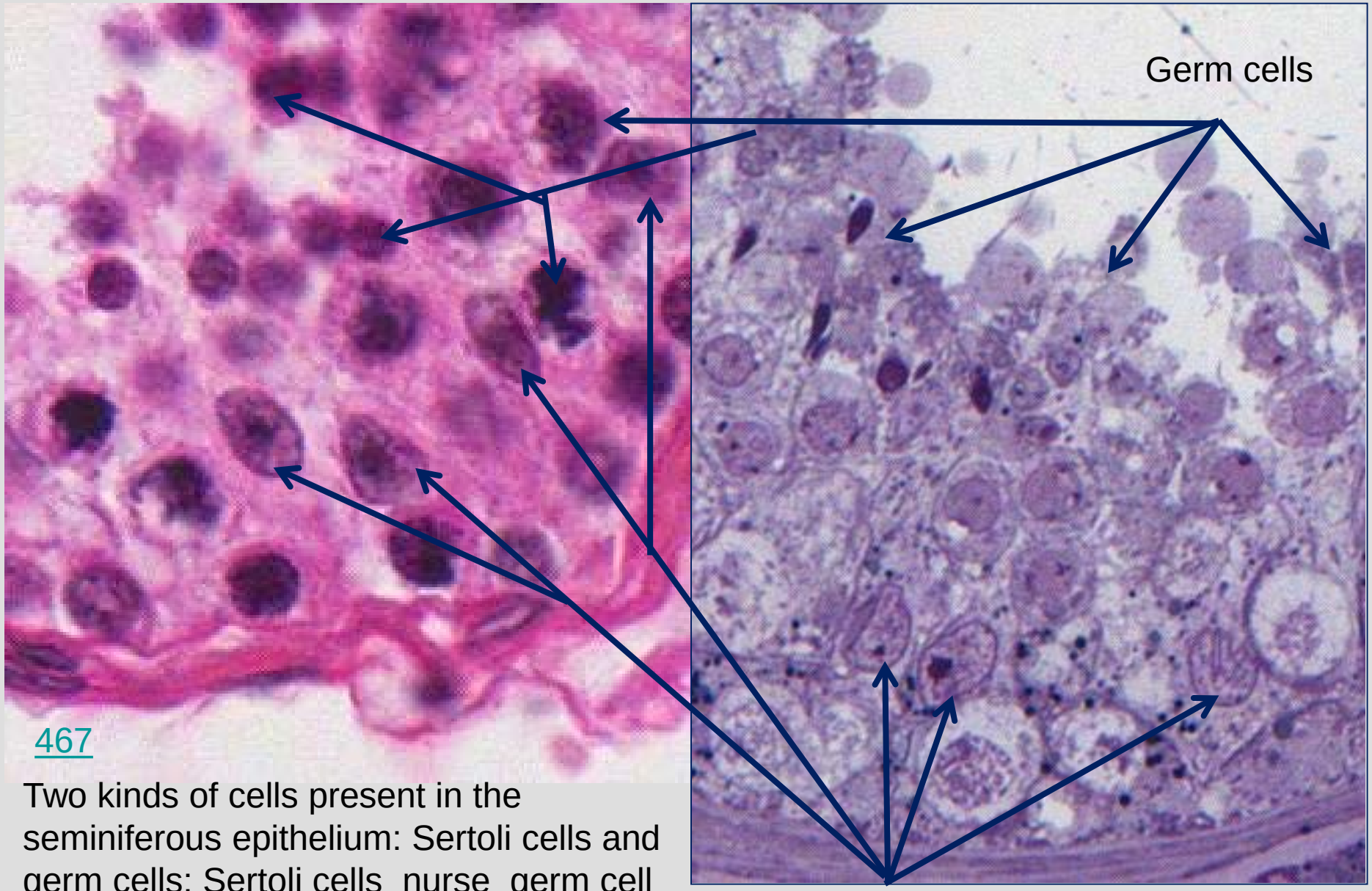
Gonocytes of the fetal testis give rise to spermatogonia, the source of cells that divide and differentiate in spermatogenesis to produce spermatozoa.

Human testis toluidine blue 19680



Spermatozoa are produced in the seminiferous epithelium lining the lumen of the testicular tubules. Testosterone is synthesized by Leydig cells located between seminiferous tubules.

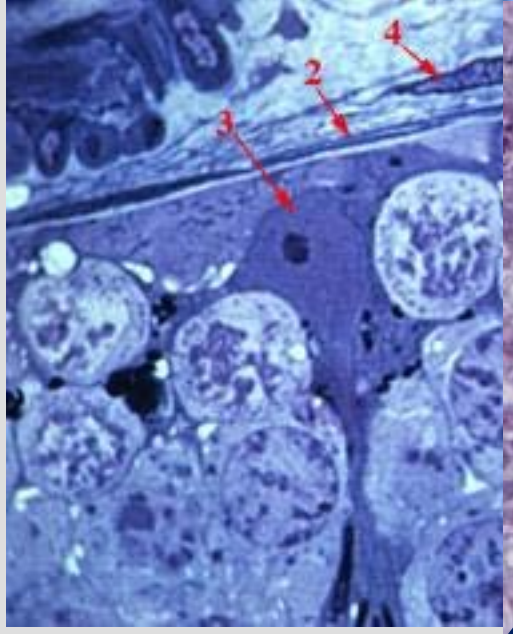
Human testis toluidine blue



467

Two kinds of cells present in the seminiferous epithelium: Sertoli cells and germ cells: Sertoli cells nurse germ cell development.

19680

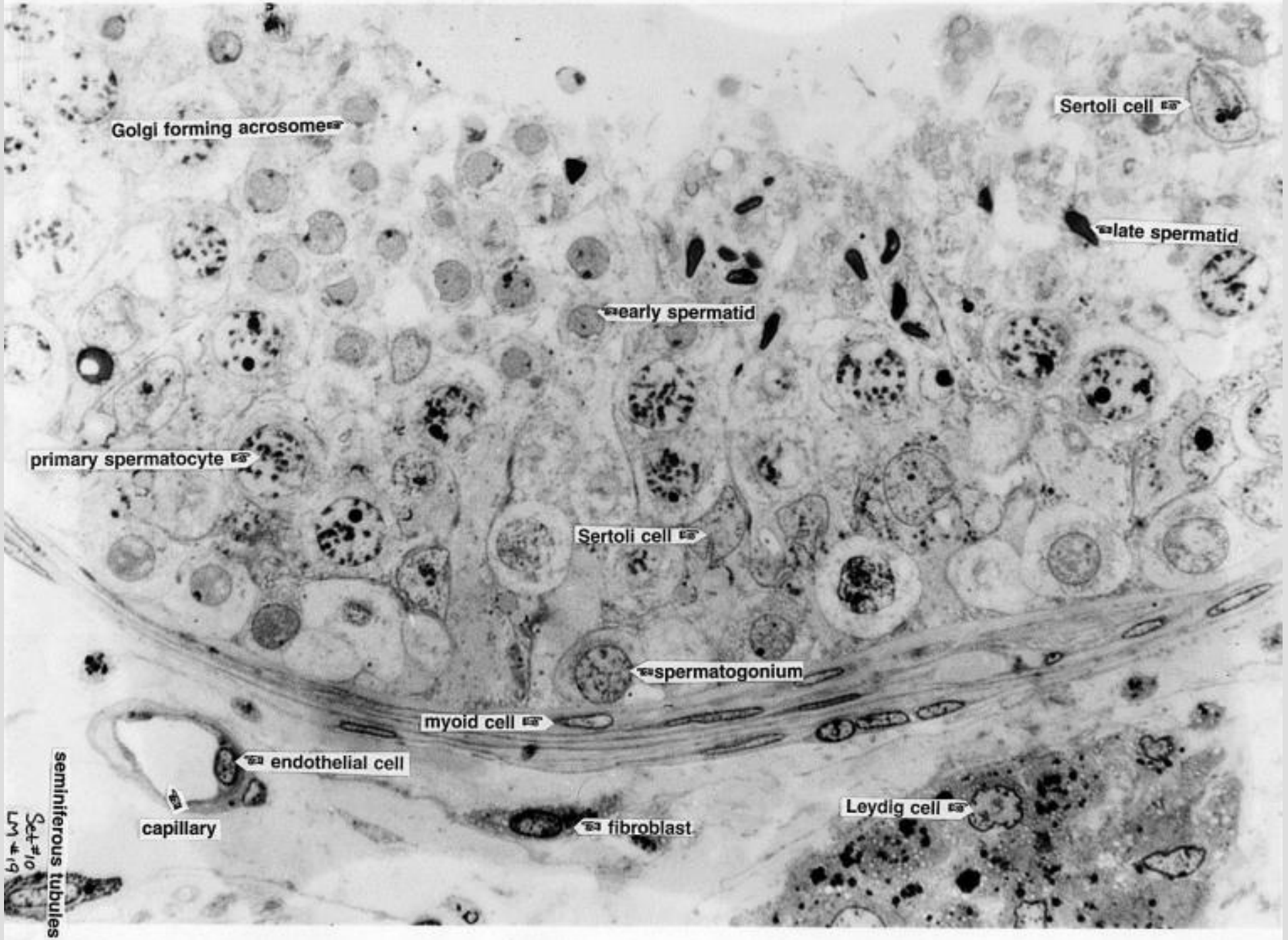


Monkey seminiferous epith

1. Spermatogonium
2. Myoid cell
3. Sertoli cell
4. Fibroblast

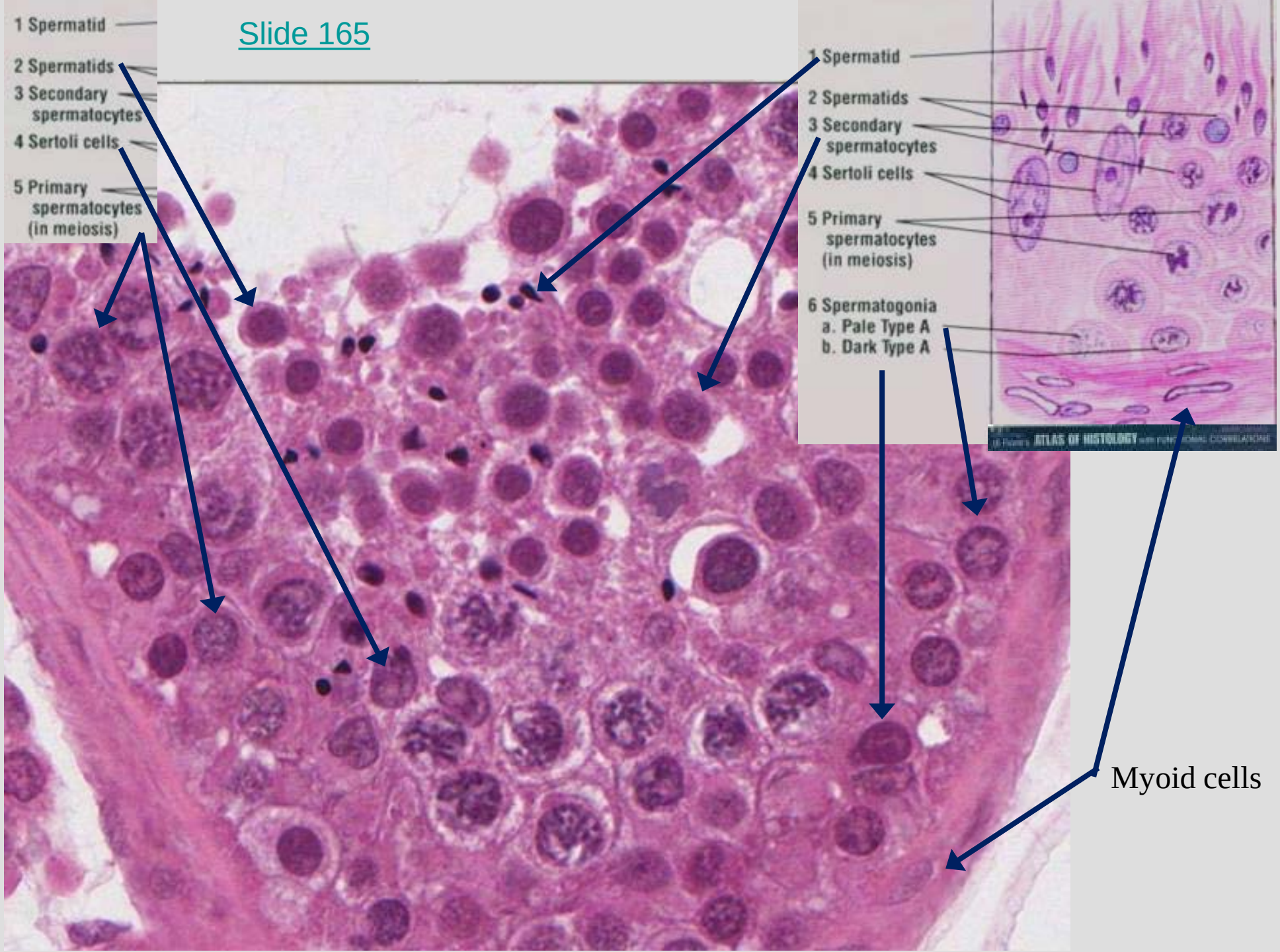
Human seminiferous tubule

19680

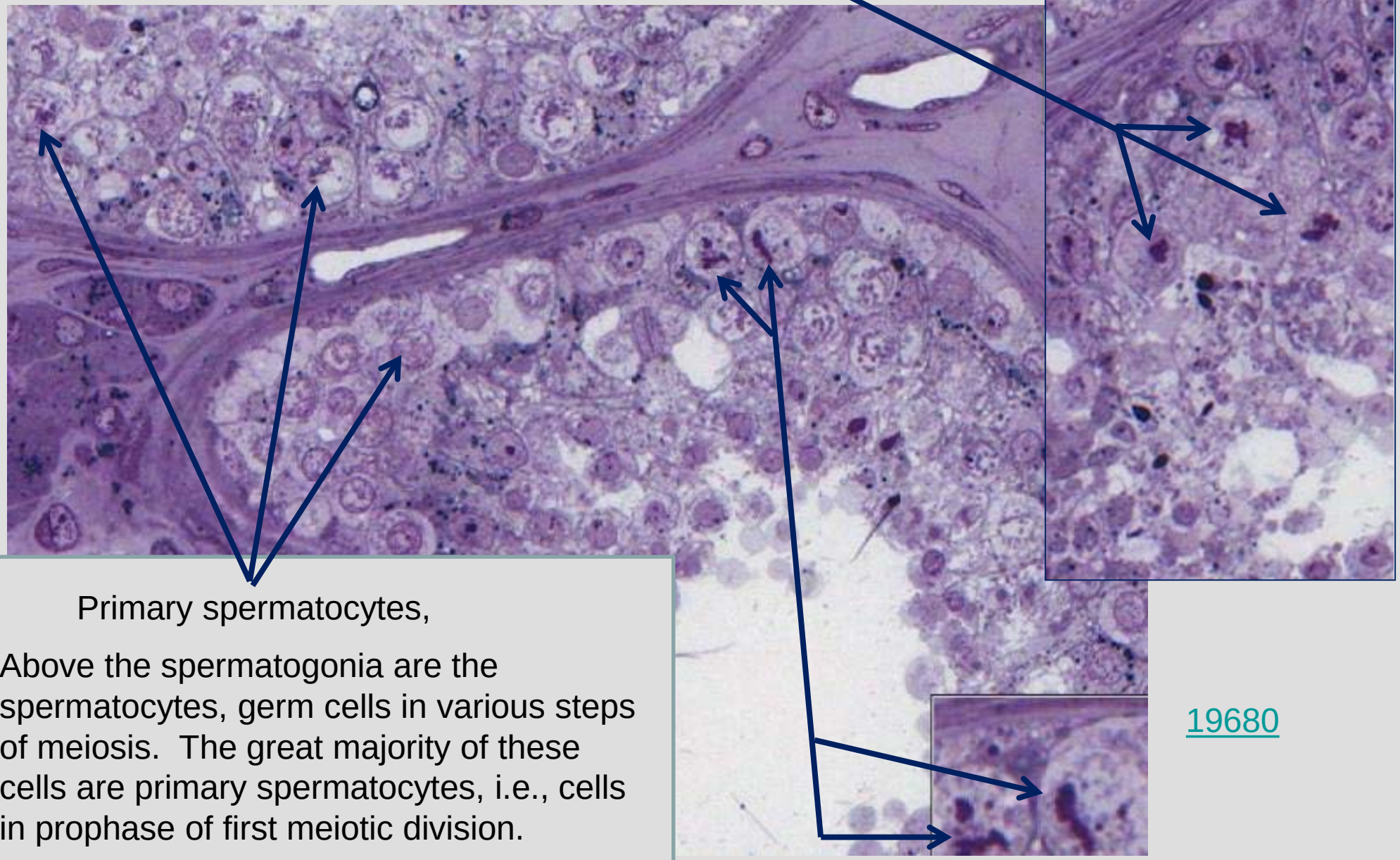

Golgi forming acrosome
Sertoli cell
late spermatid
early spermatid
primary spermatocyte
Sertoli cell
spermatogonium
myoid cell
endothelial cell
capillary
fibroblast
Leydig cell
seminiferous tubules
Sct#10
LM#19

