Male Reproductive Histology

Plate 14.276 Prostate Gland

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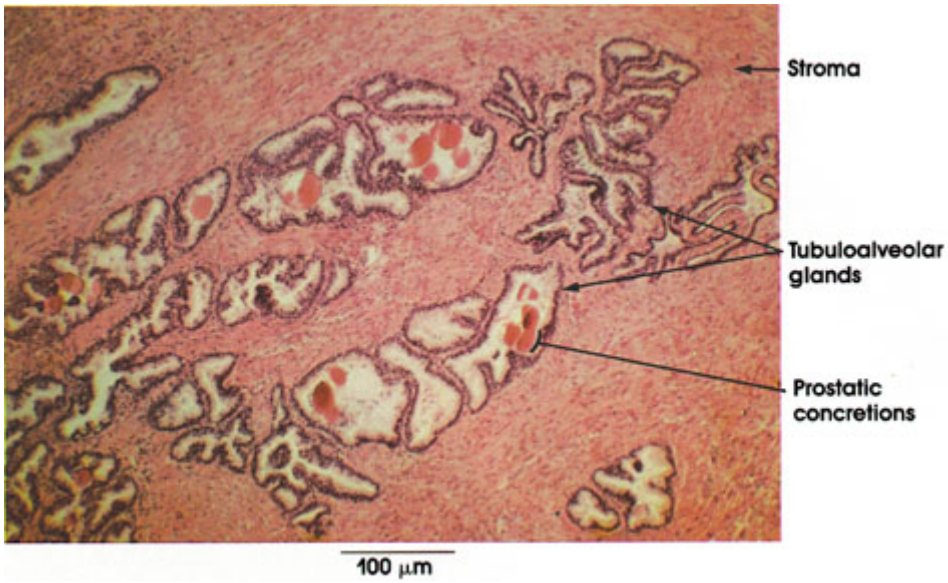
PROSTATE GLAND



Human, 10% formalln, H. & E., 162 x.

Stroma: Abundant and continuous with the gland capsule, it constitutes one third to one fourth of the gland volume and is composed of fibroelastic connective tissue intermixed with smooth muscle fibers. Glands are embedded in the stroma.

Tubuloalveolar glands: Irregular, large lumen, widely spaced tubules with alveolar extensions, which vary greatly in shape and size. Epithelial lining in tissue sections is simple cuboidal to columnar in shape, depending upon physiological state.

Prostatic concretions: Corpora amylacea, acidophilic condensed secretions of prostatic glands. They may be lamellated and increase in number with advancing age. Source of prostatic calculi.

The prostate is located at the origin of the urethra (which it surrounds), adjacent to the urinary bladder. The prostate secretes a thin, opalescent, slightly acid fluid, which contains several enzymes, including diastase and proteases, and citric acid. The smaller prostatic concretions are found in the prostatic fluid.

Plate 14.277 Penis

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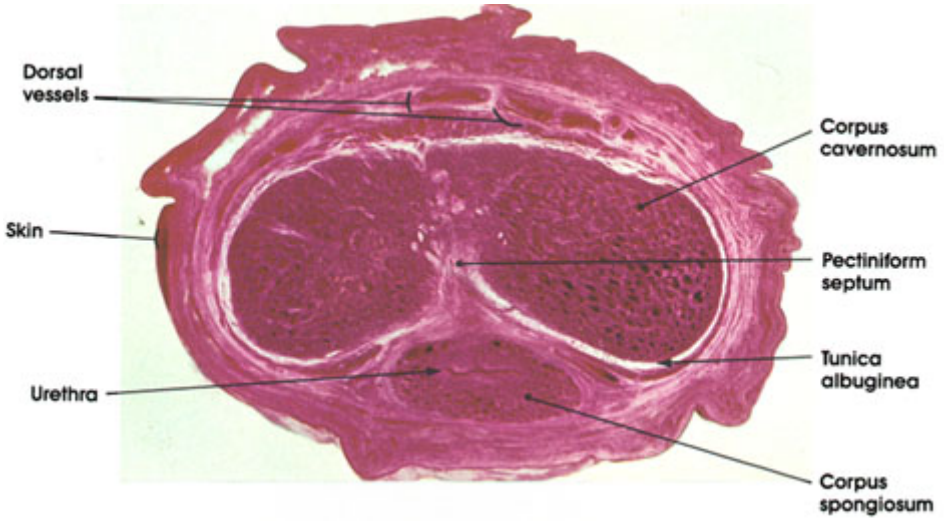
PENIS
Cross section



Human, 10% formalin, carmine stain, 2 x.

The penis is formed primarily of three cylindrical masses of erectile tissue. Note the paired corpora cavernosa and the ventrally placed corpus spongiosum (corpus spongiosum urethrae) containing the urethra. A dense collagenous tissue capsule, the tunica albuginea, surrounds the corpora cavernosa. This capsule fuses in the midline to form the pectinate septum, which is thickest and most complete near the root of the penis. The tunica albuginea of the corpus spongiosum is thin. Each corpus consists of a network of cavernous vascular sinuses lined with endothelium, separated by fibromuscular trabeculae composed of connective tissue and smooth muscle fibers.

