Lab 17 – Male Reproductive System
IUSM – 2016

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      2. Seminiferous tubules
      3. Rete testis
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Keywords

- Corpora amylacea
- Corpora cavernosa
- Corpus spongiosum
- Ductus (Vas) deferens
- Ductus epididymis
- Efferent ductules
- Epididymis
- Helicine arteries
- Interstitial cells (Leydig cells)
- Interstitial tissue
- Myofibroblasts (myoid cells)
- Paraurethral glands
- Penis
- Primary spermatocytes
- Prostate gland
- Rete testis
- Seminal vesicle
- Seminiferous tubules
- Sertoli cells
- Spermatids
- Spermatogenesis
- Spermatogonia
- Spermatozoa
- Spermatozoon
- Spermio genesis
- Testis
- Tunica albuginea
- Urethra
each testis (Lt. “witness”) is surrounded by a dense CT capsule called the tunica albuginea (Lt. “white coat”); CT septa extend from the mediastinum testis, a thickened portion of the tunica albuginea, and divide each testis into ~250 lobules, each containing 1-4 long, highly-convoluted seminiferous tubules; spermatozoa produced in the seminiferous tubules drain into the net-like collection of ducts called the rete testis within the mediastinum testis
spermatozoa produced in the **seminiferous tubules** drain via short tubuli recti into the **rete testis** which drains into the efferent ductules which drain into the singular **ductus epididymis**; upon ejaculation, spermatozoa within the ductus epididymis are rapidly conducted through the long, muscular **ductus deferens** to the ejaculatory duct near the urinary bladder.
Leydig (interstitial) cells are large, round cells with central nuclei and eosinophilic cytoplasm – often containing lipid droplets – found in the interstitial tissue between the seminiferous tubules; they are responsible for testosterone production in response to luteinizing hormone (LH) from the pituitary gland; also in the interstitial tissue, several layers of myoid cells surround the seminiferous tubules; they are specialized contractile cells that assist in propelling spermatozoa and fluid from the tubules into the rete testis.
Seminiferous tubules (Lt. “seed bearing”) compose the majority of the parenchyma of the testis and are the site of spermatogenesis (sperm production); each seminiferous tubule is ~2ft long, thus the combined total length of the tubules within each testis is approximately 1800ft; between the tubules is a delicate interstitial stroma composed of sparse CT and vasculature within which are clusters of Leydig cells.
each Sertoli cell surrounds and nourishes 30-50 developing spermatozoa; they extend from the basement membrane to the lumen of the tube, however their nuclei are generally located in the basal aspect of the cells near the basement membrane; they are responsible for the formation of the blood-testis barrier (the tightest blood-tissue barrier in humans), have phagocytic functions, and secrete numerous factors (e.g., AMH and ABP)
spermatogonium, located on basement membrane, have a variable appearance of the nucleus depending upon subtype of cell (A or B)

primary spermatocyte, located off membrane in adluminal compartment, with large nucleus containing clumps or threads of chromatin