Slide 165

Ref code # 5

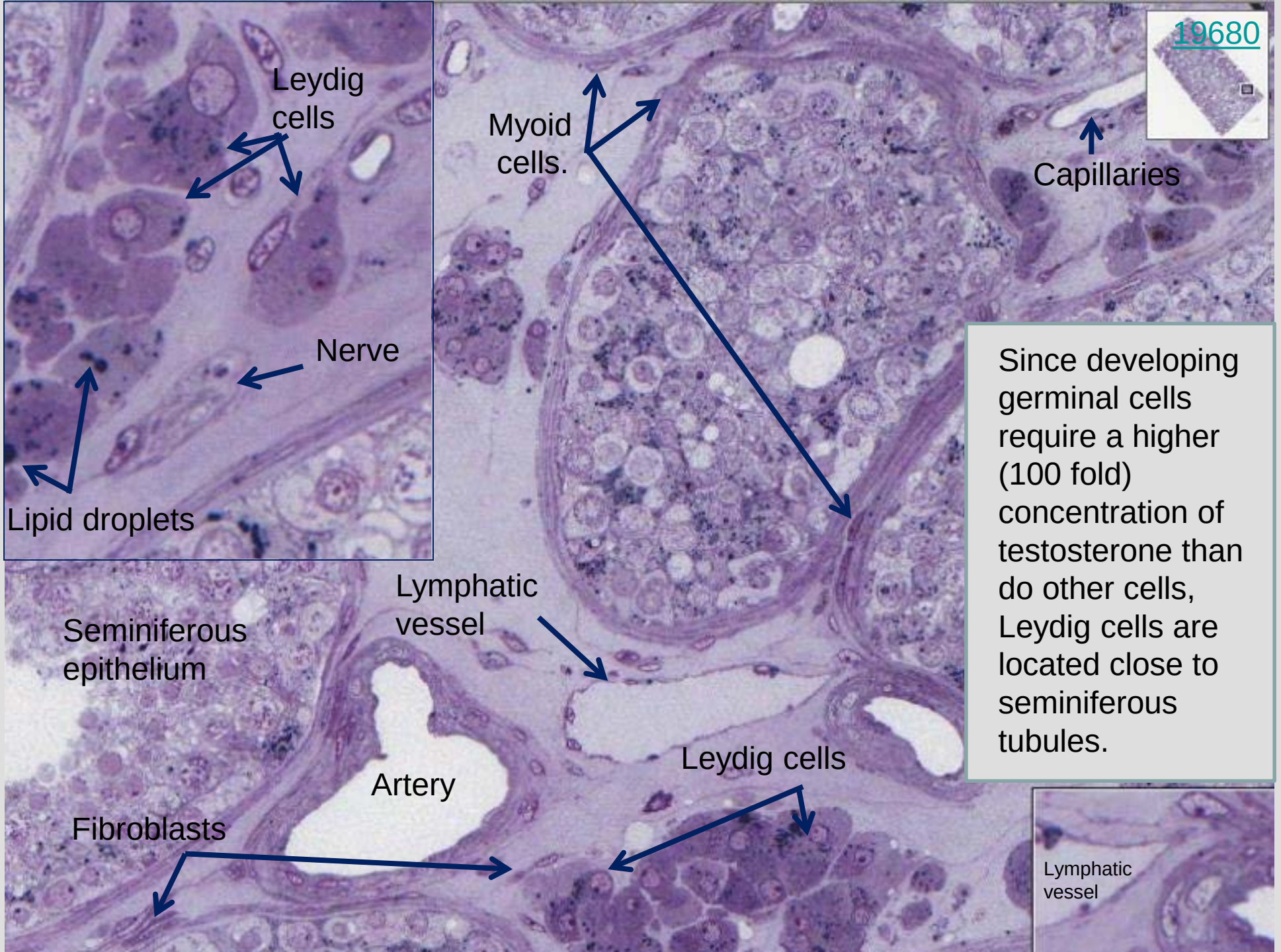


Human testis:
Mitosis on base and meiosis off base

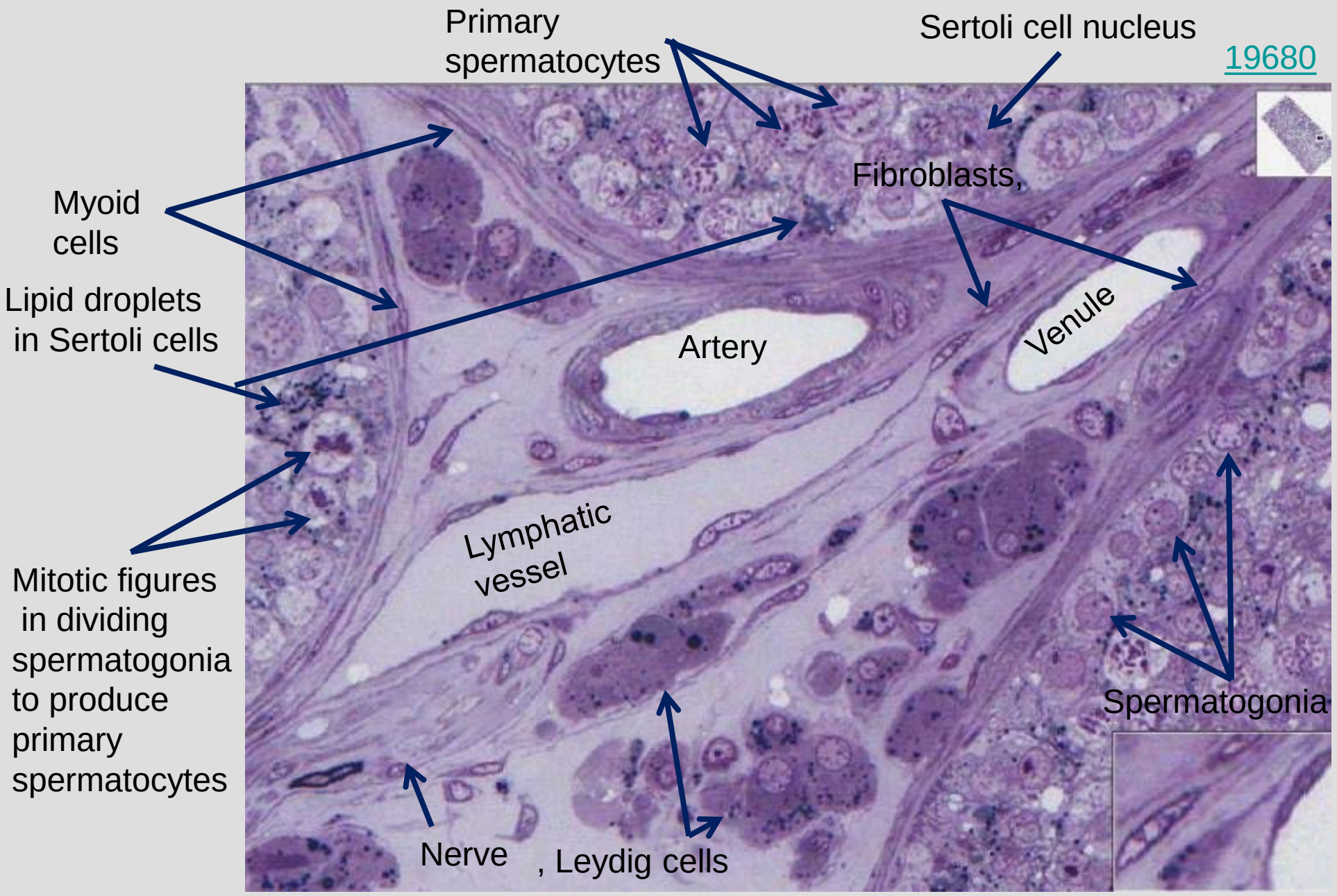


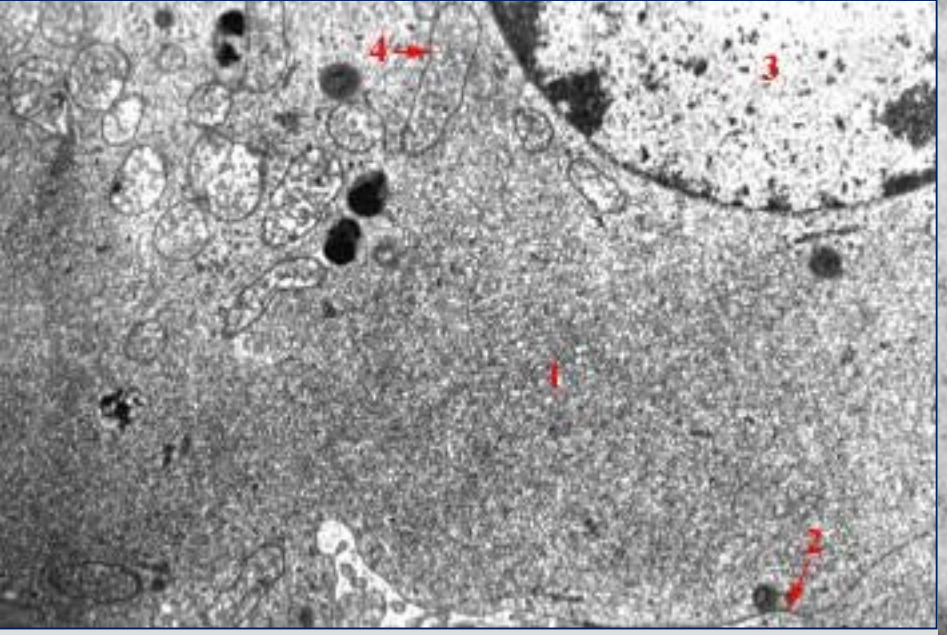
Above the spermatogonia are the spermatocytes, germ cells in various steps of meiosis. The great majority of these cells are primary spermatocytes, i.e., cells in prophase of first meiotic division.

19680


19680
Leydig cells
Myoid cells.
Capillaries
Nerve
Lipid droplets
Since developing germinal cells require a higher (100 fold) concentration of testosterone than do other cells, Leydig cells are located close to seminiferous tubules.
Lymphatic vessel
Seminiferous epithelium
Artery
Leydig cells
Fibroblasts
Lymphatic vessel

Testicular interstitium (space between/around semeniferous tubules)