The three corpora are encompassed by a common, loose connective tissue fascia rich in elastic fibers and a thin skin. Note the dorsal vessels (arteries and veins) of the penis, located in the fascia, which are part of the complicated blood supply of this organ.

Plate 14.271 Epididymis

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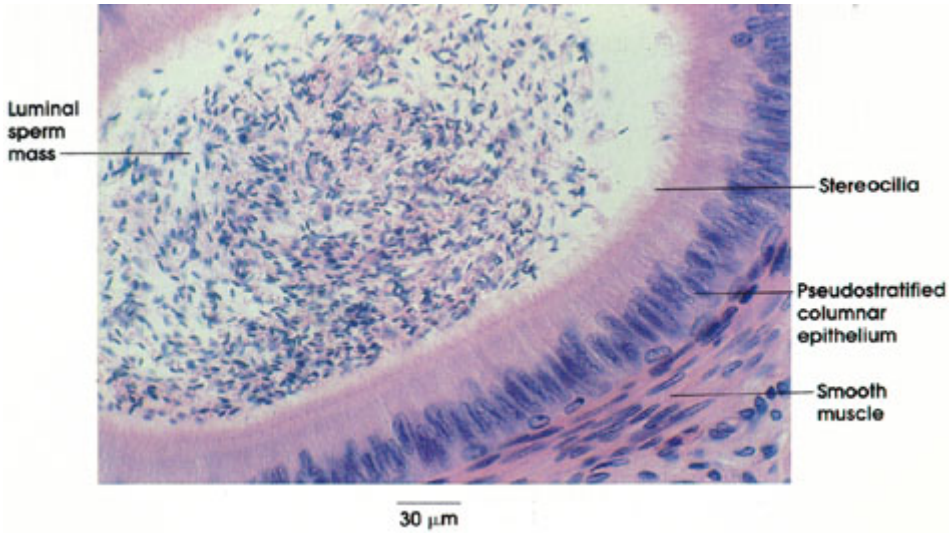
EPIDIDYMIS



Human, 10% formalin, H. & E., 345 x.

In this higher power view of the epididymis from Plate 270, the tall pseudostratified columnar epithelium is demonstrated to advantage. The luminal cells bear remarkable numbers of highly developed stereocilia on their apical surfaces. The lumen of the duct contains a packed mass of spermatozoa. Sperm gain motility and fertilizing capacity during their passage through the epididymis.

Plate 14.278 Penis

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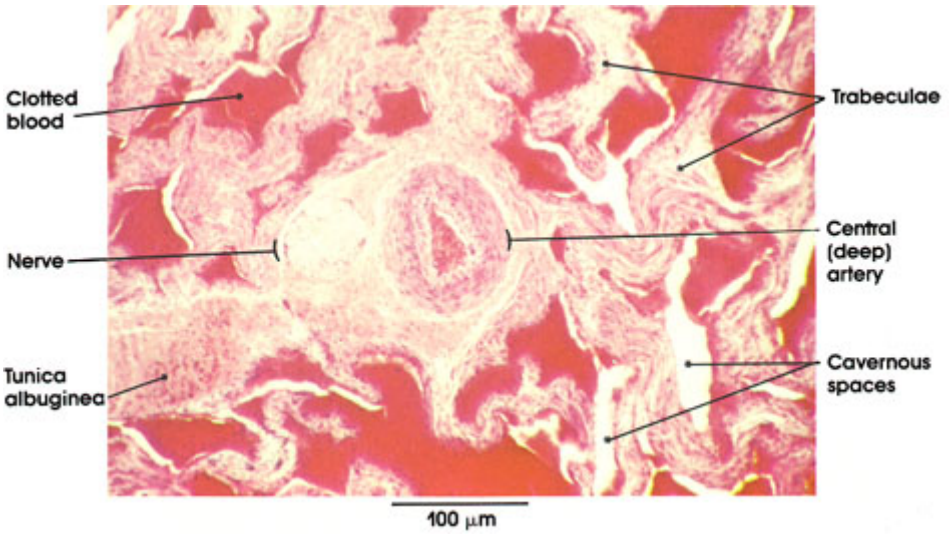
PENIS
Corpus cavernosum



Human, 10% formalin, H. & E., 162 x.

The erectile tissue of the corpus cavernosum of the penis is composed of cavernous spaces separated by fibromuscular septa or trabeculae. The latter are extensions of the tunica albuginea, the fibrous coat that surrounds the corpus. The cavernous spaces are filled with blood, and the engorgement of these spaces results in the erection of the penis. Note the central (deep) artery, which traverses the corpus cavernosum. This artery gives rise to the spiraling helicine arterioles that open into the sinuses. The central artery is the principal vessel for filling the sinuses during erection.

Adjacent to the central artery, note the nerve cut in cross section. The penis is richly supplied with spinal, sympathetic, and parasympathetic fibers. The autonomic fibers innervate the smooth muscle in the arterial wall and trabeculae.

Plate 14.270 Epididymis

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EPIDIDYMIS

Human, 10% formalin, H. & E., 54 x.

The epididymis, a highly coiled duct approximately 6 m in length in man, is firmly adherent to the gonad. in histological preparations, therefore, it is not unusual to observe sections of both testis and epididymis. The duct is divided anatomically into three major portions (head, body, and tail) and by histological criteria, several further subdivisions may be recognized. Because of the tight coiling of the duct, histological sections invariably reveal many tubular profiles in different planes of section.

The portion of the epididymis shown here is from the distal portion of the head, in which the epithelial lining of the duct is a tall pseudostratified columnar epithelium, lacking goblet cells. The tall columnar cells bear

prominent (non-motile) stereocilia on their apical surfaces, facilitating the resorption of testicular tubular fluid in which the spermatozoa are transported to the organ. A thin coat of smooth muscle surrounds the duct and is readily differentiated from the loose connective tissue surrounding the coils of the duct. A packed mass of non-motile sperm is seen within the lumen of the epididymis. In this preparation, striated muscle fibers belonging to the cremaster muscle are seen investing the organ. This muscle of the spermatic cord enables the gonad to be retracted within the scrotum toward the, abdomen.

Plate 14.268 Interstitial Cells

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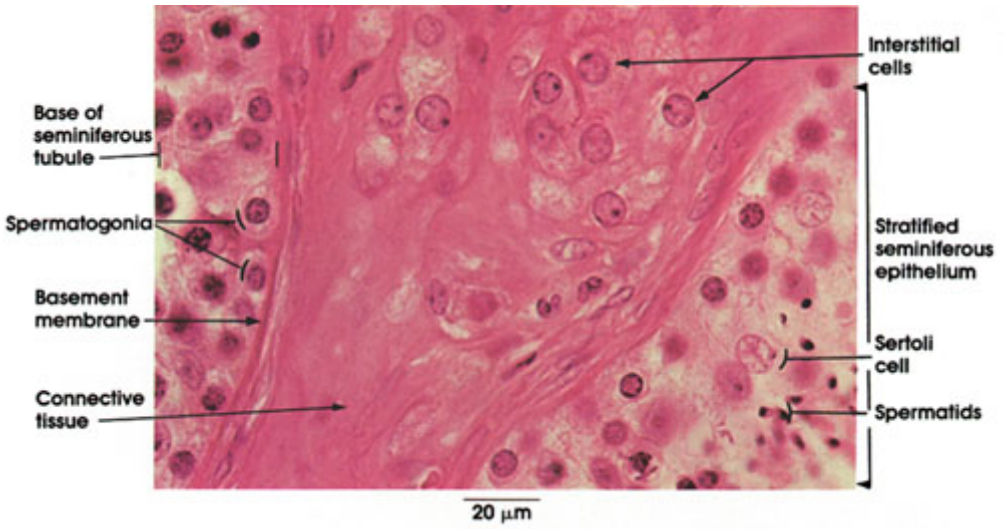
INTERSTITIAL CELLS
Testis



Human, 10% formalin, H. & E., 612 x.

This figure shows parts of two seminiferous tubules separated by a connective tissue sheath. Within this connective tissue sheath are embedded large ovoid cells, the interstitial cells of Leydig. These occur in groups, have a rounded, large eccentric nucleus with a prominent nucleolus and a vacuolated cytoplasm, which results from the loss of lipid droplets and crystals during tissue processing. The interstitial cells are the source of testosterone, the male sex hormone, whose functions include the development and maintenance of secondary sex characteristics and the structure and function of the male accessory organs, the development of psychosexual behavior (in part) in the mature male, a role in protein metabolism, and the regulation of the output of the pituitary gonadotropic hormone, interstitial cell-stimulating hormone (ICSH). The seminiferous tubules shown reveal part of their contents, spermatogonia, spermatids, and Sertoli cells