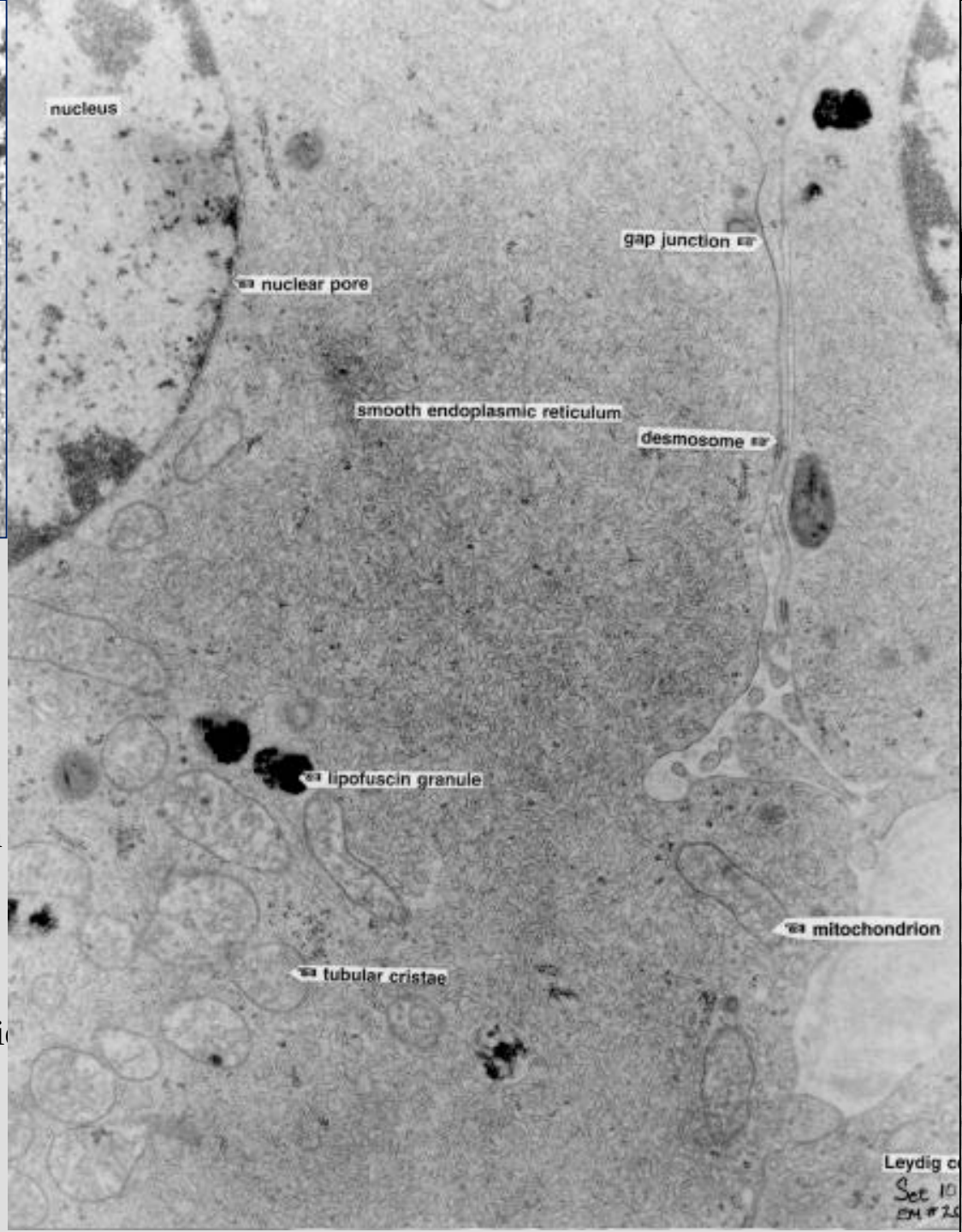


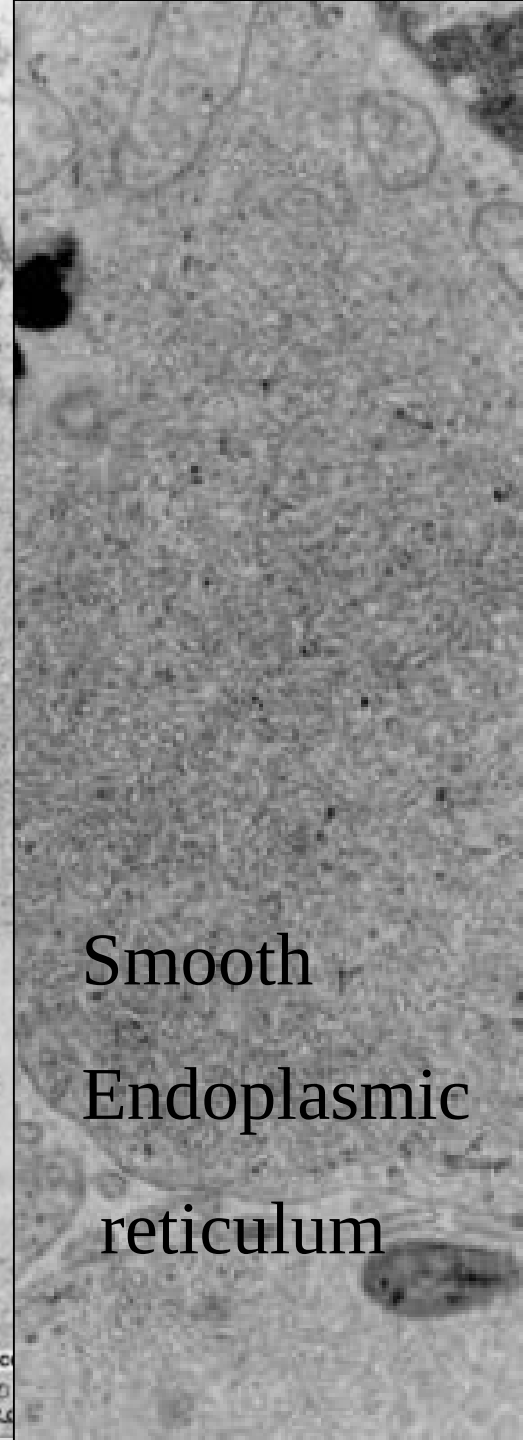


Horse Leydig cells

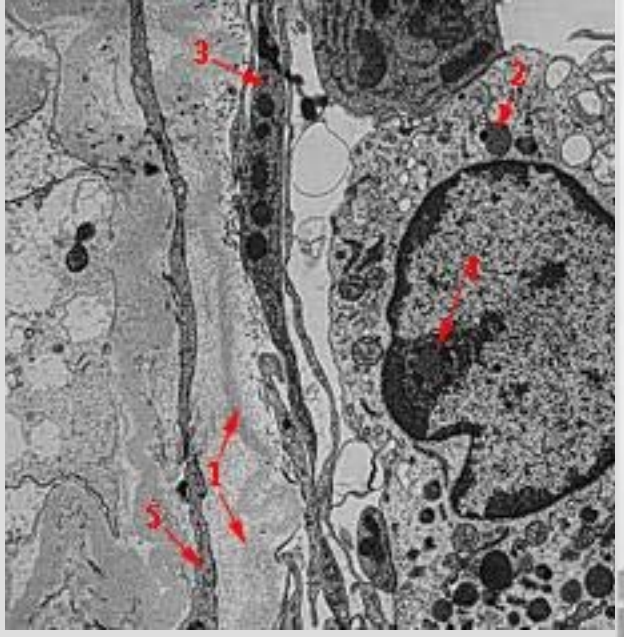
: EM 20

1. Smooth endoplasmic reticulum
2. Gap junction
3. Nucleus of leydig cell
4. Tubular cristae of a mitochondi





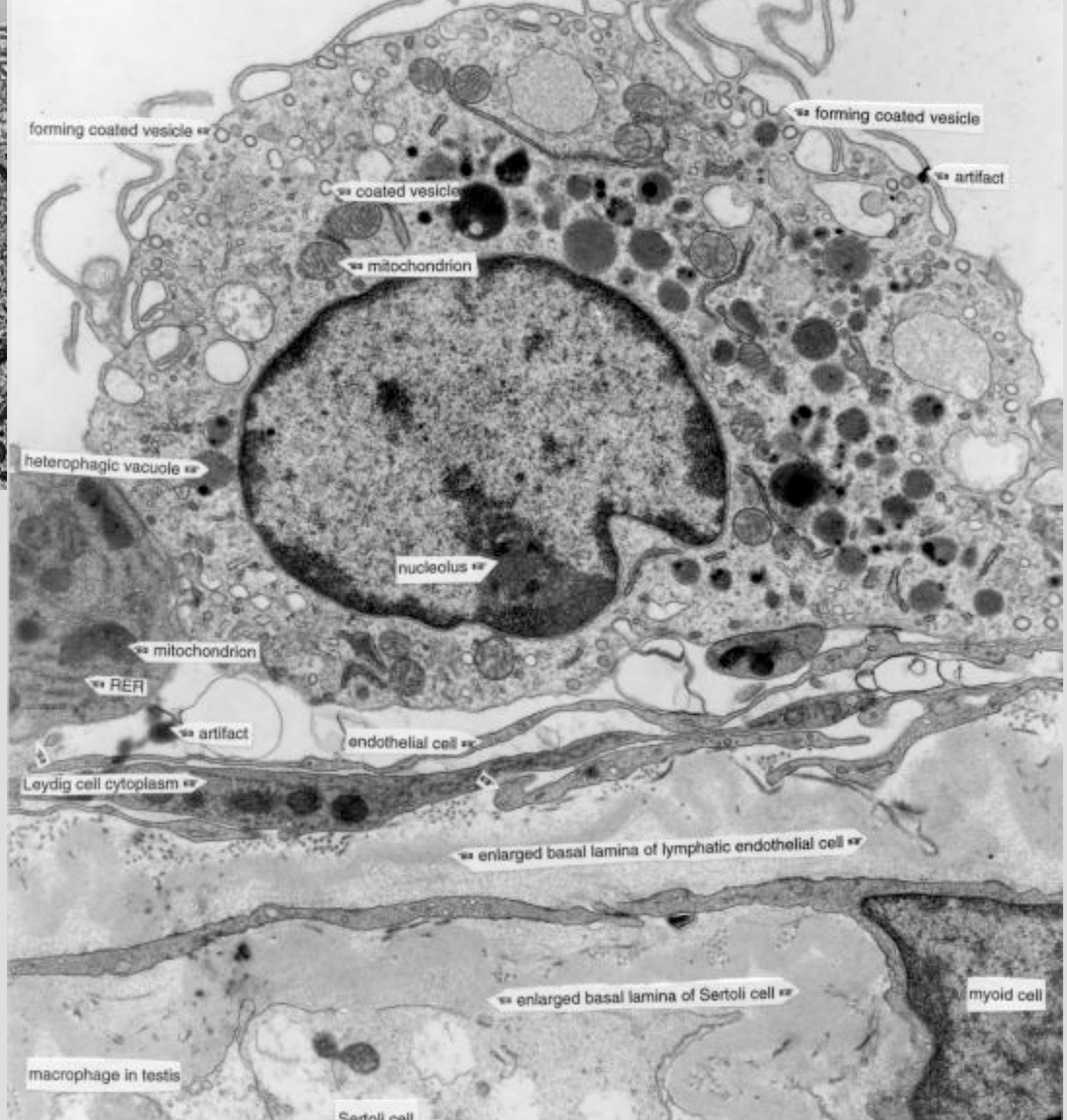
Smooth Endoplasmic reticulum

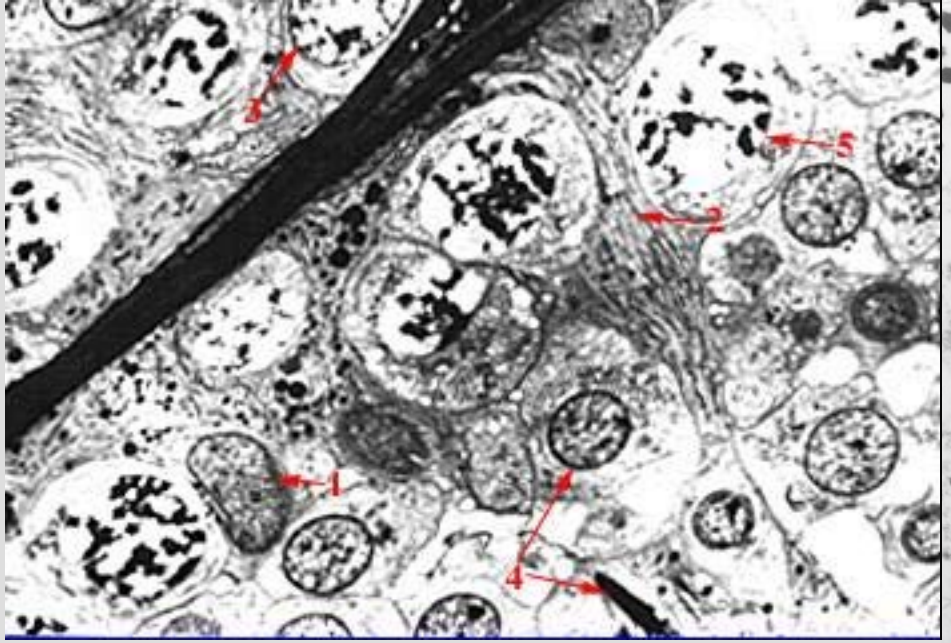


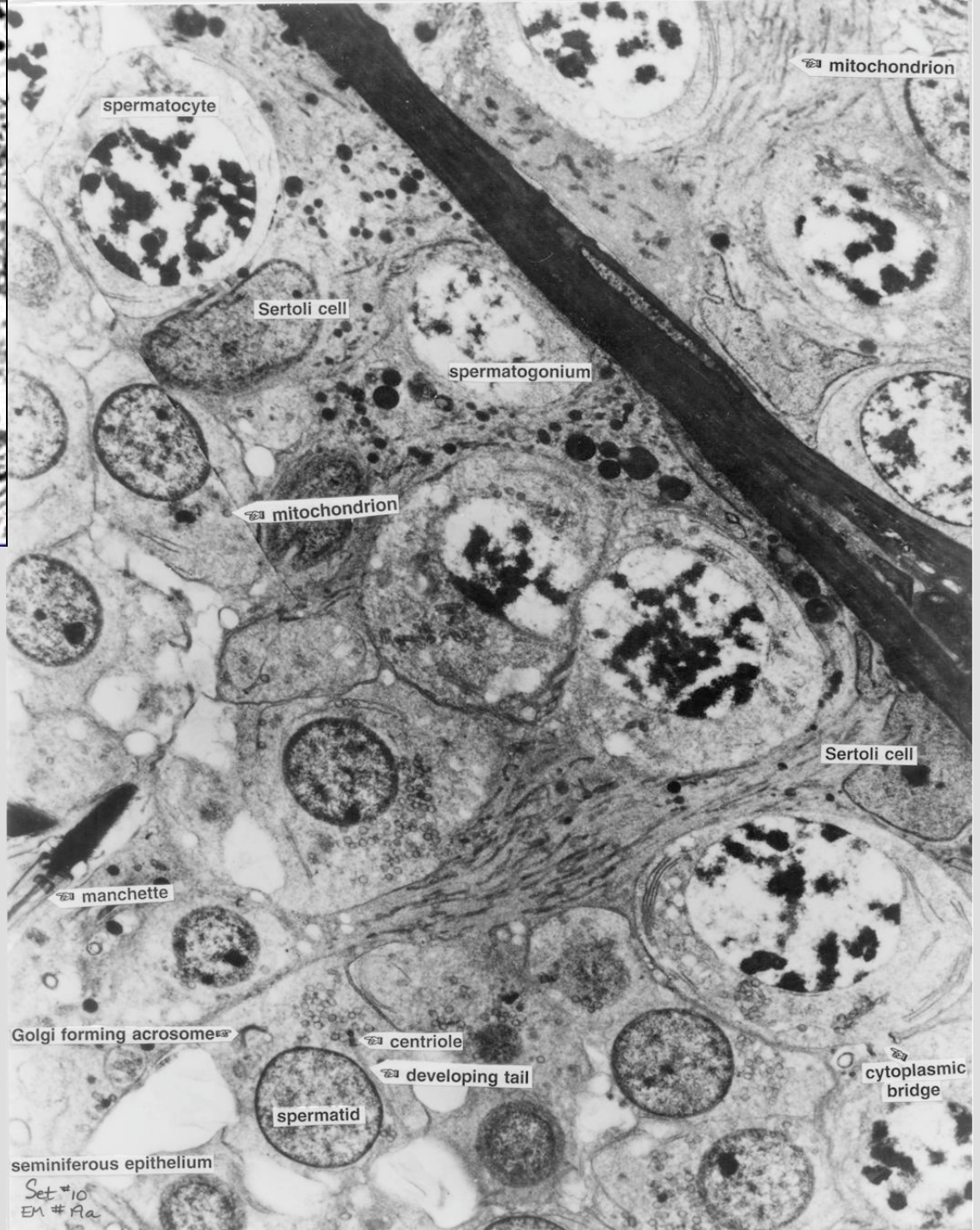
Aged rat testis

EM 8h: macrophage in testis;
30 000x

1. Enlarged basal lamina
2. Heterophagic vacuole
3. Leydig cell cytoplasm
4. Nucleolus
5. Myoid cell

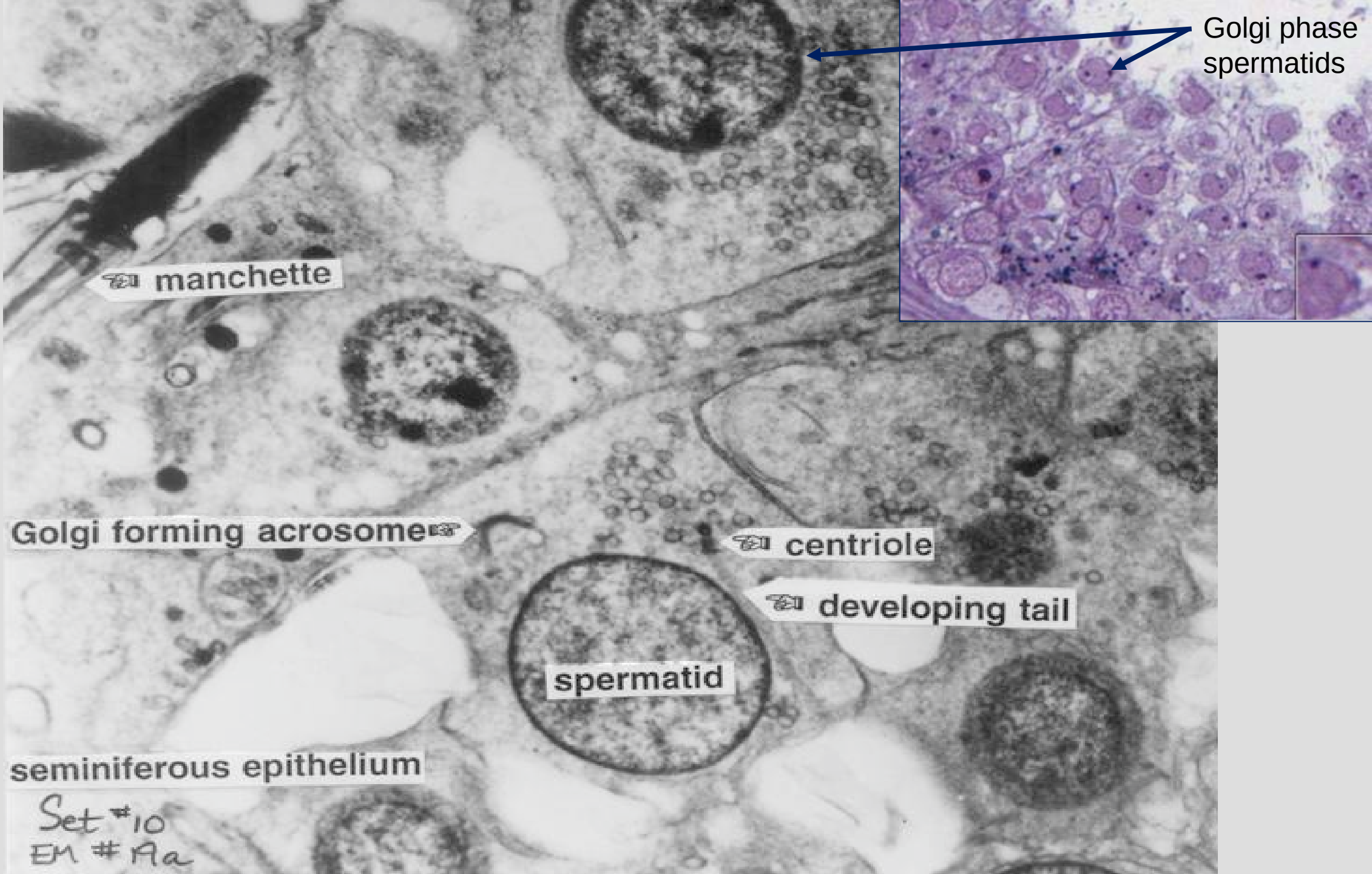


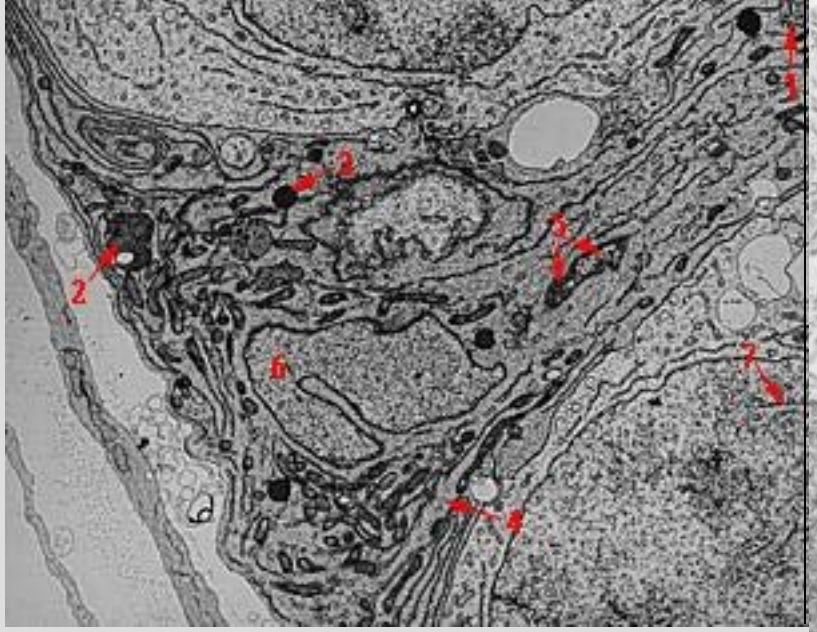




High voltage EM of horse seminiferous tubules EM 19a

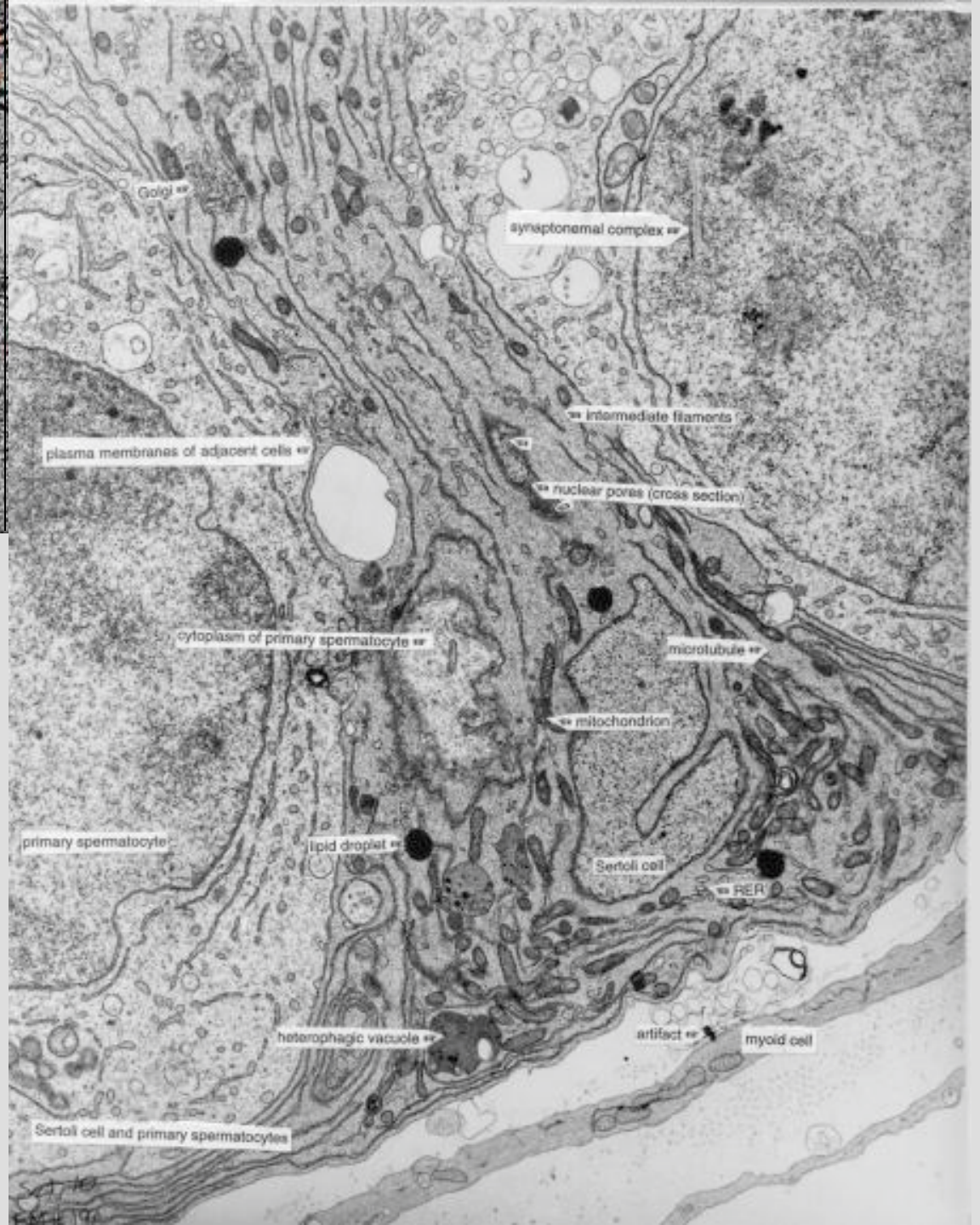
1. Sertoli cell nucleus
2. Mitochondrion
3. Spermatogonium
4. Spermatids
5. Primary spermatocyte


manchette
Golgi forming acrosome
centriole
developing tail
spermatid
seminiferous epithelium
Set #10
EM #9a
Golgi phase
spermatids

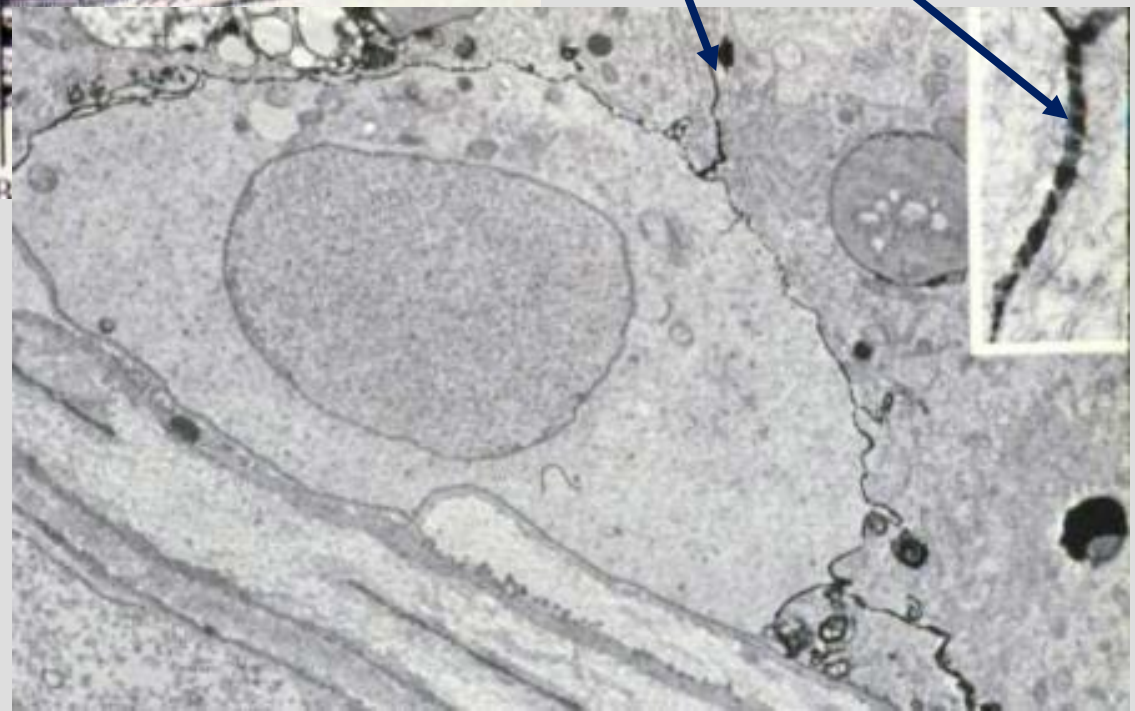


EM 19c; sertoli cell; 13 300x

1. Golgi
2. Heterophagic vacuole
3. Lipid droplet
4. Microtubule
5. Nuclear pores (cross-section)
6. Sertoli cell
7. Synaptoneural complex



Occluding junctions between Sertoli cells



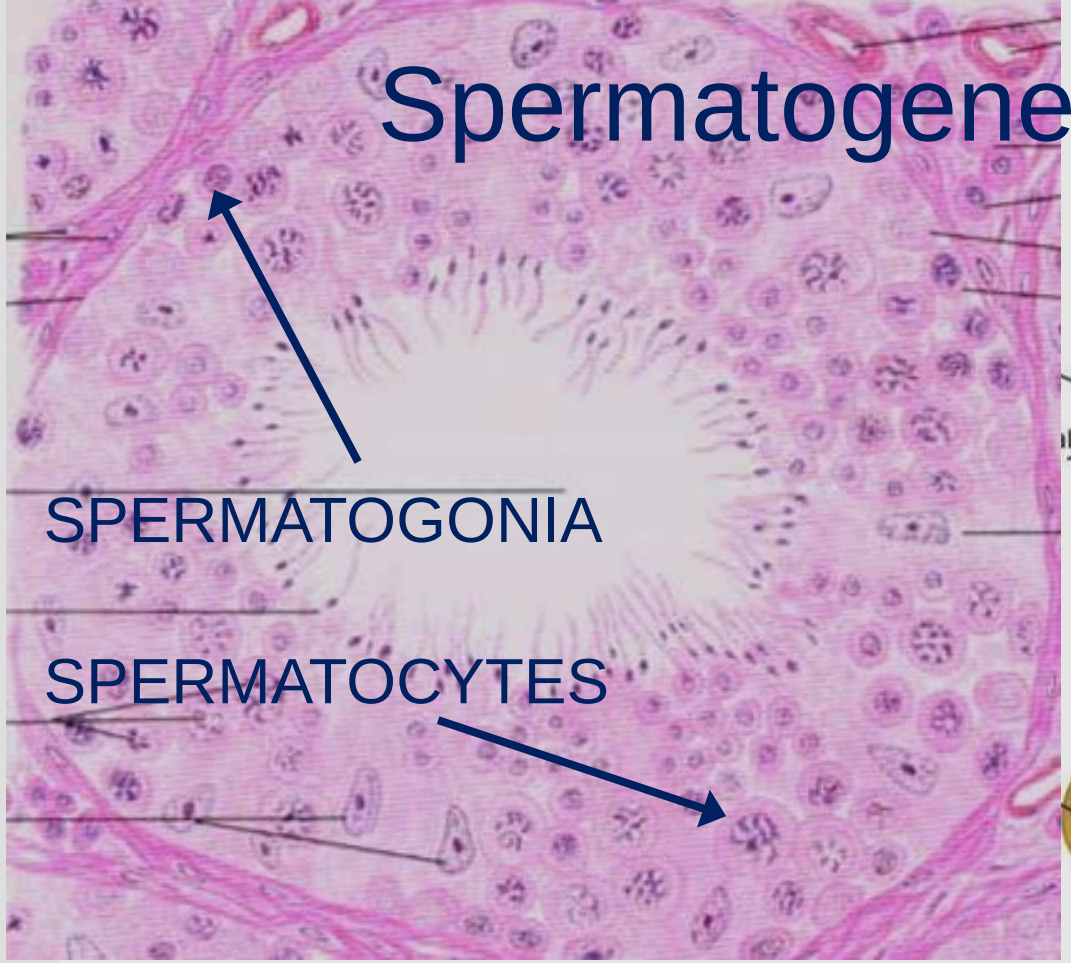
Blood-testis barrier resizes in the occluding junctions between Sertoli cells in seminiferous tubules