Plate 14.272 Vas Deferens

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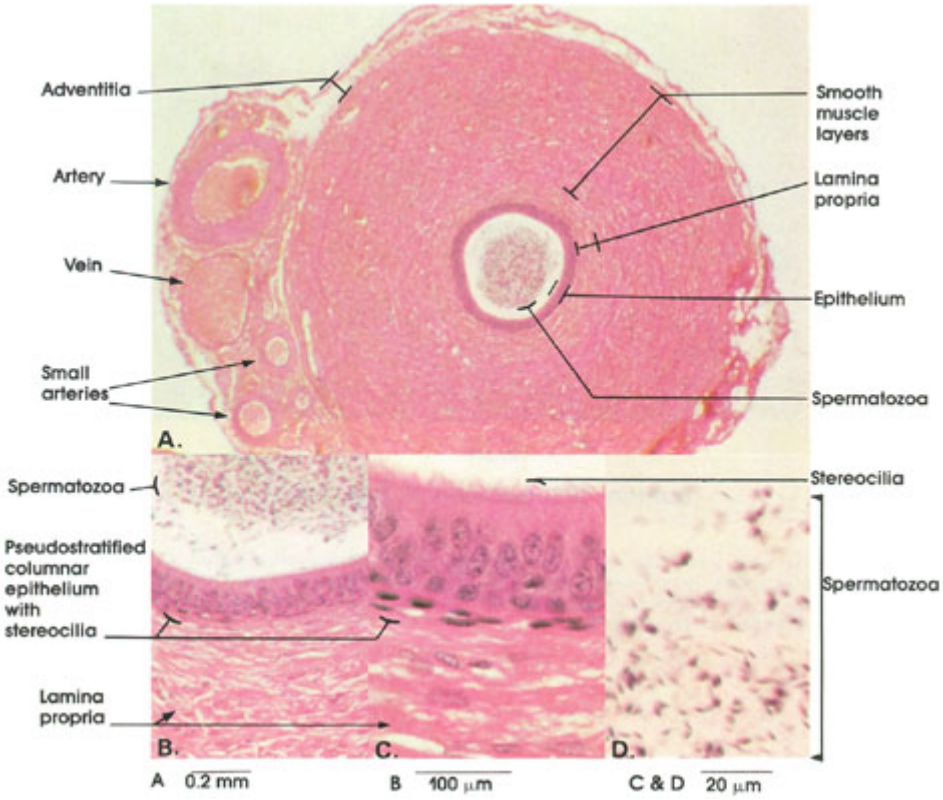
VAS DEFERENS
Cross section



Dog, 10% formalin, H. & E.,
A. 50 x., B. 162 x., C. & D. 612 x.

The ductus deferens (A) is the most prominent component of the spermatidicord and is readily palpated through the scrotal skin. Within the cord, the vas lies in company with a plexus of veins, the pampiniform plexus (so-named for the resemblance of the tortuous veins to tendrils of a vine), branches of the spermatic artery and nerves of the spermatic plexus, and the cremaster muscle.

The mucosa of the vas deferens consists of a prominent pseudostratified columnar epithelium bearing conspicuous stereocilia (B and C and is underlaid by a lamina propria, which abuts the robust muscular components of the organ without a defined submucosal layer. The musculature of the organ is organized into sparse inner longitudinal, prominent middle circular, and well-defined outer longitudinal layers. The vas is surrounded by an adventitia throughout its length. The organ's overall topography, together with the tendency of its mucosa to be thrown into deep folds upon fixation, causes this organ to be readily mistaken for other muscular ducts of the body (i.e., ureter

and oviduct). Careful examination of the lining epithelium will confirm identification of each; in addition, the vas may exhibit a packed mass of luminal sperm (D). At the time of ejaculation, the vas rhythmically contracts, conveying spermatozoa stored within the terminal portion of the epididymis and along the length of the vas itself to the ejaculatory ducts. Electron-microscopic studies of the vas have confirmed that its fine structure differs significantly along its length and that the description of the vas as a passive conduit for sperm is inadequate. The scrotal ductus deferens (frequently referred to clinically as the vas) is the common site of ligation or excision of a portion of the organ in the surgical procedure of vasectomy.

Plate 14.273 Seminal Vesicle

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SEMINAL VESICLE

Monkey, 10% formalin, H. & E., 21 x.

The seminal vesicles arise as tortuous diverticula of the vas deferens and therefore present histologically as multiple sections through a tubular structure. The wall consists of adventitia, muscularis, and elaborate mucosa, thrown into several orders of branching folds. The folds, like villi of the intestinal tract, are underlaid by a tunica propria of loose connective tissue. Secretions produced by the epithelial cells are delivered to a central luminal channel*, the extent of which is largely obscured by the tortuosity of the tube. Lobulation of the organ by septa from the adventitia is incomplete and inconspicuous. See Plate 275 for higher power detail of the mucosa.

Plate 14.274 Seminal Vesicle

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SEMINAL VESICLE

Human, 10% formalin, H. & E., 162 x.

The seminal vesicle is a diverticulum of the adjacent ductus deferens with a remarkably folded mucosal lining of pseudostratified cuboidal or columnar epithelium projecting into the lumen. The lumen frequently contains acidophilic rounded secretion masses. Underlying the epithelial lining is a thin supporting sheath of connective tissue, the lamina propria, which extends into the mucosal folds. Beneath the lamina propria is a coat of smooth muscle fibers consisting of an inner circular layer and an outer longitudinal layer.

Plate 14.275 Seminal Vesicle

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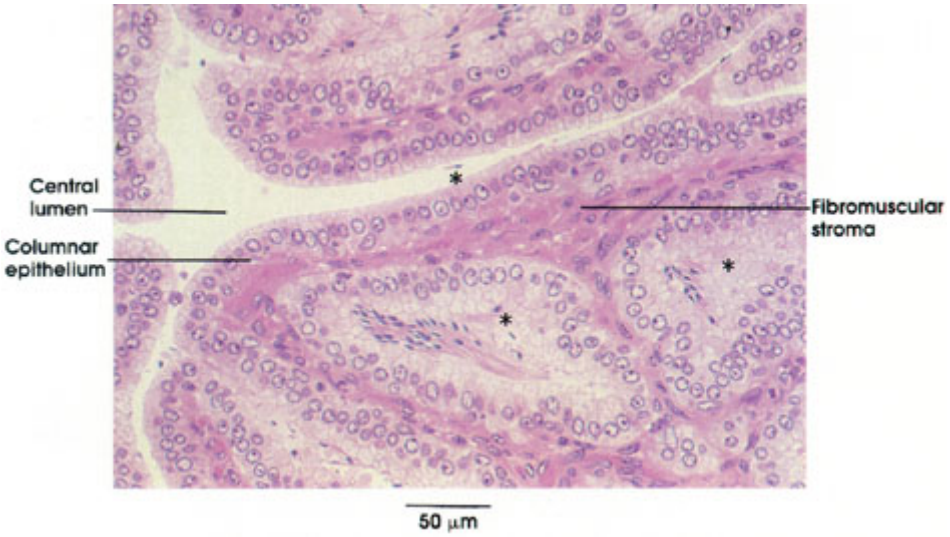
SEMINAL VESICLE



Monkey, 10% formalin, H. & E., 269 x.

The complex ramifications of the mucosa are shown; the folds are lined by a columnar to pseudostratified columnar epithelium. Epithelial development is androgen-dependent. The height of the epithelium in this specimen suggests ample hormonal stimulation and active secretion. Post-mortem migration of spermatozoa (asterisks) into the recesses and pockets formed within the mucosal lining gave rise to the earlier erroneous interpretation that the seminal vesicle serves as a reservoir or storage depot for sperm. The gland is in fact a major secretory accessory sex gland, the secretions of which, in man, contribute the majority of the seminal volume.

Plate 14.265 Seminiferous Tubule

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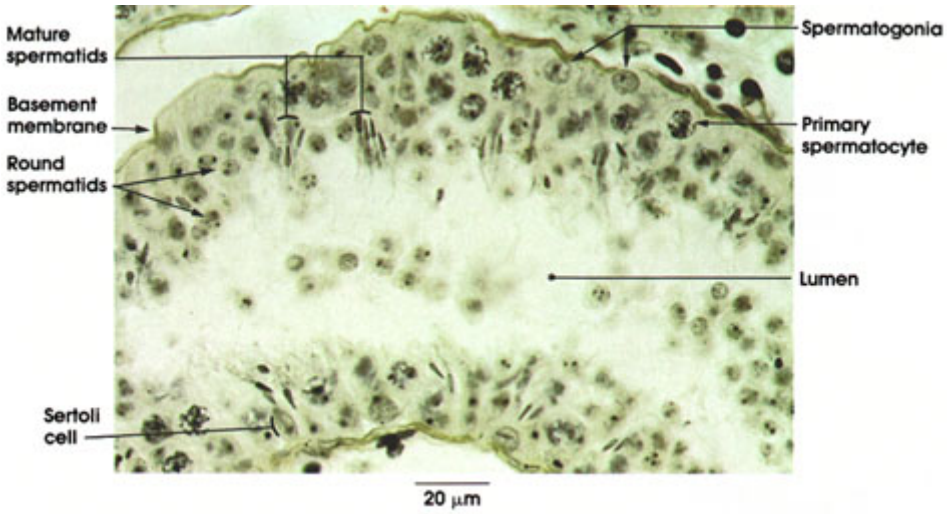
Peer Review Status: Externally Peer Reviewed

SEMINIFEROUS TUBULE



Rhesus monkey, Helly's fluid, iron hematoxylin and orange G stains, 612 x.

In the seminiferous tubule, spermatogenic cells are arranged in orderly layers between the basement membrane and the lumen.

Spermatogonia: Located directly above the basement membrane. Spherical nucleus. Spermatogonia are the germ cells from which spermatozoa ultimately arise. They are the only sex cells present before onset of puberty. They contain 23 pairs of chromosomes.

Primary spermatocytes: Lie in the next layer, deep to the spermatogonia. Largest germ cells. Nuclei are large and vesicular with condensed chromatin. Chromatin may appear as elongated spiremes, i.e., irregularly disposed chromatin filaments. Primary spermatocytes divide by meiosis. Meiosis is nuclear division in which the diploid chromosome number (23 pairs) is halved to the haploid number (23 single set) in the formation of sex cells.

Round spermatids: Adjacent to the lumen. Small in size. Spermatids constitute the last stage in the transformation to spermatozoa.

Mature spermatids: Heads are located near Sertoli cells, and tails project into the lumen. Heads are transformed nuclei of round spermatids. Will be released into lumen as spermatozoa.

Sertoli cells: Supporting cells of the testicular epithelium, which were first described by the Italian physiologist Enrico Sertoli in 1865. Tall columnar cells extend from the basement membrane to the lumen. Nucleus ovoid in shape with prominent nucleolus. Cell borders are difficult to outline in this preparation.