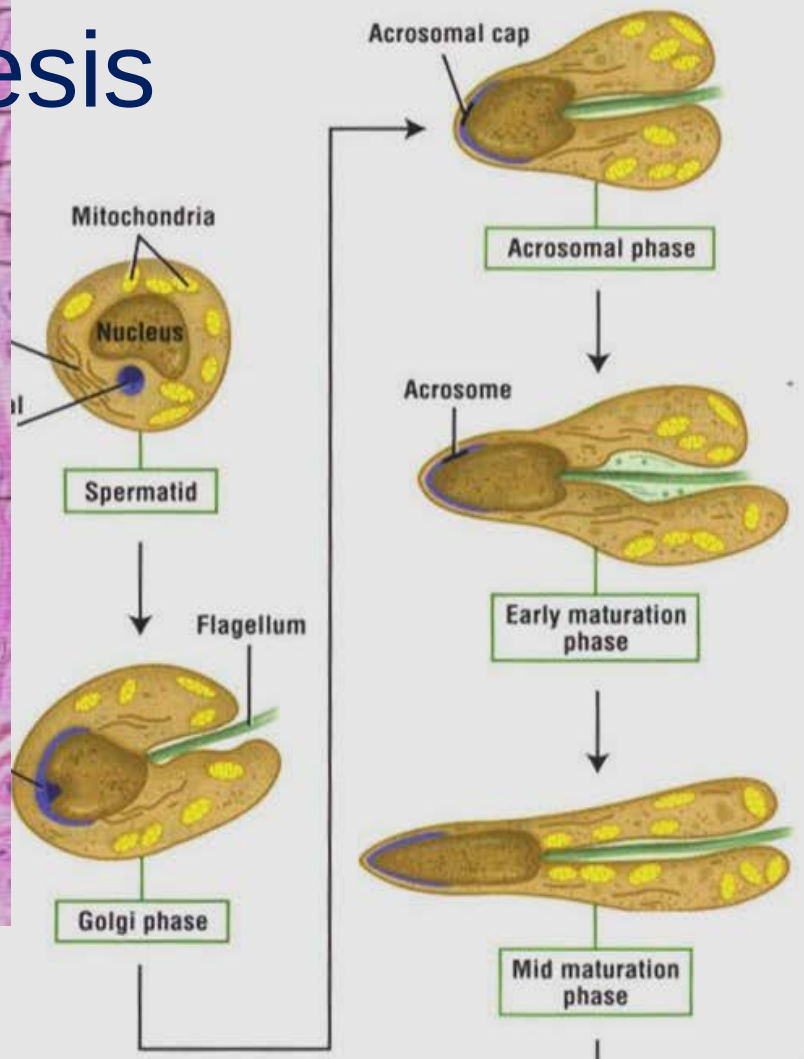
Spermatogenesis

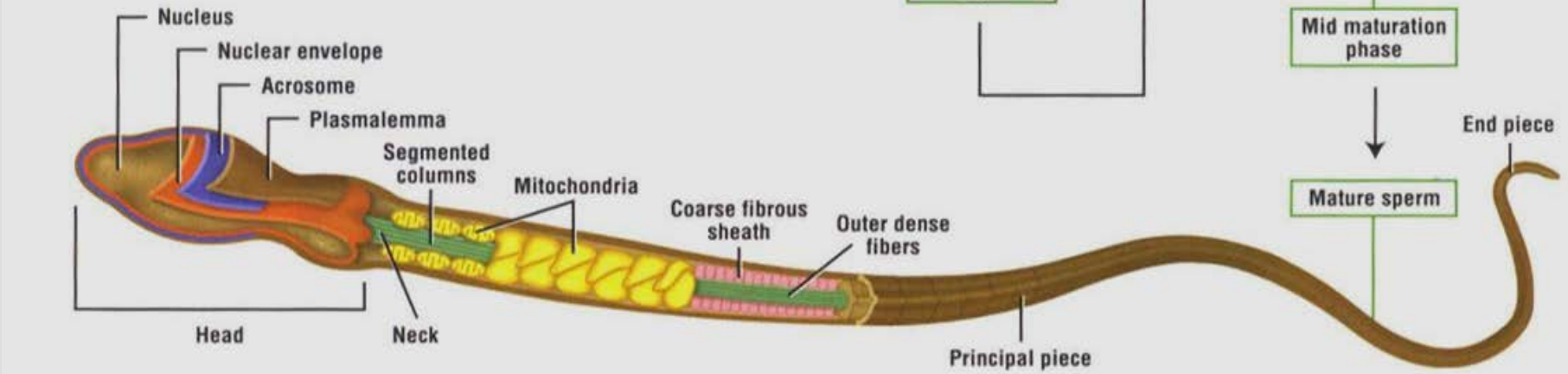
EVENT	CELL TYPE
SPERMATOCYTOGENESIS	SPERMATOGONIA
MEIOSIS	SPERMATOCYTES
SPERMIOGENESIS	SPERMATIDS

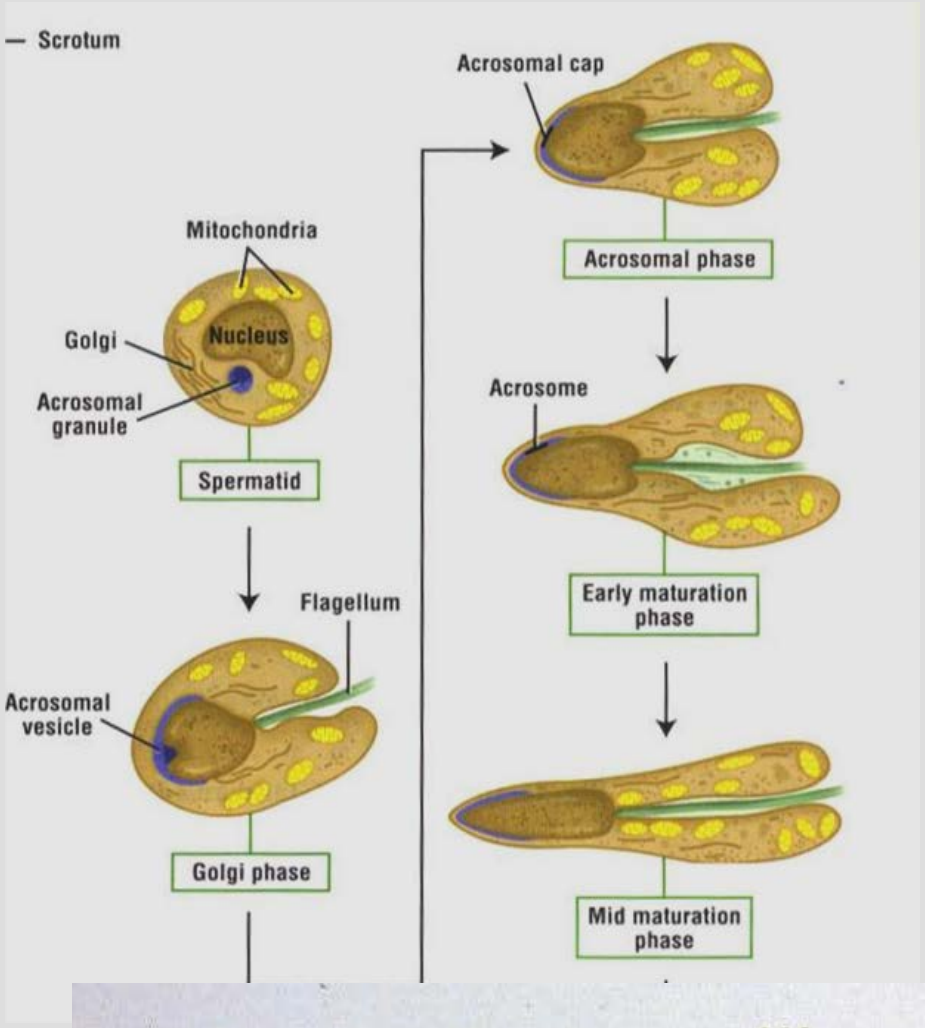
Spermatogenesis

Ref code
5









Golgi phase

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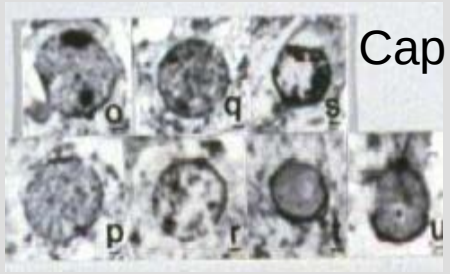
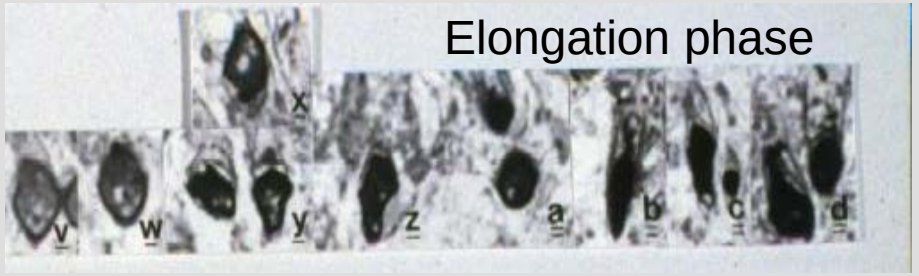
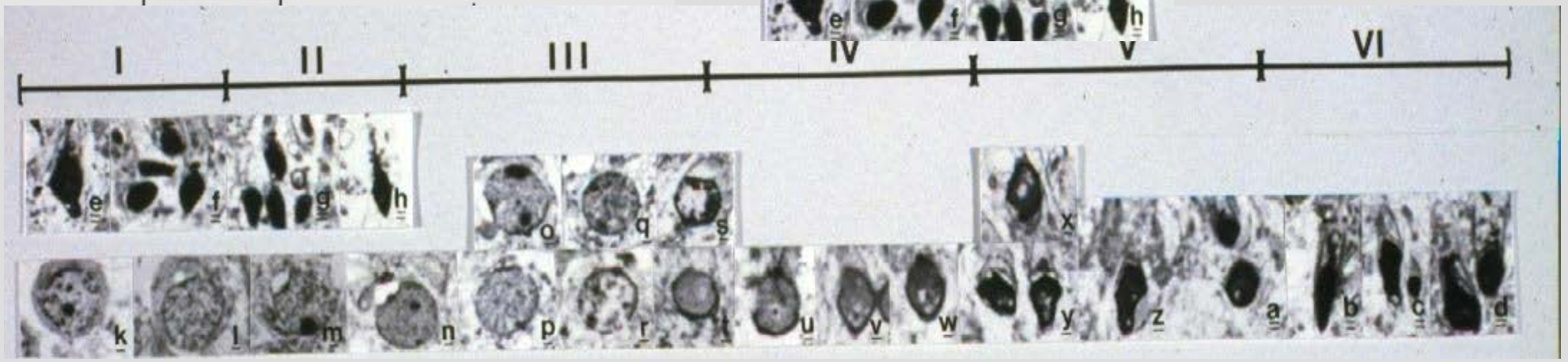
Cap phase



Elongation phase

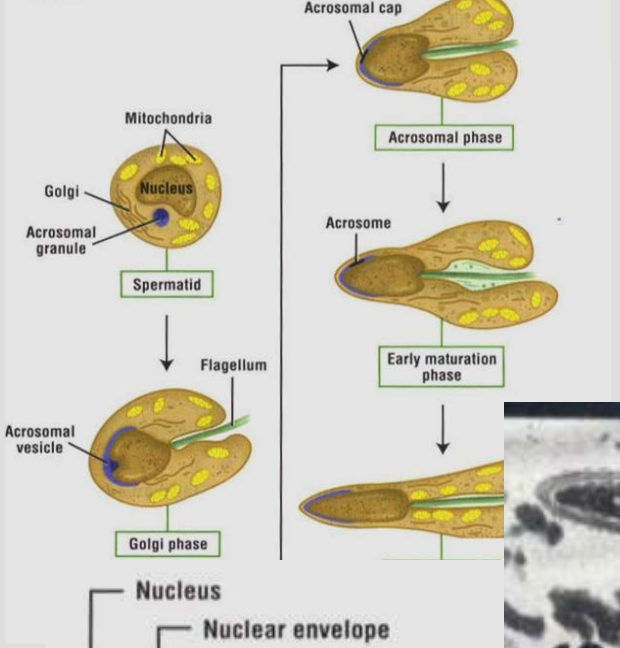


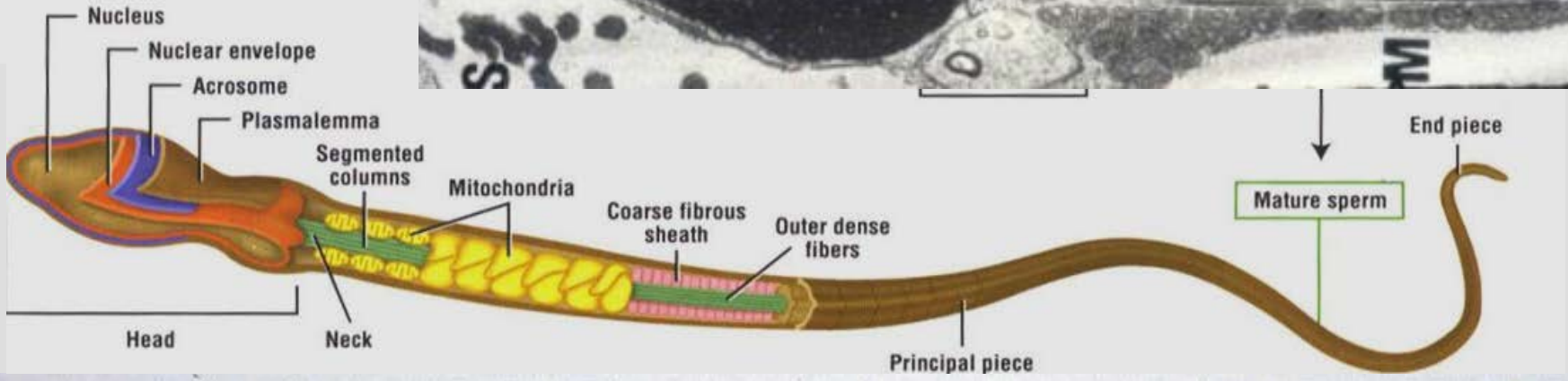
Maturation phase



Ref code
5

Maturation phase





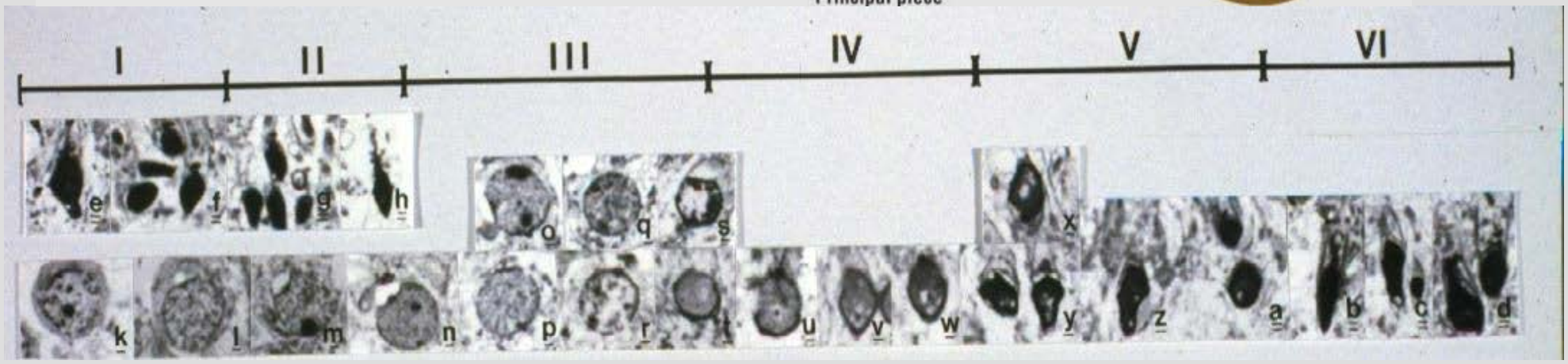


Fig. 17-5 Ductuli Efferentes and Transition to Ductus Epididymis. Stain: hematoxylin-eosin. Low magnification (inset: medium magnification).

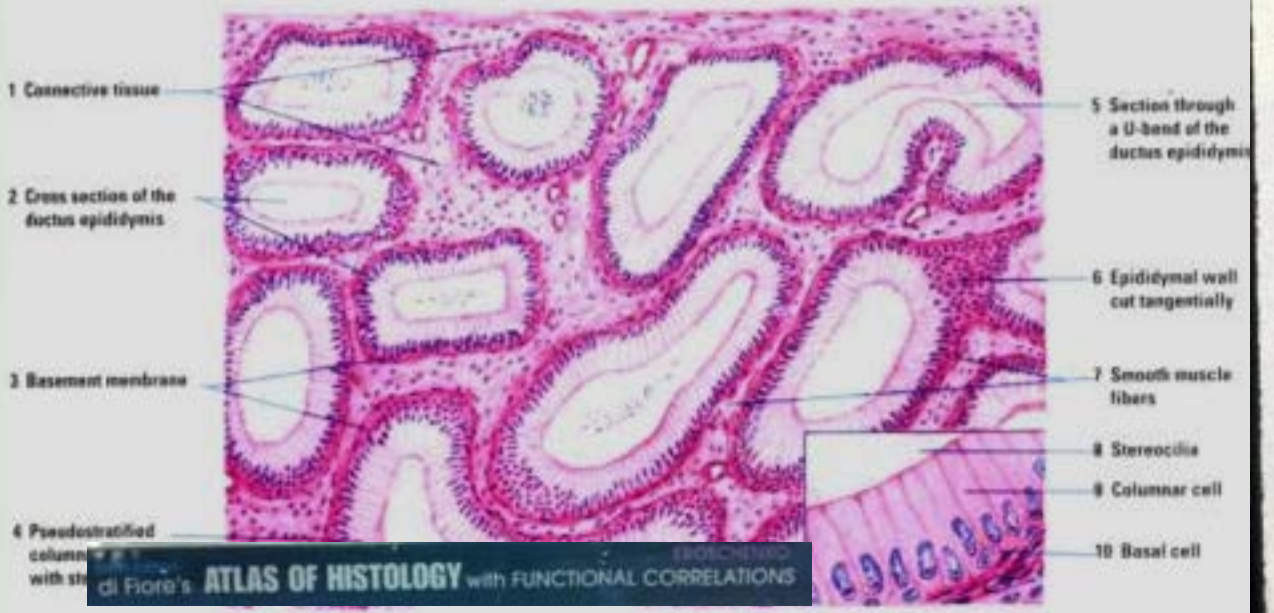
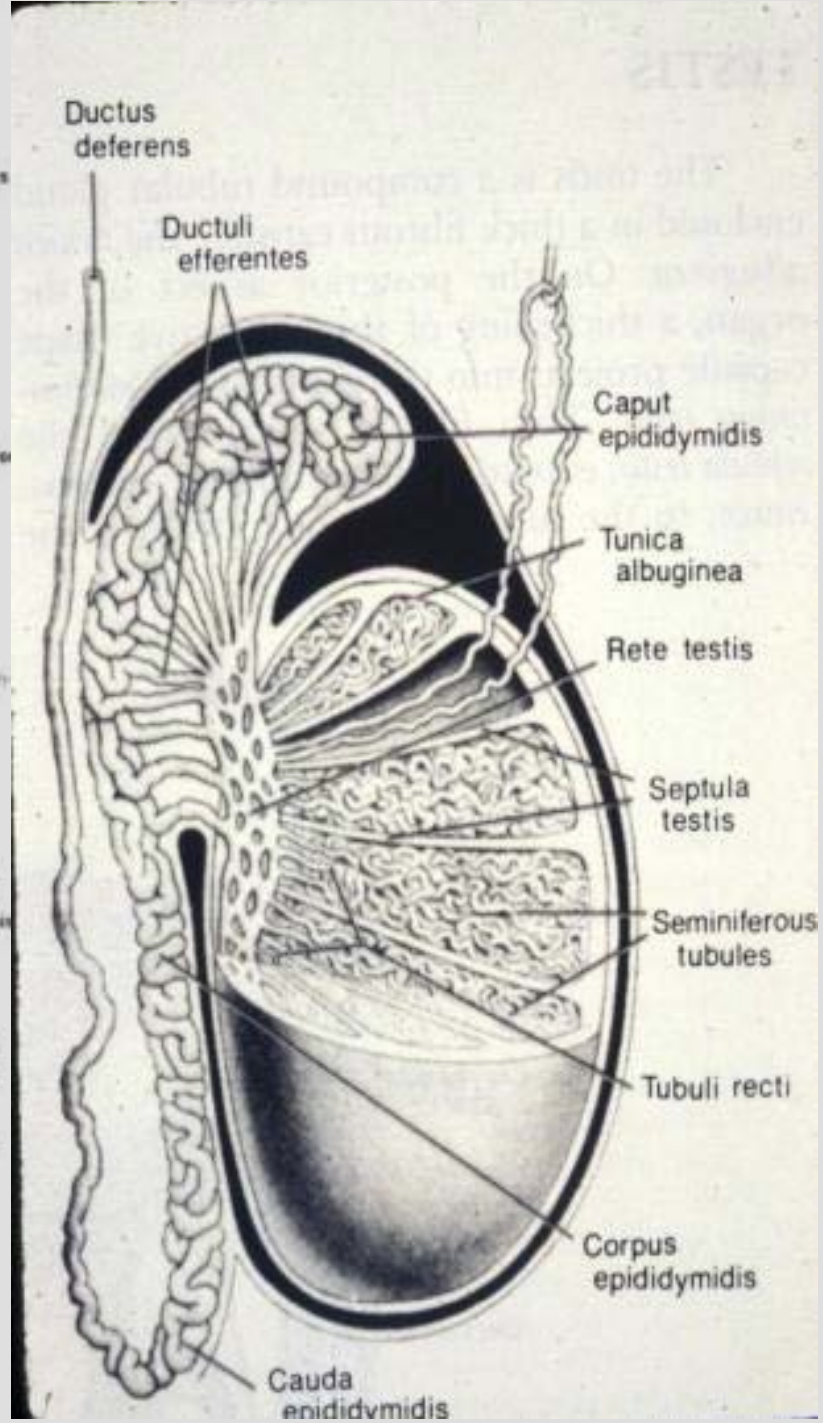


Fig. 17-6 Ductus Epididymis. Stain: hematoxylin-eosin. Low magnification (inset: high magnification).