The process of spermatogenesis from spermatogonia to mature spermatozoa requires about 64 days in man.

Plate 14.266 Testis

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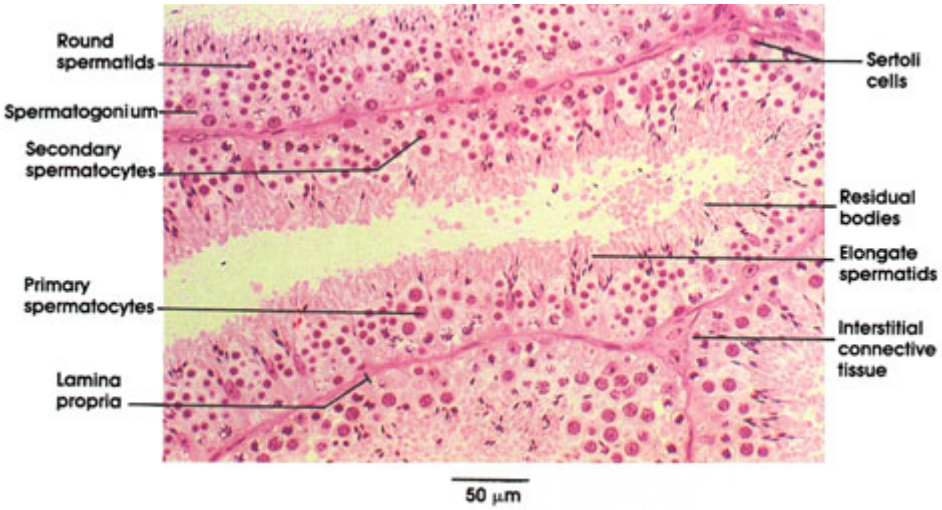
TESTIS
Seminiferous epithelium



Monkey, glutaraldehyde, 1.5 μm plastic section, H. & E., 216 x.

Plastic-embedded, 1.5 μm, sections reveal to particular advantage the cell types constituting the seminiferous epithelium. The longitudinal section of a tubule in the center of the field contains many such representative cell types. Note the spermatogonia on the basement membrane. The largest of the germ cells, the primary spermatocytes with their characteristic meiotic prophase nuclei, occupy the region of the epithelium just apical to the basal layer of spermatogonia. The infrequently seen secondary spermatocytes are intermediate in size and placement within the epithelium between primary spermatocytes and spermatids.

Most apically situated within the epithelium are the spermatids, which possess either the smallest round nuclei of any cell of the epithelium or elongate, condensed nuclei, depending upon their stage of maturation toward mature spermatozoa.

The eosinophilic cytoplasmic remnants resulting from the differentiation of round spermatids to elongate spermatids are seen at the luminal surface and are termed residual bodies. Sustentacular cells, the Sertoli cells, phagocytize much of this residual cytoplasm. The nuclei of Sertoli cells are identified by their distinctive urn shape and prominent nucleolus. Note also how clusters of spermatids develop synchronously, enveloped within the apical extensions of Sertoli cell cytoplasm.

Adjacent seminiferous tubules share a common lamina propria; an area of interstitial connective tissue is shown where three adjacent tubules meet. Leydig cells are commonly found in such areas but are not present in this particular section.

Plate 14.269 Testis

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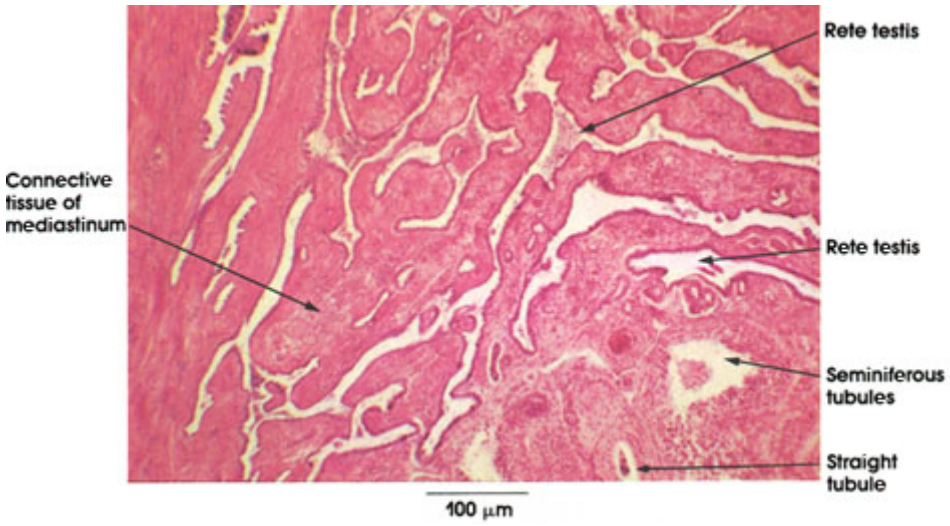
Peer Review Status: Externally Peer Reviewed

TESTIS
Straight tubules and rete testis



Human, 10% formalin, H. & E., 50 x.

The seminiferous tubules of the testis (tubuli contorti) open into the straight tubules (tubuli recti). The latter are short, straight tubules lined with a single layer of tall columnar Sertoli cells. The straight tubules empty into a system of irregular, anastomosing epithelium-lined cavernous spaces, the rete testis, located in the dense connective tissue of the mediastinum.

Plate 14.262 Testis

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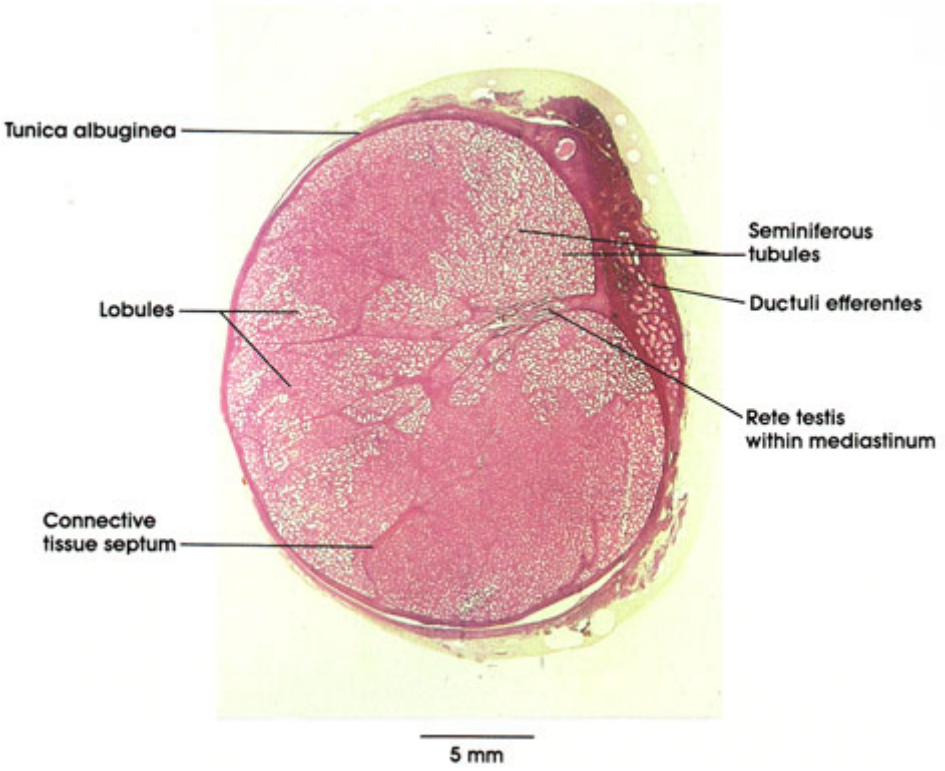
TESTIS



Human, 10% formalin, H. & E., 3.4 x.

The integrity of the delicate, tubular parenchyma of the male gonad is maintained by the robust connective tissue capsule of white fibrous connective tissue, the tunica albuginea, and the septa, which project interiorly, dividing the organ into lobules. The lobules contain the seminiferous tubules, lined with the specialized seminiferous epithelium, which gives rise to the male gametes, the spermatozoa. In addition, a posterior connective tissue mass (the mediastinum) projects to the interior of the organ and provides an avenue for the egress of fluid and spermatozoa from the seminiferous tubules. Irregular, epithelium-lined, anastomosing channels form a network, the rete, within the mediastinum. From these channels, the ductuli efferentes arise, pierce the tunica albuginea, and subsequently form, in man, the first portion of the epididymis.

Neither the seminiferous tubules nor the intratesticular duct system have significant muscular coats, or motile cilia by which to move the tubular contents. This underscores the role of fluid flux in moving the spermatozoa through the initial portion of the excurrent duct system. The ductuli efferentes are the sole portion of the male duct system that bears motile cilia on the lining epithelial cells.

The testis is invested on its anterior and lateral aspects by a serous envelope, the tunica vaginalis, which is a peritoneal vestige carried with the testis in its descent to the scrotum. The testis is cushioned by and glides within this serous envelope, relieving compression, to which the organ is exquisitely sensitive.