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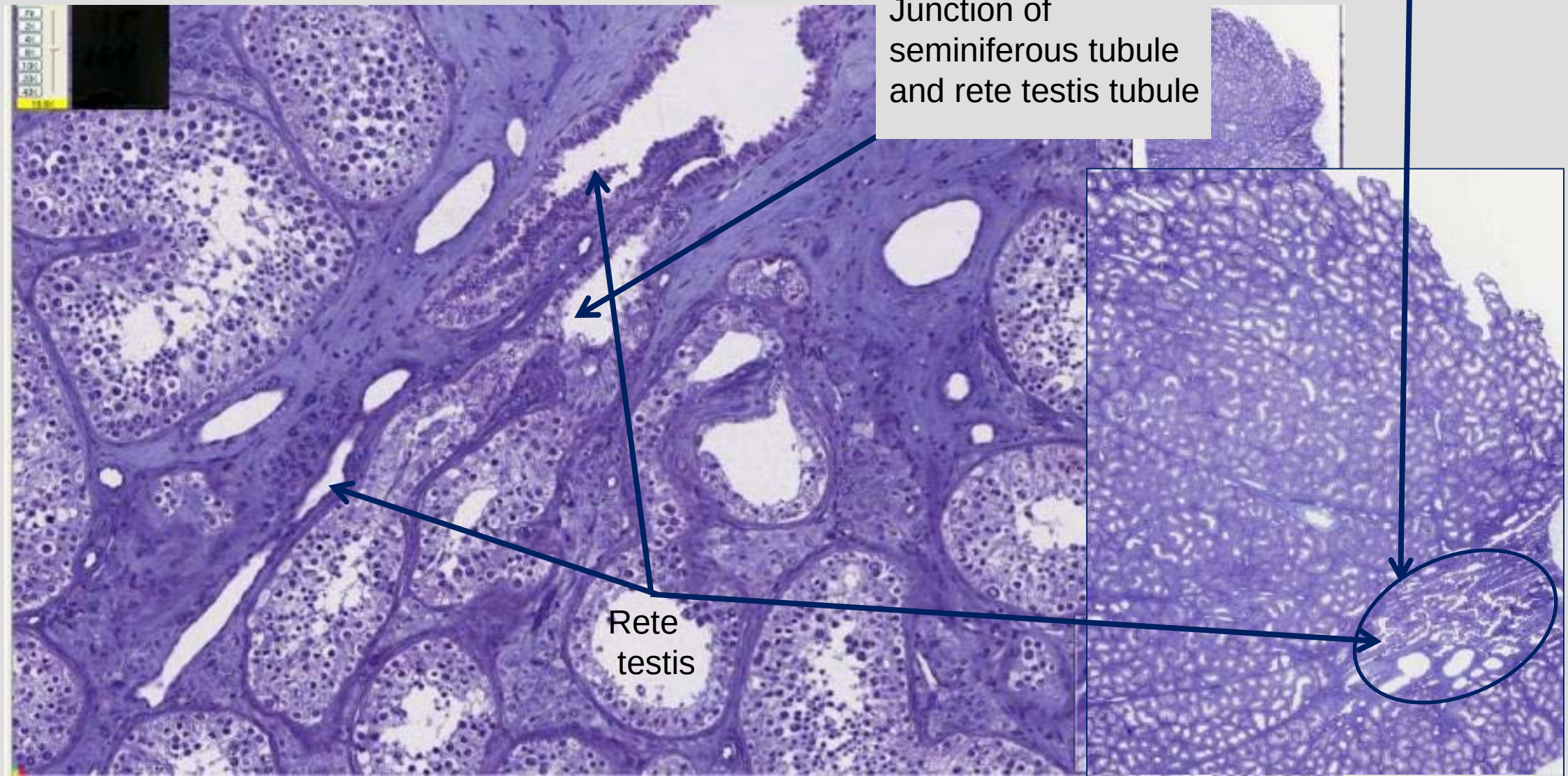
Ref code # 5

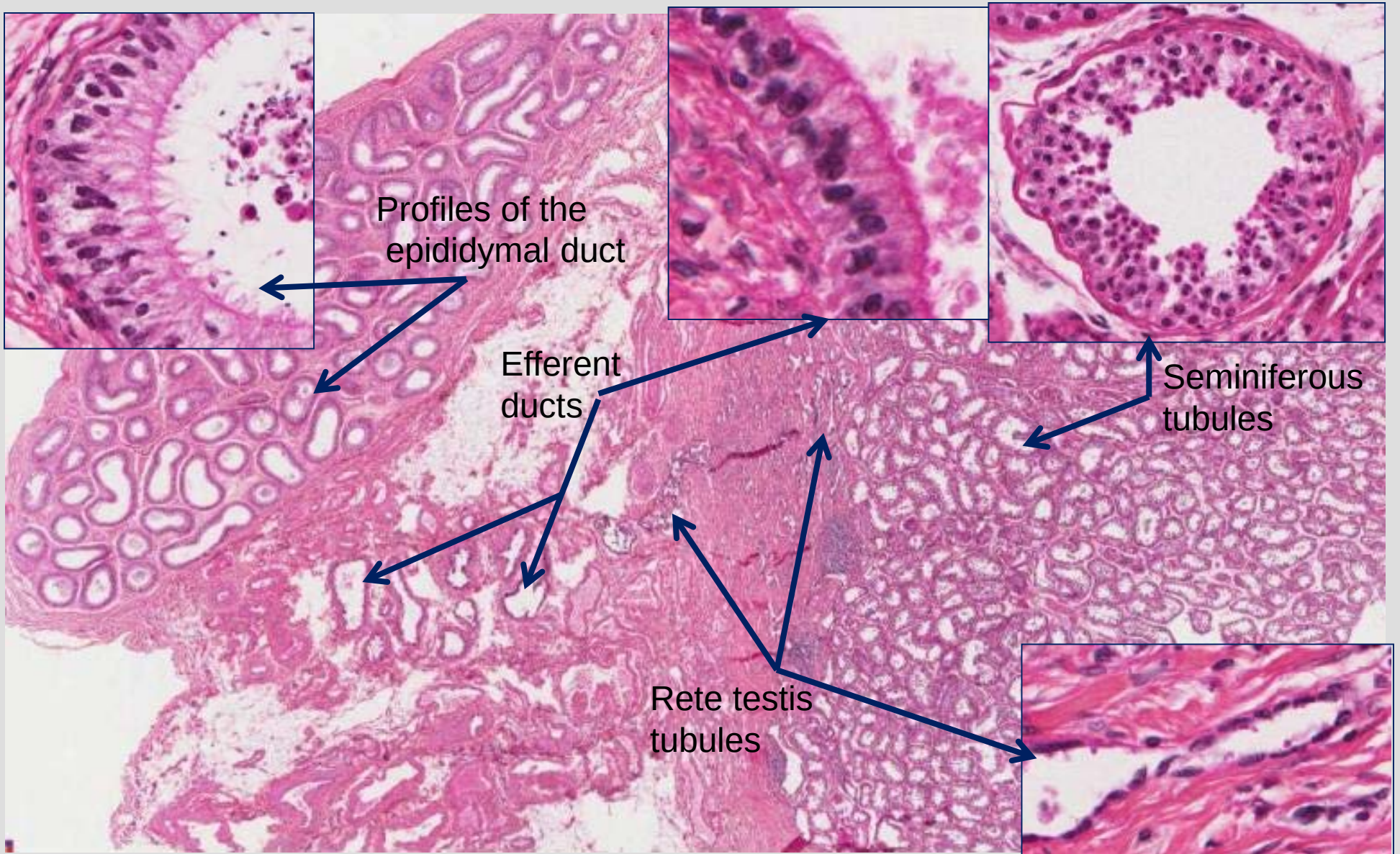
Fig. 17-2 Seminiferous Tubules, Straight Tubules, Rete Testis, and Ductuli Efferentes (Efferent Ductules).
Stain: hematoxylin-eosin. Low magnification (inset: high magnification).

19709

Human testis: junction of seminiferous tubule and rete testis for sperm to exit (toluidine blue)



Testis and epididymis – efferent duct and epididymis

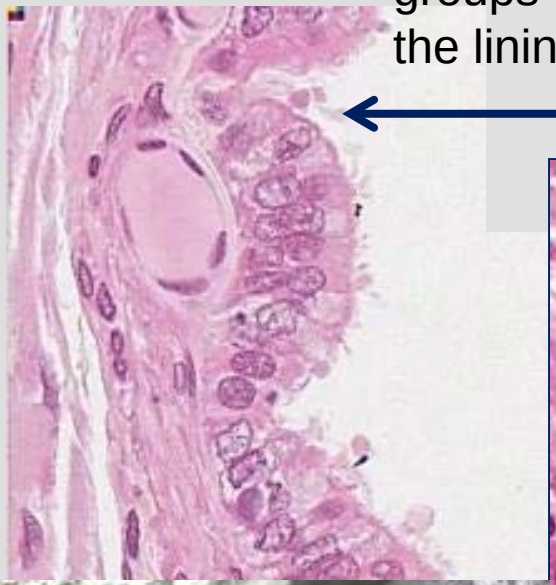


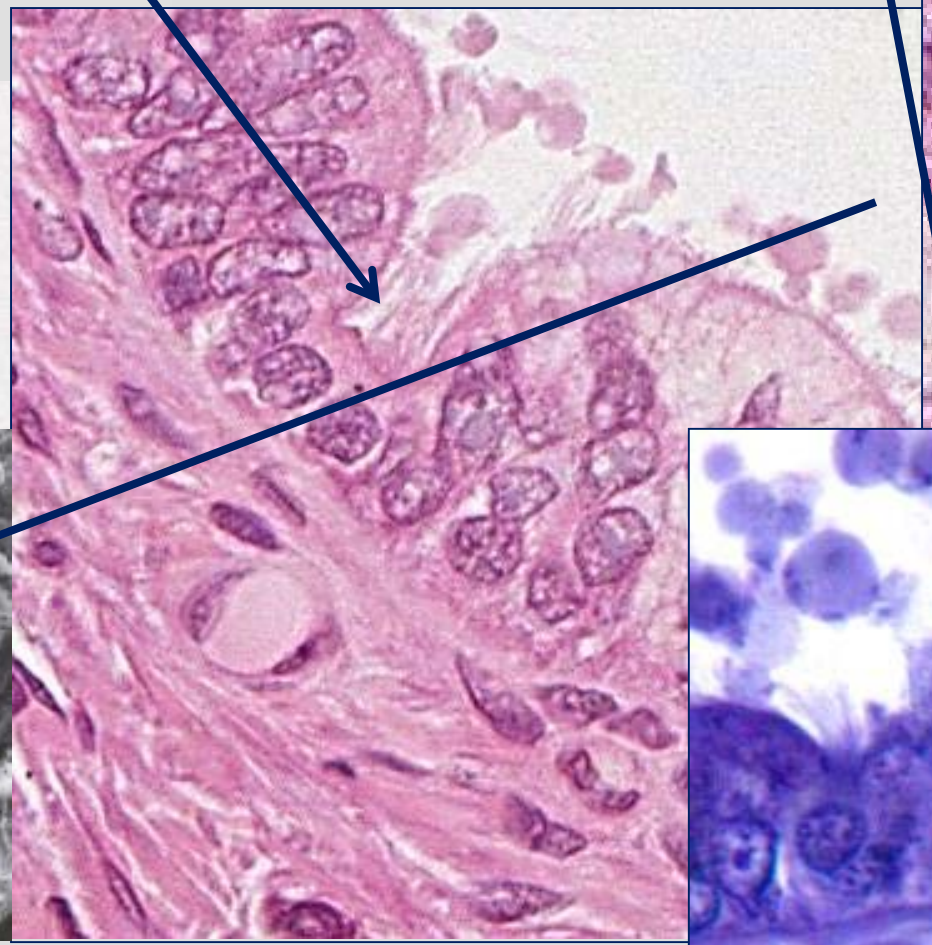
Efferent ducts

True cilia on their apical surface help move sperm through the duct in human .

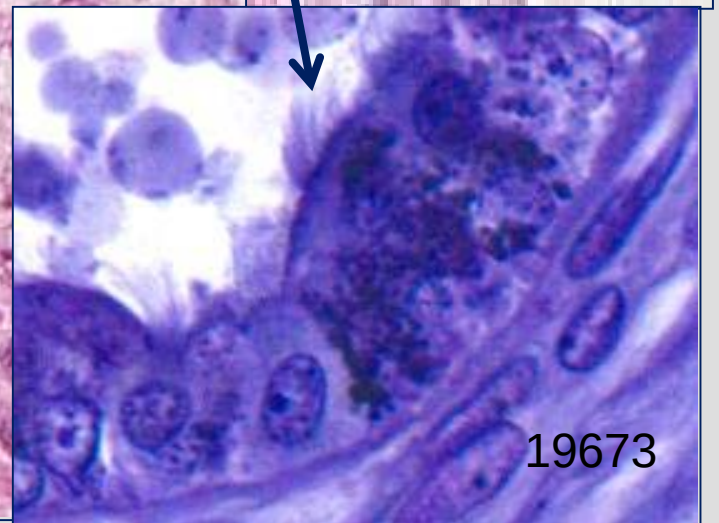
199

Human efferent ducts have a characteristic scalloped luminal profile due to alternating groups of high and low columnar cells in the lining epithelium





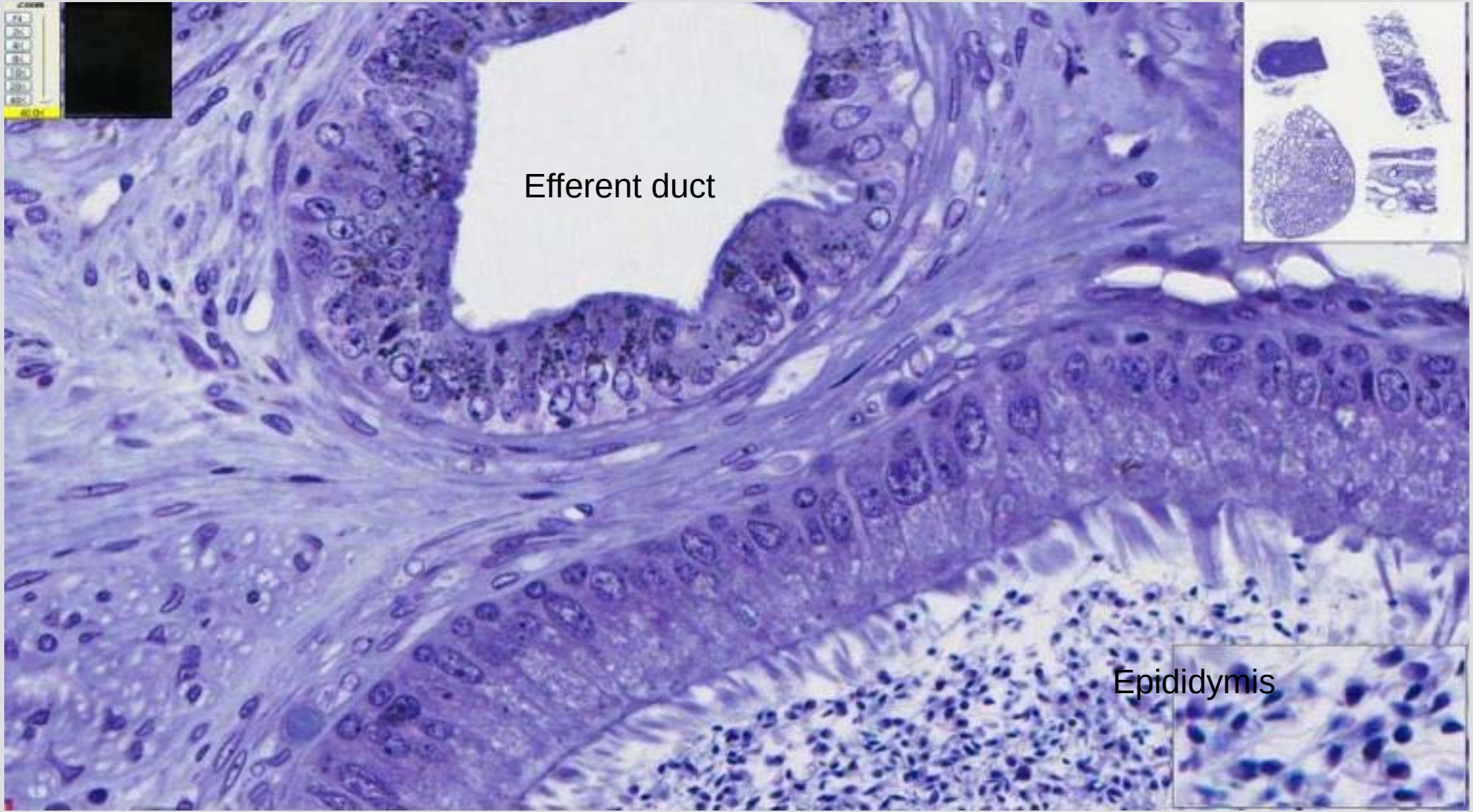
Horse efferent duct



19673

True ciliated cells (efferent duct) and stereociliated cells (epididymis, with sperm in lumen) of psudostratified columnar epithelium (toluidine blue)

19678

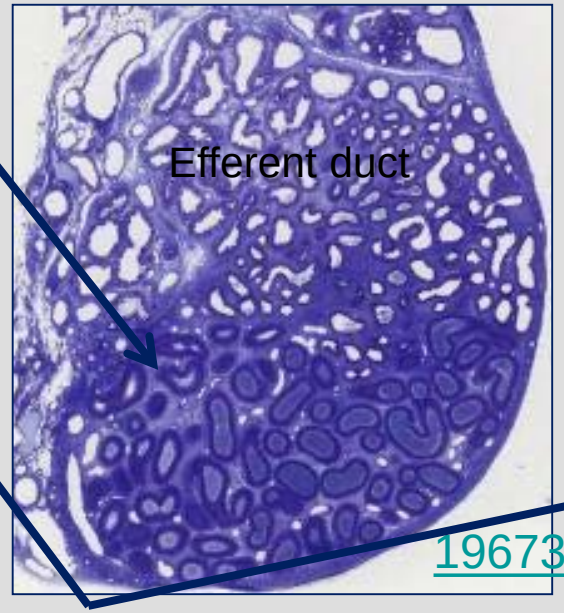


Epididymis

Head

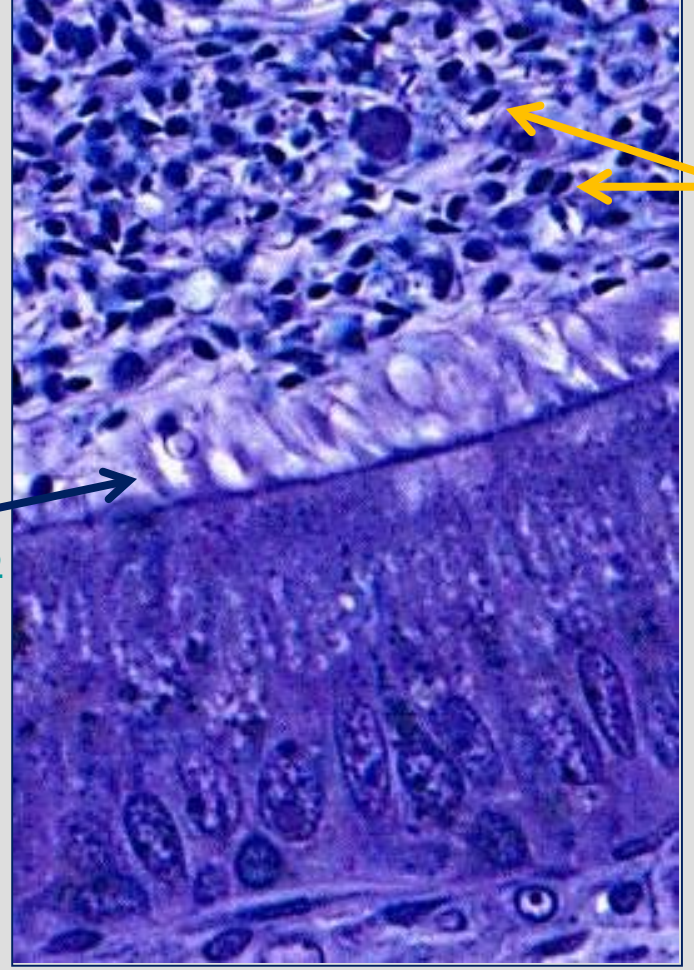
199

Stereocilia



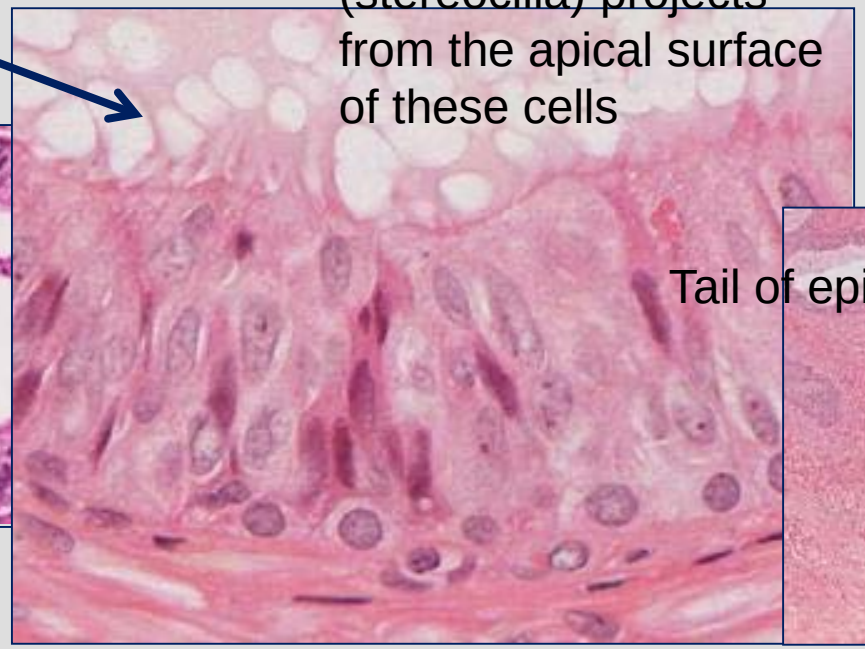
19673

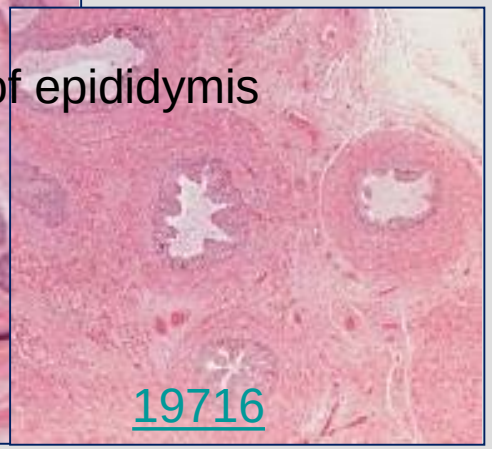
Extremely long (30µm), branching microvilli (stereocilia) projects from the apical surface of these cells



sperm

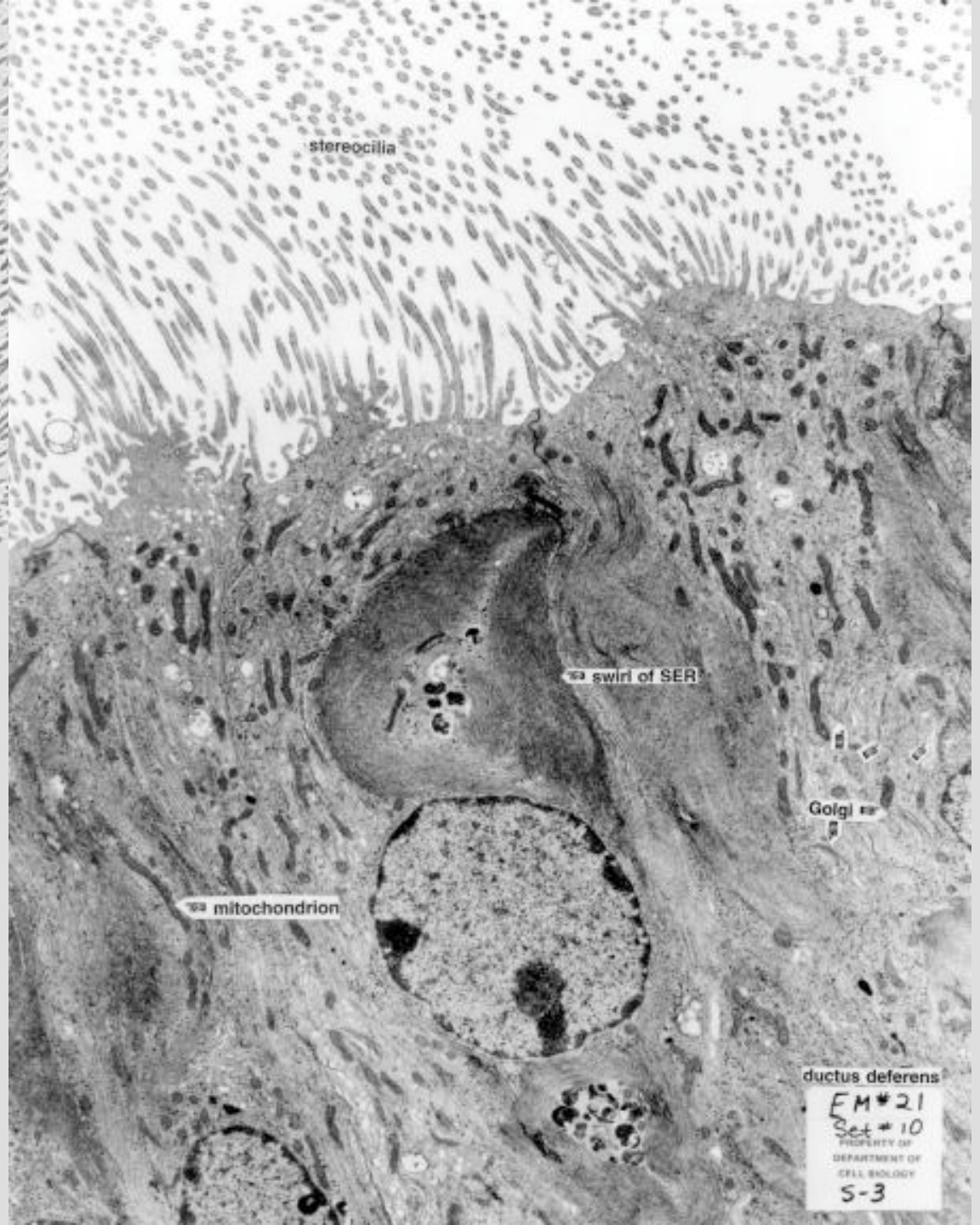
467





19716

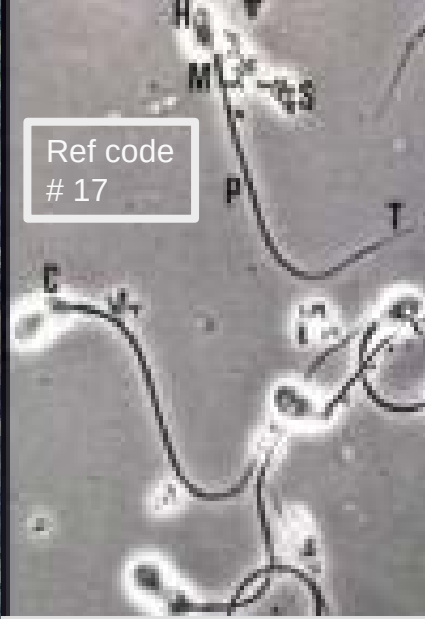
Smooth muscle layer is thicker in more distal regions of epididymis



EM 21: ductus deferens; 11 000x

1. Golgi
2. Stereocilia
3. Mitochondria
4. Swirl of SER

Epididymal Sperm Maturation



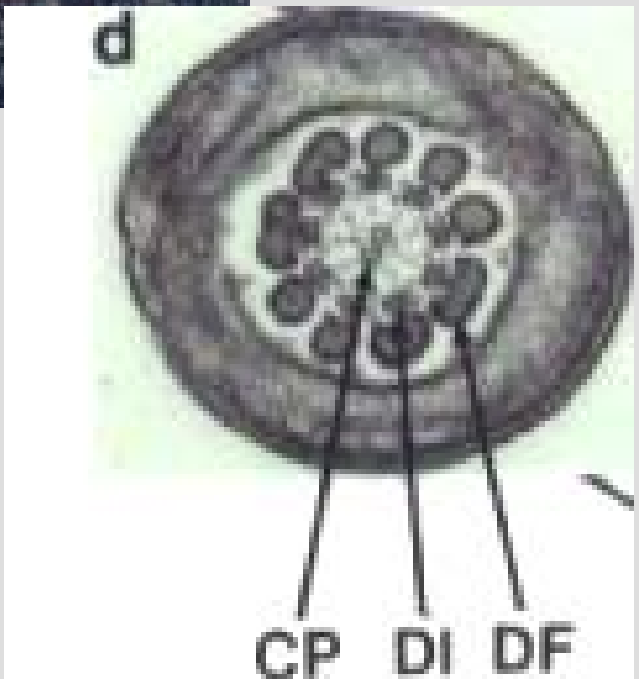
Fertility

Motility

Nature of plasma membrane

Mitochondrial structural stability

Chromatin stability



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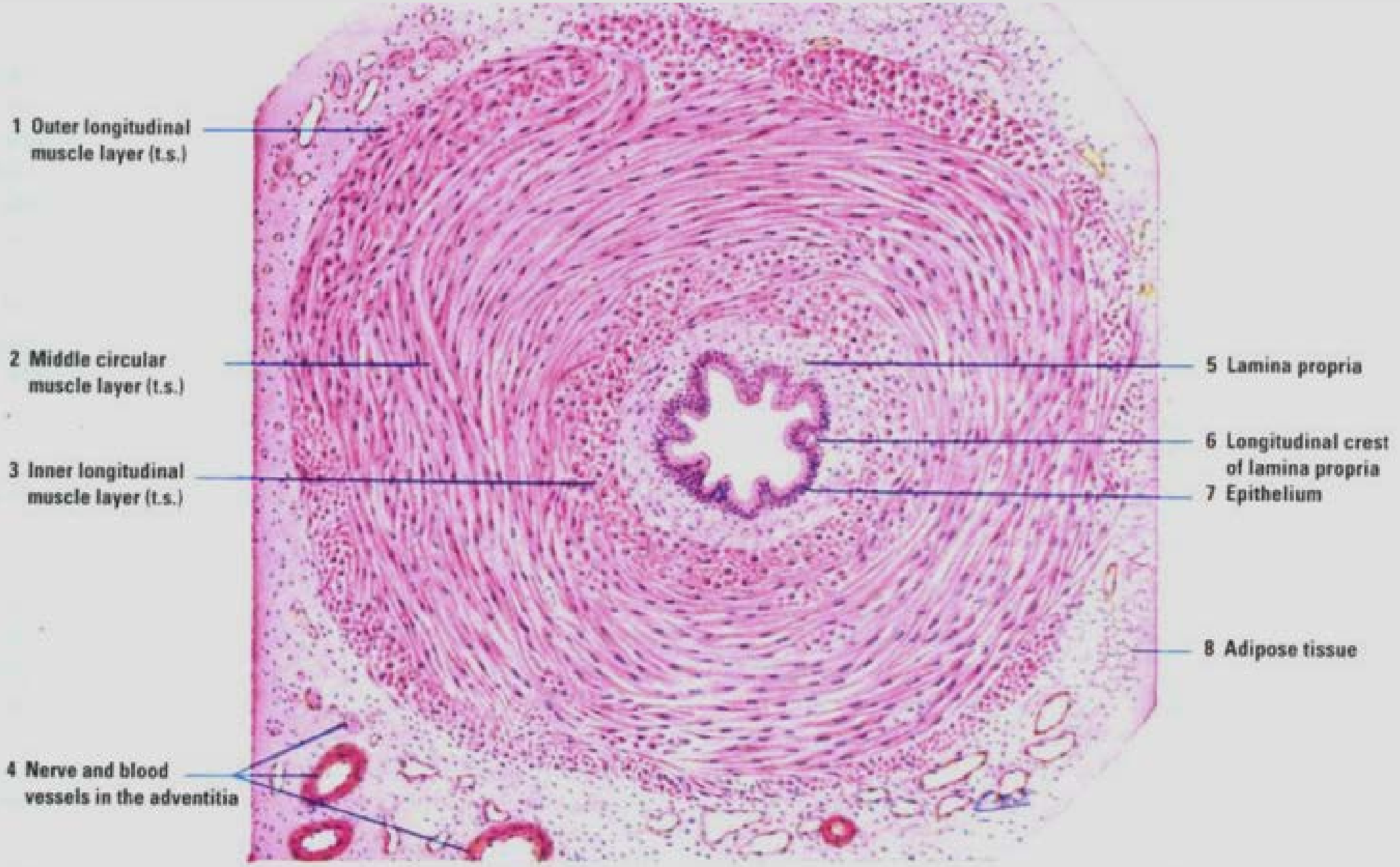
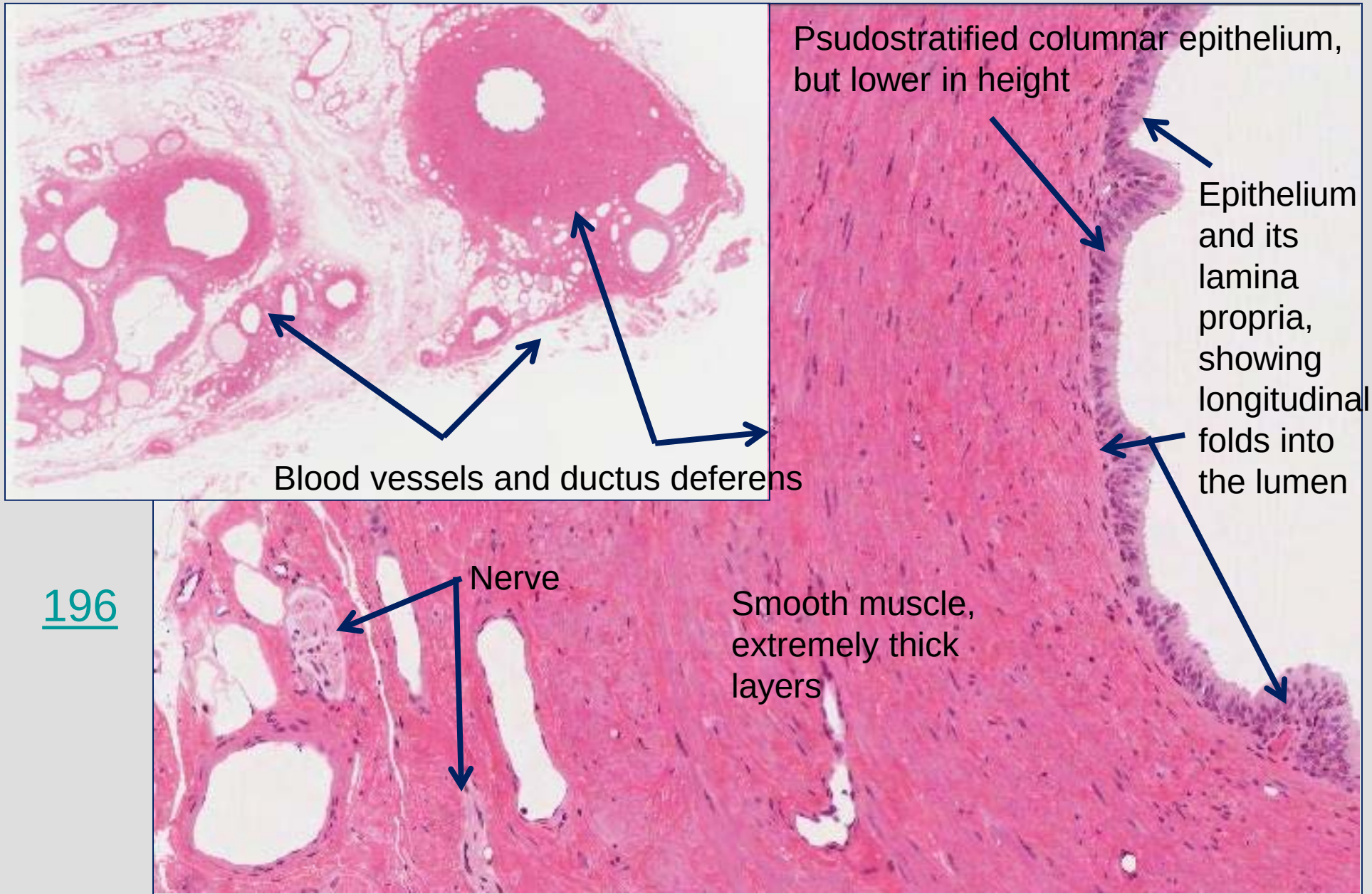


Fig. 17-7 **Ductus Deferens (transverse section).** Stain: hematoxylin-eosin. Low magnification.

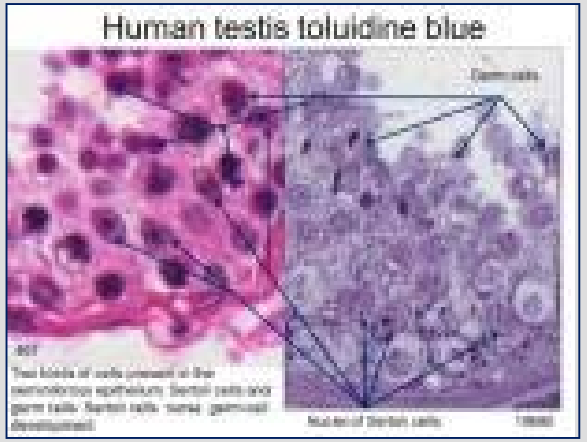
DUCTUS DEFERENS IN THE SPERMATIC CORD

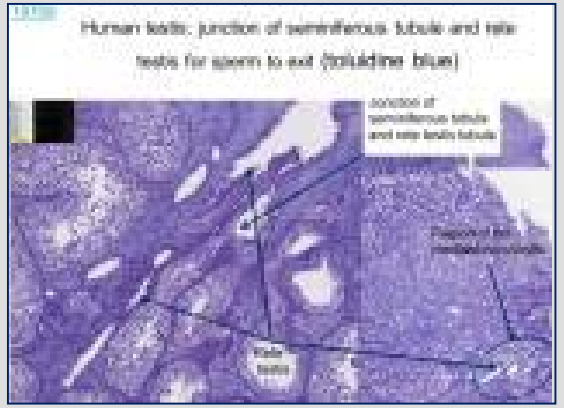


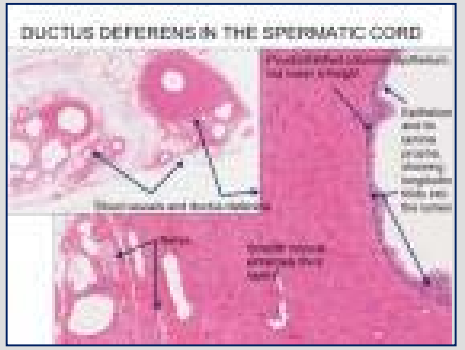
196

Mechanisms of Sperm Transport

Location	Force
Seminiferous tubules	Bulk flow (10 ul/g/hr) minor Contractions of myoid cells
Rete testis	Bulk flow ciliary action
Efferent ducts	Bulk flow ciliary action
Epididymis	Contractions of smooth muscle
Ductus deferens	Contractions of smooth muscle during ejaculation speed is 800 mm/second