Plate 14.263 Testis: Periphery

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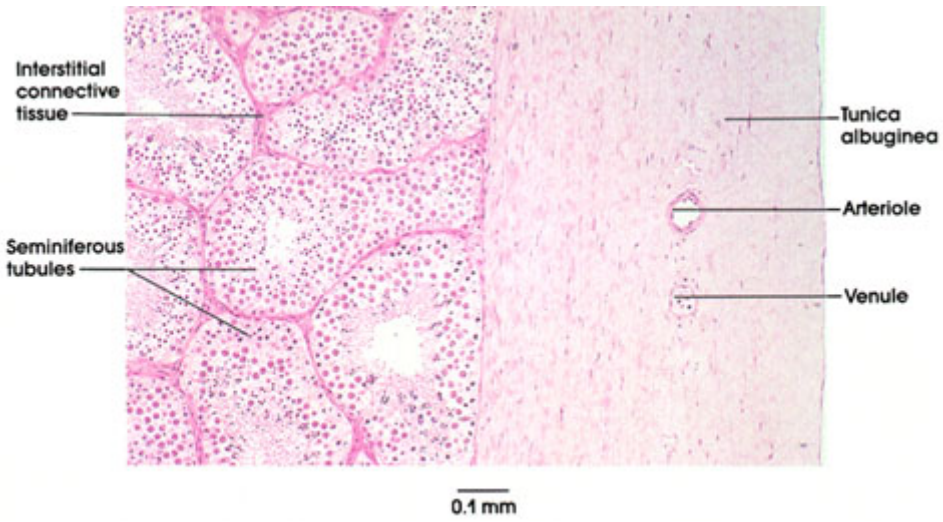
Peer Review Status: Externally Peer Reviewed

TESTIS
Periphery



Monkey, glutaraldehyde; 1.5 μm plastic-embedded section, H. & E., 84 x

The testis is enclosed by a robust dense white fibrous connective tissue capsule, the tunica albuginea, designated for its glistening white appearance in the unfixed state. Vascular elements pierce the tunica albuginea and travel within septa that are continuous with the intertubular connective tissue of the organ; posteriorly, the tunica albuginea is specialized as the mediastinum testis. Deep to the tunica, note the many profiles of seminiferous tubules, which are lined with the complex seminiferous epithelium. The epithelium is seen to better advantage in later plates at higher magnification.

Plate 14.264 Testis

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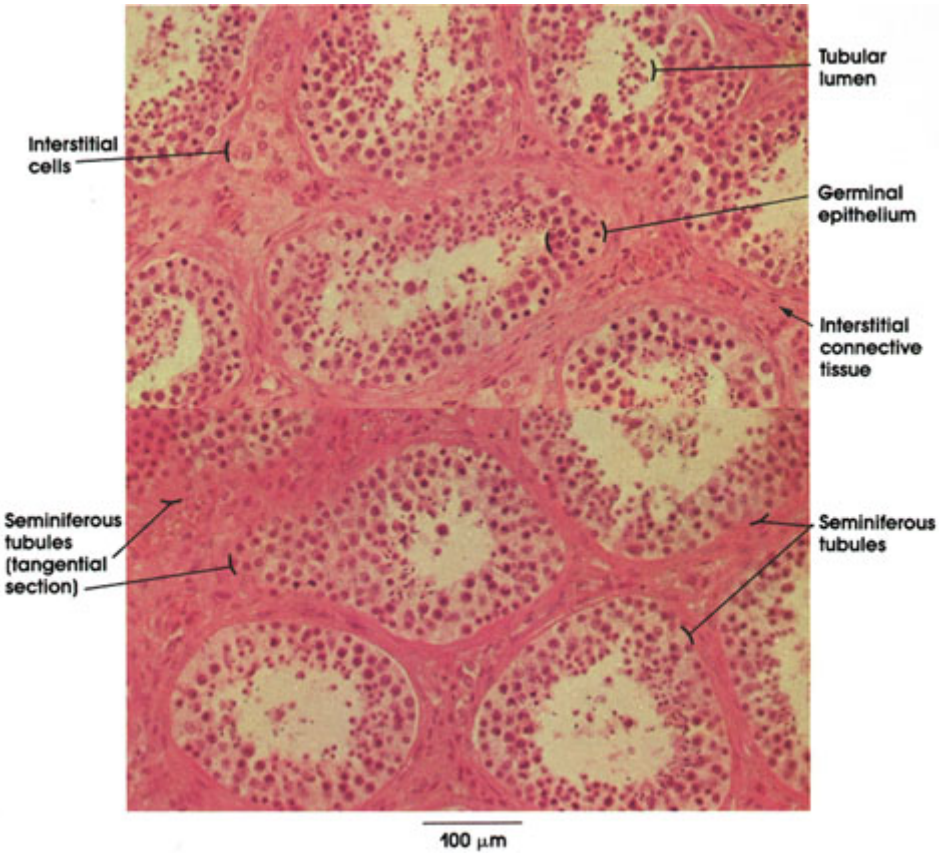
TESTIS



Human, 10% formalin, H. & E., 162 x.

This is a section of the testis showing the seminiferous tubules separated by interstitial connective tissue. The seminiferous tubules are lined by a stratified epithelium, the germinal epithelium, composed primarily of sex cells with some supporting cells. The epithelium rests on a basement membrane that varies in thickness with age. The lumina of the seminiferous tubules contain mature sex cells (spermatozoa). Seminiferous tubules are separated by an interstitial stroma made up of loose connective tissue and containing the interstitial cells of Leydig. These large ovoid cells that occur in groups secrete testosterone, the male sex hormone.