Spermatic cord

Epididymis

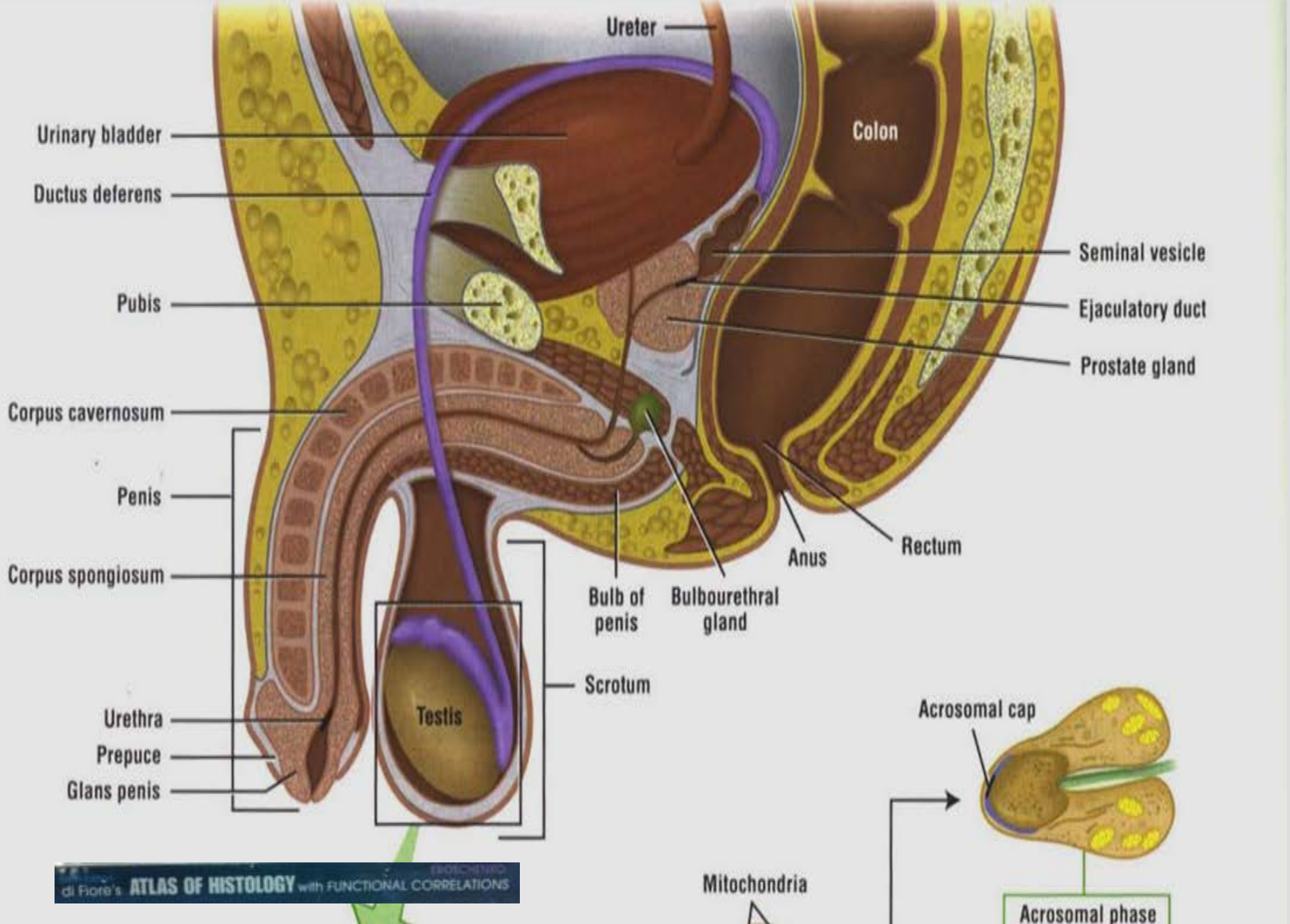
Testis

Human testis and epididymis

Spermatic cord human

19678

Ductus deferens


Ureter
Urinary bladder
Ductus deferens
Colon
Seminal vesicle
Pubis
Ejaculatory duct
Prostate gland
Corpus cavernosum
Penis
Corpus spongiosum
Anus
Rectum
Bulb of penis
Bulbourethral gland
Scrotum
Testis
Urethra
Prepuce
Glans penis
Acrosomal cap
Mitochondria
Acrosomal phase
di Fiore's ATLAS OF HISTOLOGY with FUNCTIONAL CORRELATIONS

Ref code
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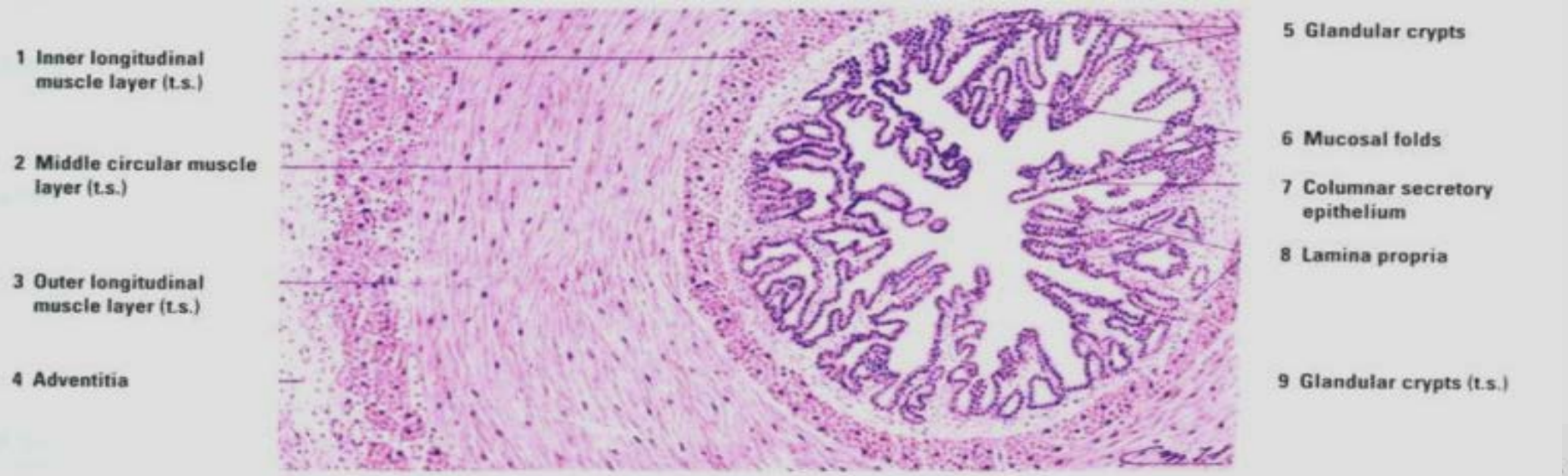
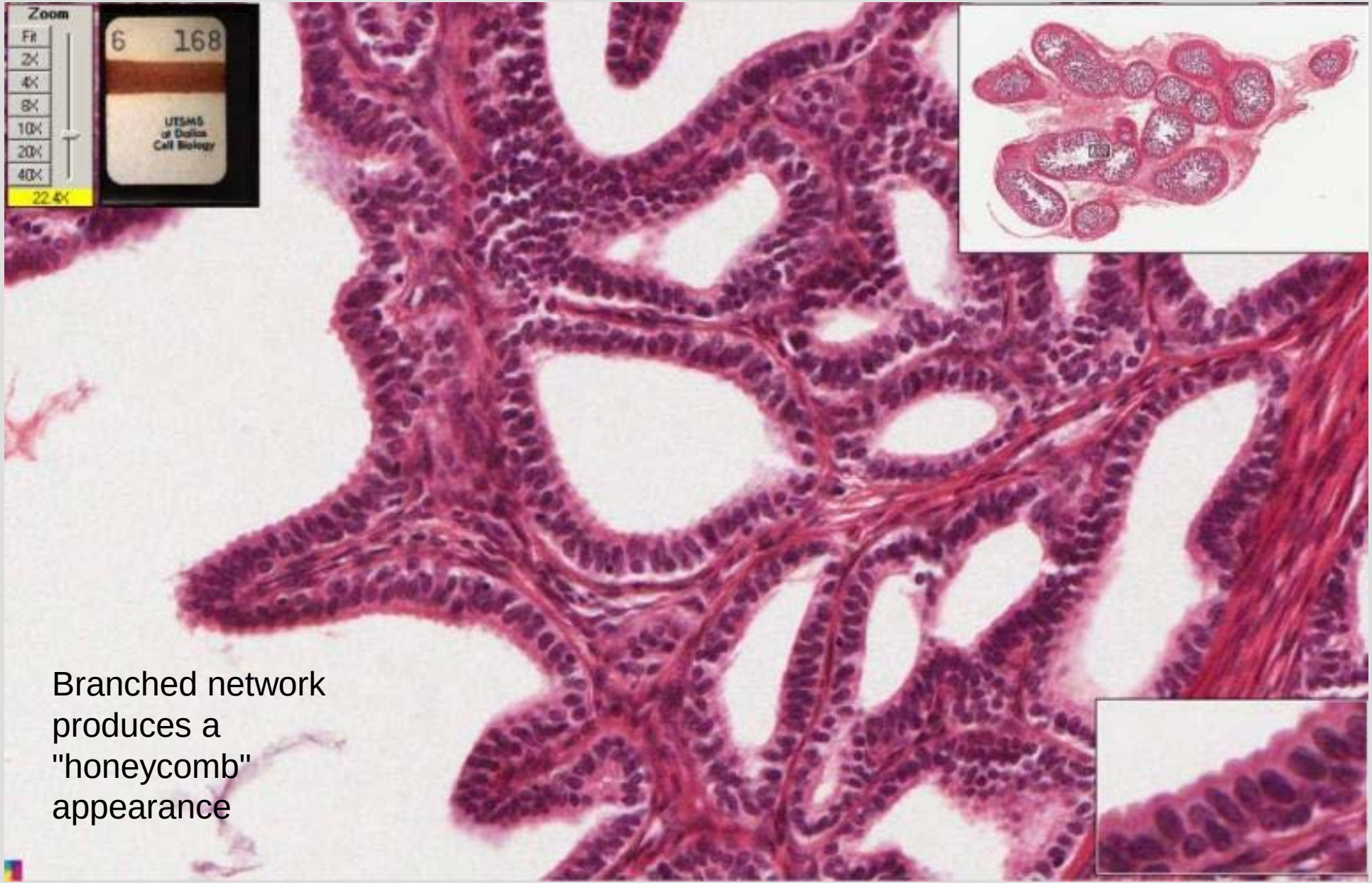


Fig. 17-8 Ampulla of the Ductus Deferens (transverse section). Stain: hematoxylin-eosin. Low magnification.

Fig. 17-11 Seminal Vesicle. Stain: hematoxylin-eosin. Low magnification.

168

Seminal vesicle, monkey



Branched network produces a "honeycomb" appearance

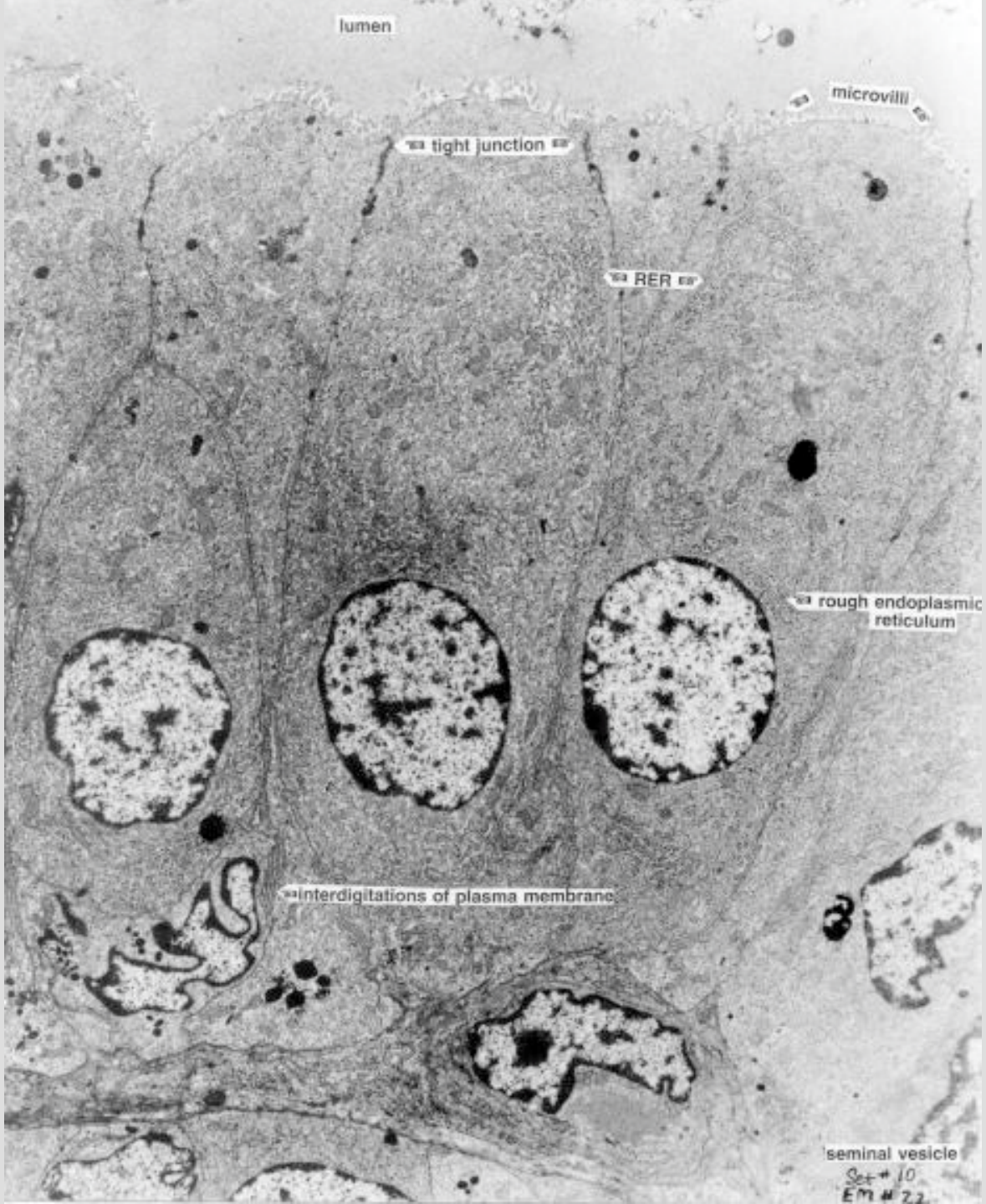

lumen
microvilli
tight junction
RER
rough endoplasmic reticulum
interdigitations of plasma membrane
seminal vesicle
Set # 10
EM # 23

Fig. 17-9 Prostate Gland With Prostatic Urethra. Stain: hematoxylin-eosin. Low magnification.

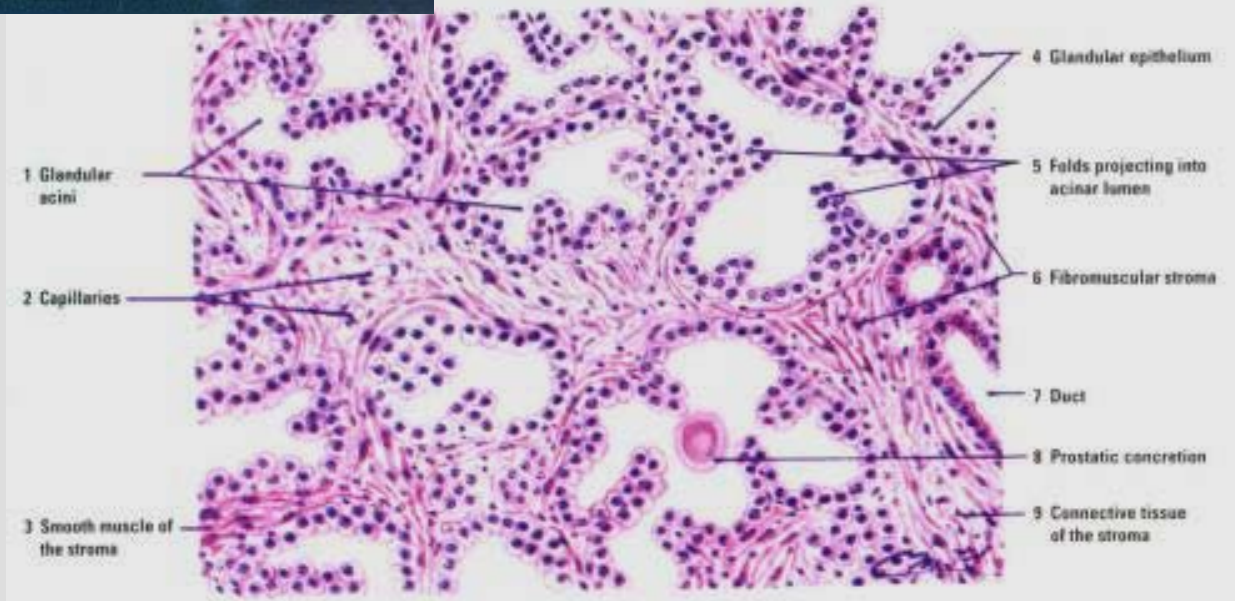
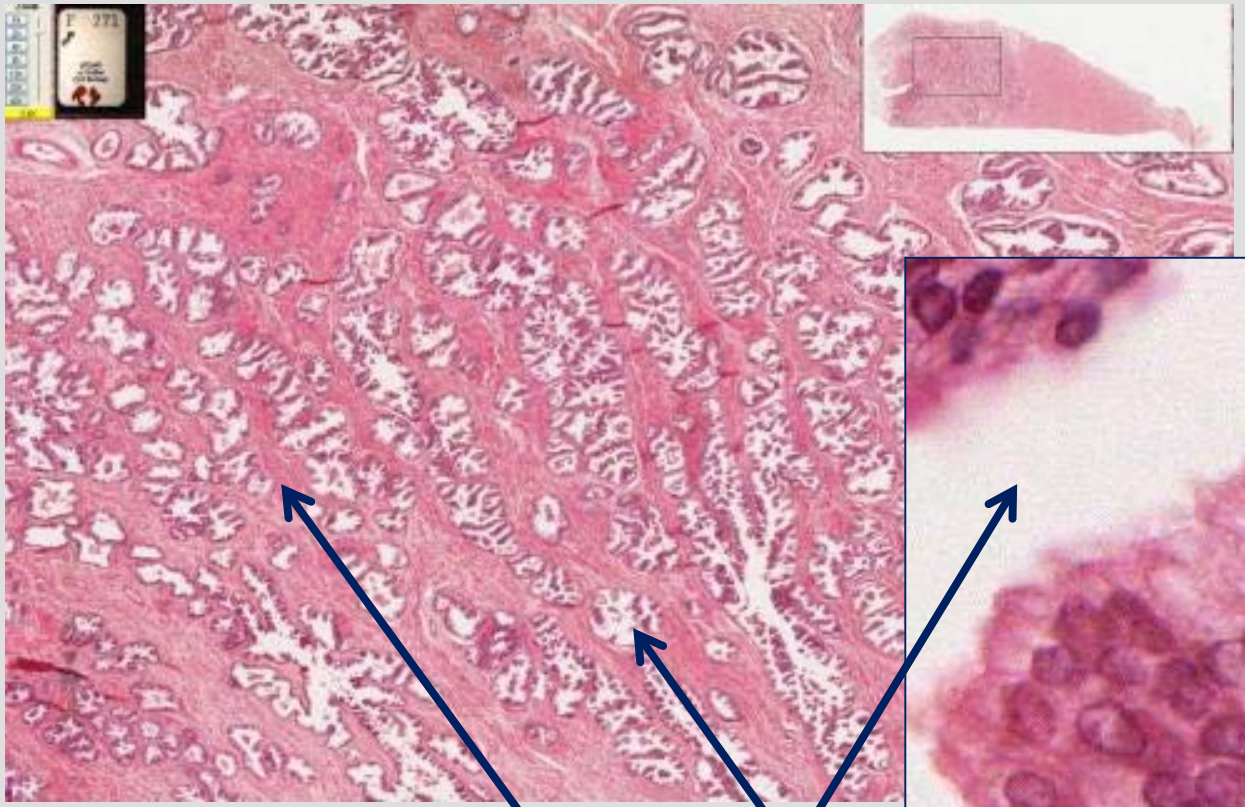


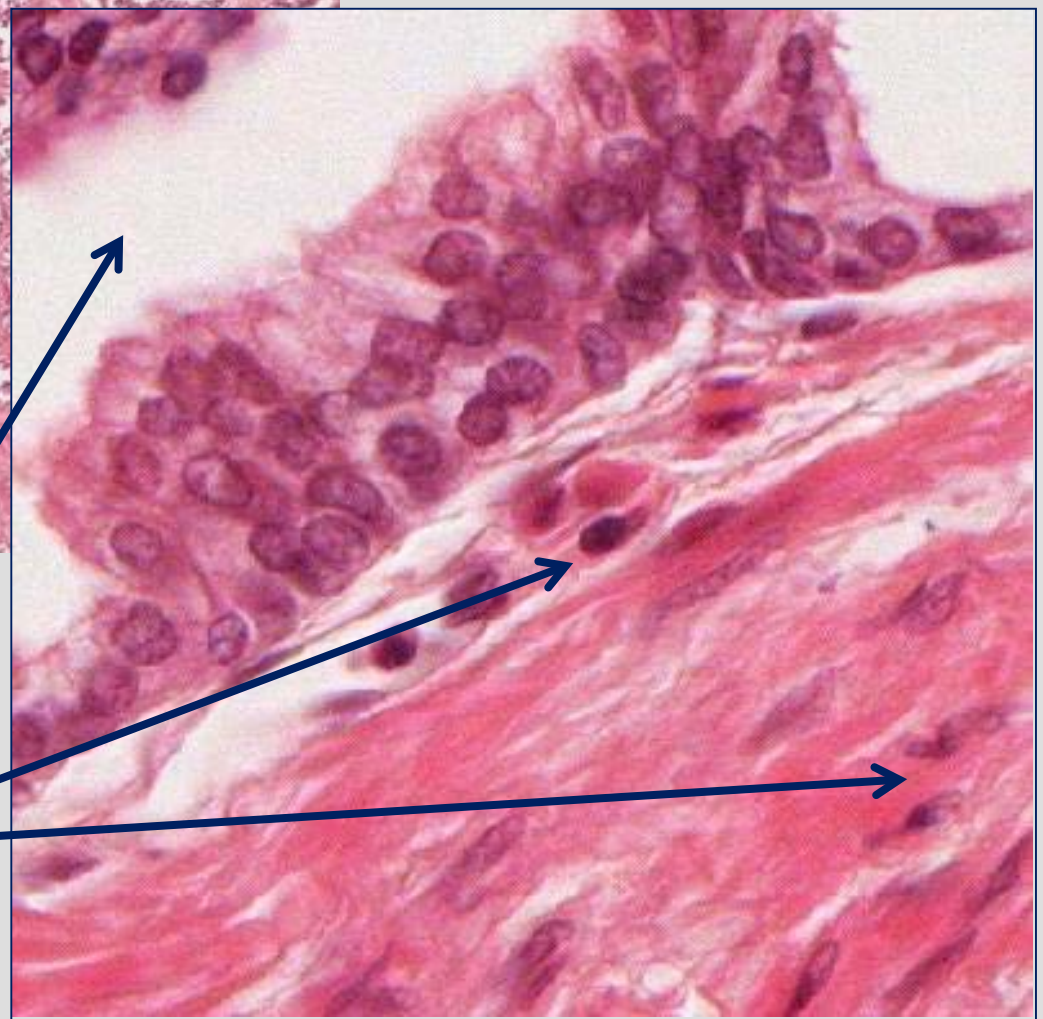
Fig. 17-10 Prostate Gland (sectional view, prostatic glands). Stain: hematoxylin-eosin. Medium magnification.

271

Prostate

Prostate is a firm mass of collagenous connective tissue and smooth muscle that is invaded by numerous glandular outpocketings of the urethra



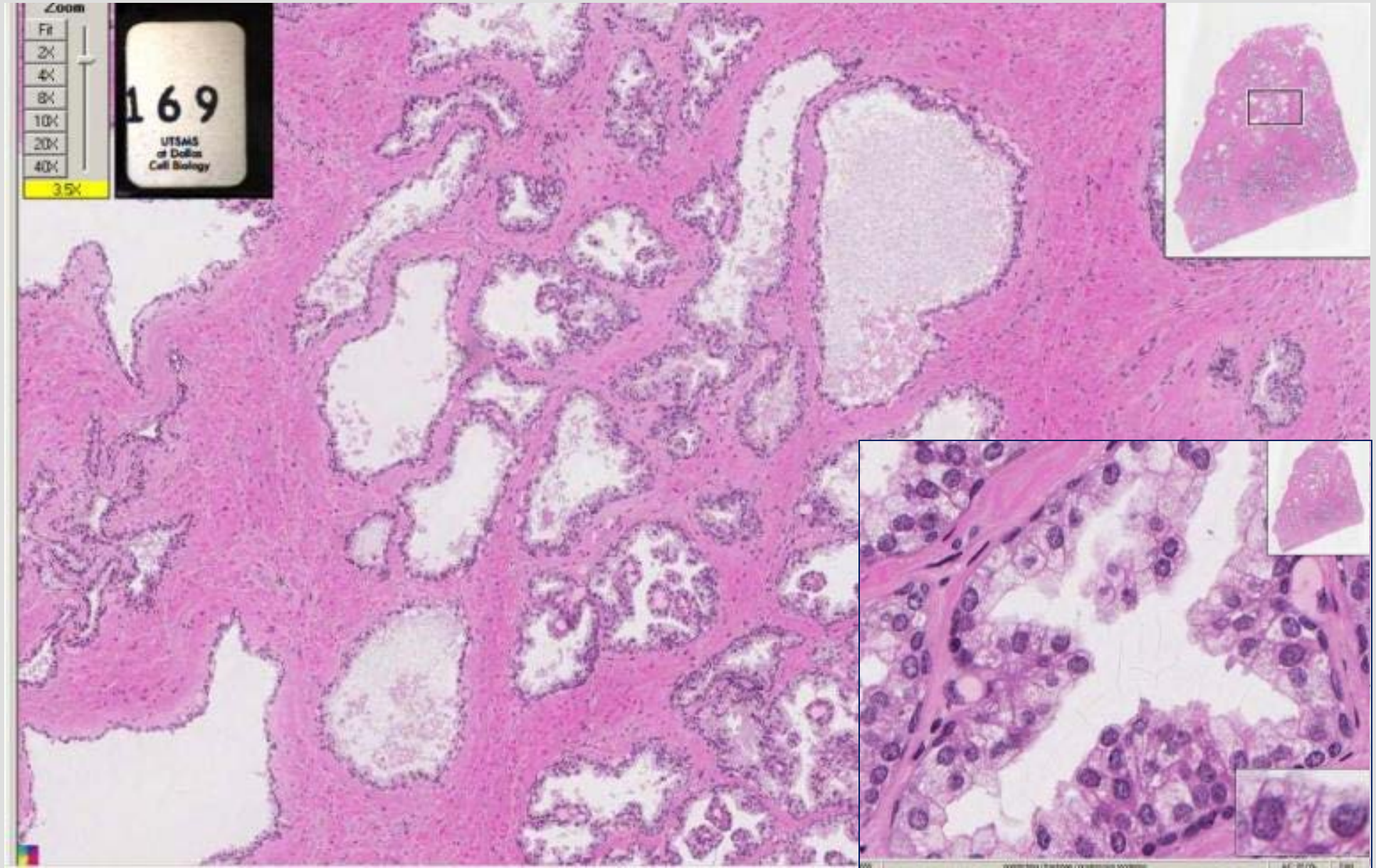


Lumen of gland

Note the abundance of smooth muscle in its interstitium.

169

Prostate



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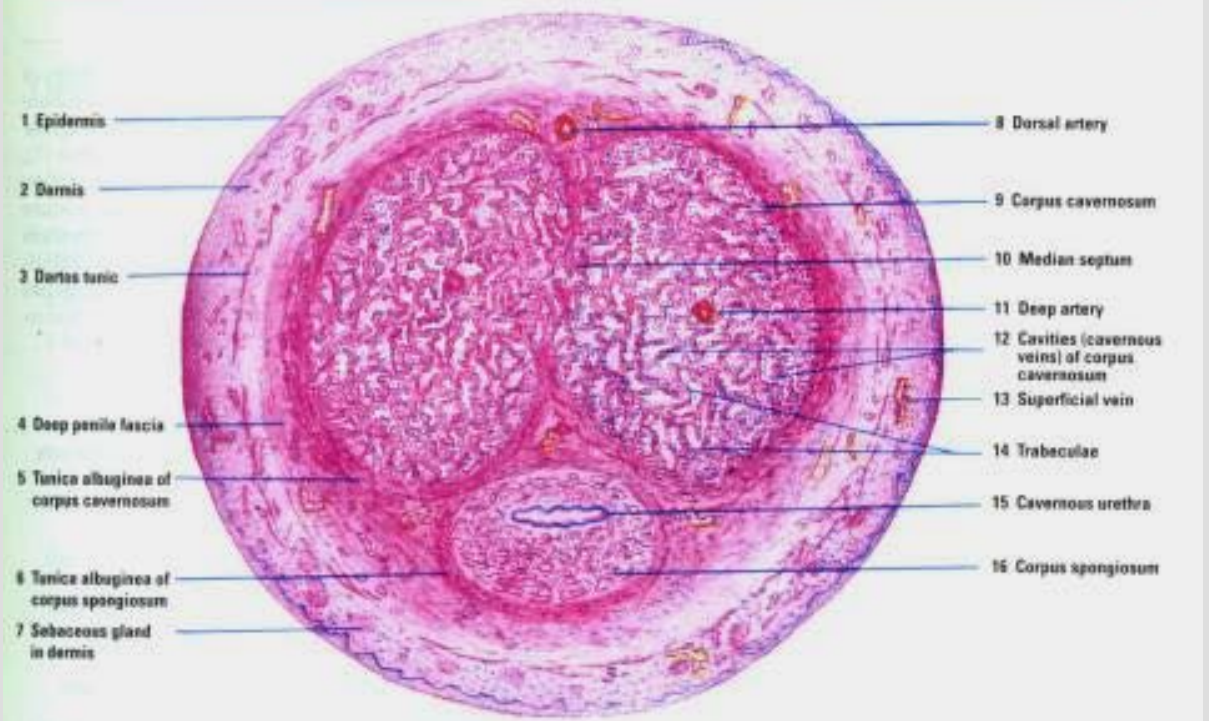
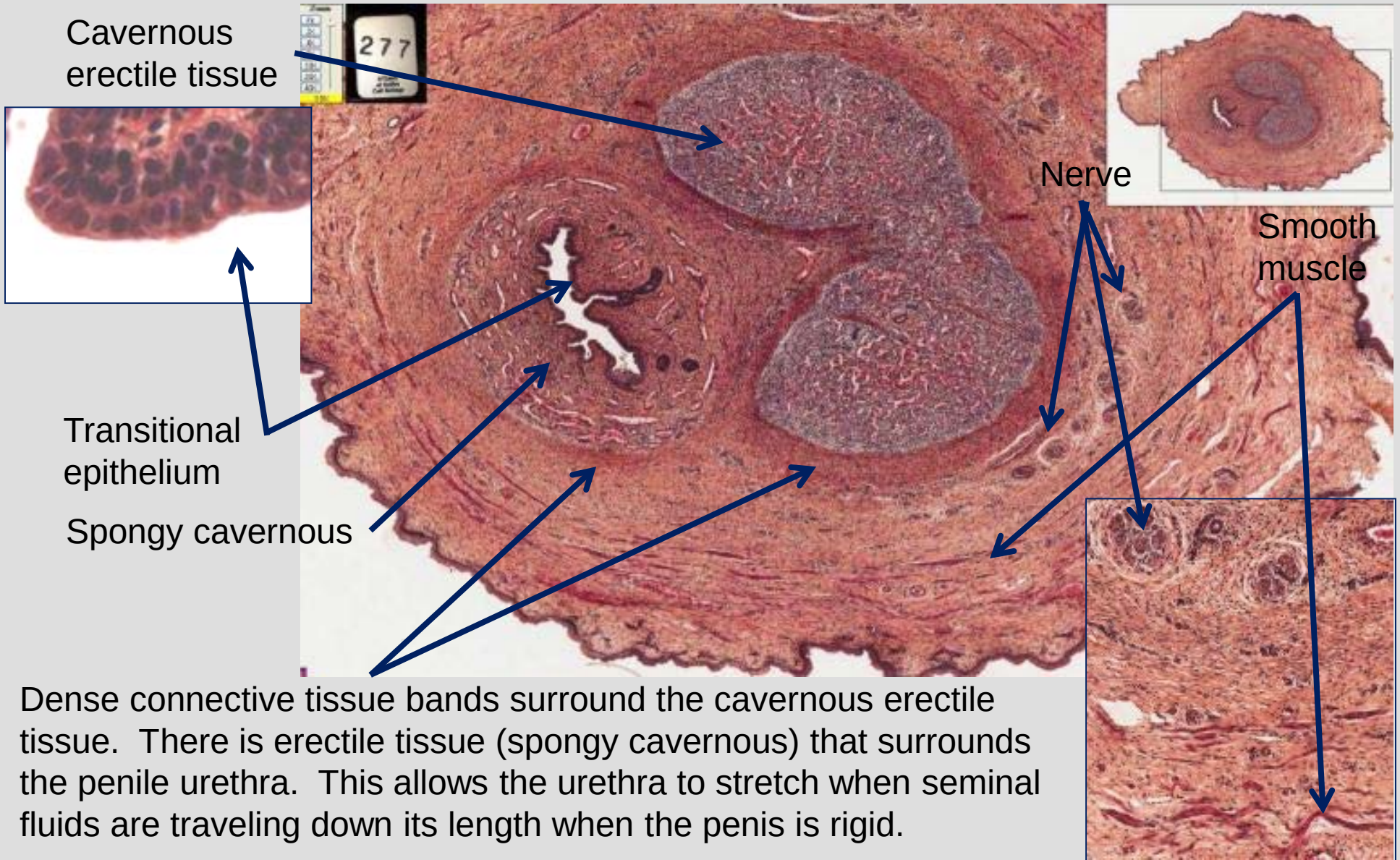


Fig. 17-13 Penis (transverse section). Stain: hematoxylin-eosin. Low magnification.

Fig. 17-14 Cavernous Urethra (transverse section). Stain: hematoxylin-eosin. Low magnification.

277 Penis – transitional epithelium and surrounding spongy cavernous of penal urethra

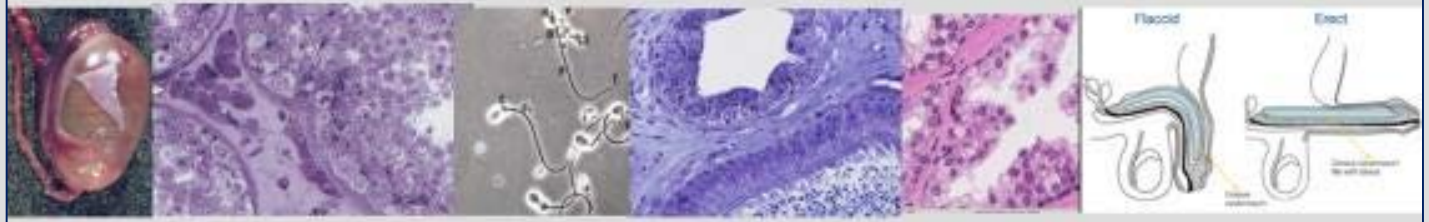


Dense connective tissue bands surround the cavernous erectile tissue. There is erectile tissue (spongy cavernous) that surrounds the penile urethra. This allows the urethra to stretch when seminal fluids are traveling down its length when the penis is rigid.

In summary

Function of Male Reproductive System

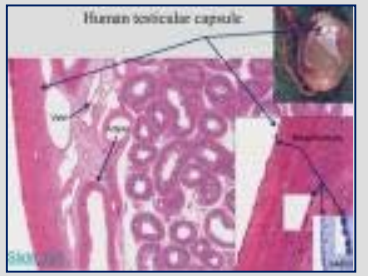
The testis produces both spermatozoa, an exocrine secretion, and testosterone, an endocrine secretion.

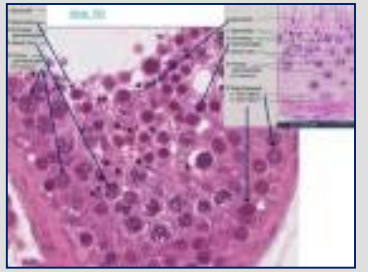


The function of the male reproductive system are to:

- produce, maintain, and transport spermatozoa (the male gametes) and protective fluid (semen) and
- discharge the spermatozoa-containing semen within the female reproductive tract during mating.

Produce and deliver male gametes





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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. 3nd 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.
4. Elias, H. et al., 1978. Histology and Human Microanatomy. A Wiley Medical Publication. John Wiley & Sons, New York. ISBN 0-471-04929-8.
5. Eroschenko, V. 2000. Di Fiore's Atlas of Histology with Functional Correlations. 9th Edition. Lippincott Williams & Wilkins. Philadelphia. ISBN 0- 7817-2676-X.
6. Fawcett, D.W., 1986. Bloom and Fawcett. A Textbook of Histology. 11th Edition. W.B. Saunders Company. Philadelphia. ISBN 0-7216-1729-8.
7. Fawcett, D.W., 1986. Bloom and Fawcett. A Textbook of Histology. 12th Edition. Chapman and Hall. New York. ISBN 0-412-04691-1.
8. Guyton, A.C. 1971. Textbook of Medical Physiology. 4th Edition. W.B. Saunders Company. Philadelphia. Library of Congress # 74-118589.
9. Ham, A.W. 1974. Histology. 7th Edition. J.B. Lippincott Company. Philadelphia. ISBN 0-397-52062-X.
10. Ham, A.W. and Cormack, D.H. 1979. Histology. 8th Edition. J.B. Lippincott Co. Philadelphia. ISBN 0-397-52089-1.
11. Junqueria, et al., 1995. Basic Histology. 8th Edition. Appleton and Lange. Norwalk, Connecticut. ISBN 08385-0567-8.
12. Junqueira, et al., 1998. Basic Histology. 9th Edition. Appleton and Lange. Stamford, Connecticut. ISBN 0-8385-0590-2.
13. Knobil, E. et al. 1988. The Physiology of Reproduction. Volume 1. Raven Press. New York. ISBN 0-88167-281-5.
14. Langley, et al., 1974. Dynamic Anatomy and Physiology. 4th Edition. McGraw-Hill Book Company. New York. ISBN 0-07-036274-2.
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.
17. Varner, D. et al. 1991. Diseases and Management of Breeding Stallions. American Veterinary Publications. Goleta, California. ISBN 0-939674-33-5.
18. Von Hagens, Gunther and A.Whalley, 2007. Body Worlds – The Anatomical Exhibition of Real Human Bodies. ISBN 978-3-937256-04-7
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 Male Reproductive System

1.The blood - testis barrier
   a. is created by Sertoli cell - Sertoli cell desmosomal junctions
   b. has no counterpart in oogenesis
   c. prevents the movement of preleptotene primary spermatocytes from the basal to the adluminal compartments of the seminiferous epithelium
   d. a and b
   e. a, b, and c

2. Which organ - mechanism of spermatozoan transport does not match?
   a. seminiferous tubules - bulk flow
   b. rete testis - bulk flow, limited ciliary action
   c. efferent ducts - bulk flow, ciliary action
   d. epididymis - stereociliary action
   e. all organs mechanisms match

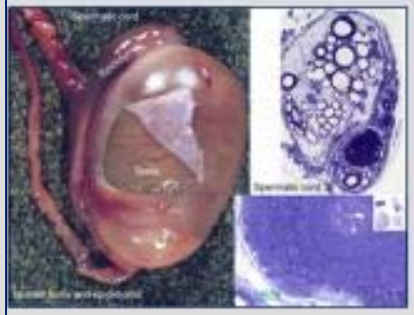
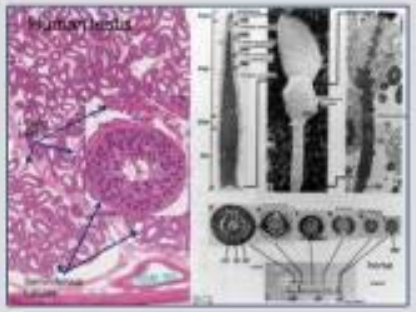
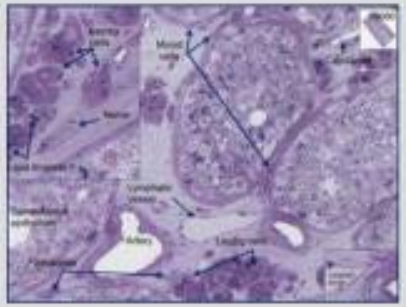
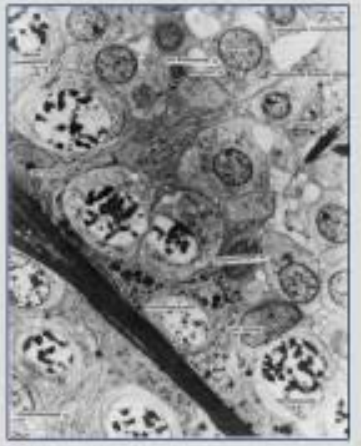
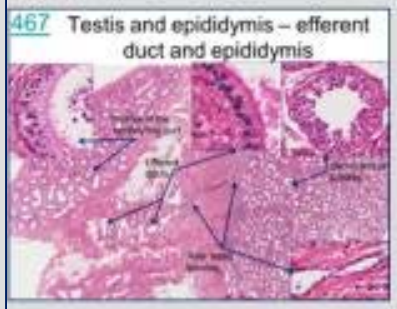
3. Meiosis occurs only during:
   a. spermatogenesis
   b. oogenesis
   c. asexual reproduction
   d. a and b
   e. a, b, and c

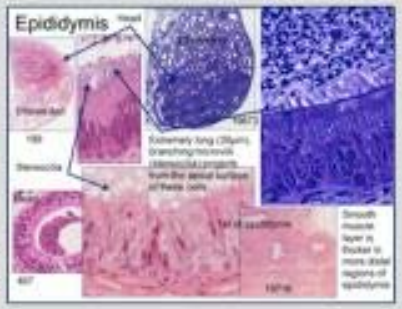

Stockholms
Medeltidsmuseum

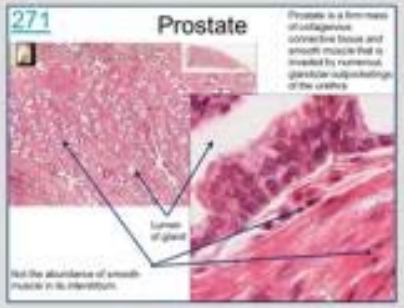
The end of

Medical School Histology Basics
Male Reproductive System

VIBS 289 lab





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