spermatid, located closer to lumen, with more condensed nucleus

spermatozoon, adjacent to lumen, with small, pointed nucleus

spermatogonia \( \rightarrow \) primary spermatocyte \( \rightarrow \) secondary spermatocyte (rarely seen) \( \rightarrow \) spermatids \( \rightarrow \) spermatozoa; in total, each spermatozoon takes over 80 days to develop and mature; it takes \(~74\) days to form in the tubule and 10 days pass through and mature in the epididymis; despite the slow development, on average \(2 \times 10^8\) sperm develop each day (2300 sperm/sec) due to the extreme length of tubules and vast numbers of cells
short, straight tubules called **tubuli recti** join the seminiferous tubules to the rete testis; they are continuations of the seminiferous tubules but lack the stratified seminiferous epithelium and spermatogenic cells; instead, they are composed solely of a simple layer of Sertoli cells which transitions into the simple cuboidal epithelium of the rete testis; due to their short lengths and the cross sectioning usually used for the testis, tubuli recti are not often seen
the rete testis (Lt. “net of the testis”) is an interconnected network of simple cuboidal epithelium-lined channels that conduct spermatozoa from the seminiferous tubules (via tubli recti) to the efferent ductules which drain into the ductus epididymis; the rete testis is surrounded by the dense CT of the mediastinum testis which is continuous with the connective tissue of the tunica albuginea.
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The epididymis (Gr. "upon the testis") is attached to the outside of the testis and is divided into head, body, and tail regions; it contains efferent ductules from the testis and the ductus epididymis.
the efferent ductules (Lt. “carrying-out ducts”) are 15-20 ducts that carry spermatozoa from the rete testis within the testis to the epididymis; they compose the bulk of the head of the epididymis and empty into the singular ductus epididymis; the majority of excess fluid from the seminiferous tubules is absorbed by the microvilli-covered cells of the efferent ductules
**efferent ductules** are lined by a pseudostratified epithelium consisting of basal cells and groups of ciliated columnar cells and interspersed cuboidal cells with microvilli – the alternating taller columnar cells and lower cuboidal cells can give an overall jagged or saw-toothed appearance to the lumen; a few thin layers of smooth muscle surround the tubules and, in conjunction with the beating of the cilia, assist in moving the still immobile spermatozoa toward the ductus epididymis.
the **ductus epididymis** is a long tube (~15ft) that receives spermatozoa from the multiple efferent ductules; it is the site of continued sperm maturation and storage – principally within the tail region; sperm may be stored for several months before they are reabsorbed if ejaculation has not occurred
Slide 155: Testis, H&E

- Pseudostratified columnar epithelium with **stereocilia**
- Stored spermatozoa
the **ductus epididymis** is composed of a pseudostratified columnar epithelium with small, round basal cells located near the basement membrane and tall principal cells lined with long, branching **stereocilia** (microvilli); surrounding the ductus is a coat of smooth muscle that serves to move spermatozoa through the duct; the coat is thin in the head and body regions but thickens considerably in the tail.
the **ductus (vas) deferens** (Lt. “carrying-away duct”) is a continuation of the tail of the ductus epididymis; it travels within the spermatic cord, carrying spermatozoa during ejaculation from the ductus epididymis to the ejaculatory duct at the seminal vesicle (near urinary bladder)
a **spermatic cord** travels from each testis through the inguinal canal into the abdominal cavity; the cord is surrounded by the cremaster muscle (Gr. “suspender”) which facilitates raising and lowering of the testis in response to temperature changes; the cord contains the **ductus deferens**, testicular artery, lymphatics, bundles of sympathetic and sensory nerves, and the pampiniform plexus (Lt. “vine-shaped”) which composes the bulk of the cord; the veins of the plexus are thicker-walled than typical veins and may be confused as arteries, however their walls, like large veins, generally contain two layers of smooth muscle (inner circular and outer longitudinal)
the ductus deferens is a thick-walled muscular tube composed of three general layers: an innermost mucosa lining the lumen, a thick muscularis – where the majority of force for ejaculation is generated – containing three layers of smooth muscle: inner longitudinal (I), intermediate circular (C), and outer longitudinal (O); and an outer adventitia; the above slide shows two sections of the same ductus deferens, one with a folded mucosa and one with a distended mucosa
the epithelium of the **ductus deferens** is similar to that of the ductus epididymis – both are pseudostratified columnar epithelium with stereocilia; however, the lumen of the ductus deferens is larger in diameter and is generally seen in a pleated state with longitudinal mucosal folds, lacking the “smooth” lumen appearance seen in the ductus epididymis
on the posterior of the urinary bladder, the ampullas of each of the ductus deferens join with the excretory ducts from the seminal vesicles (Lt. “small semen bladder”) to form the ejaculatory ducts; the seminal vesicles are outgrowths of the ductus deferens and function to secrete seminal fluid which composes the majority (80%) of an ejaculation; they each consist of a single, coiled tubular lumen surrounded a highly-folded mucosa, a two layered muscularis (inner circular and outer longitudinal), and an adventitia
the **mucosa** of the seminal vesicles is highly folded into primary and secondary folds creating mucosal crypts between the folds; the epithelium is generally a low pseudostratified columnar epithelium but may appear more cuboidal; it is shorter and lacks the stereocilia of the ductus deferens.
from the urinary bladder, the urethra (prostatic) passes through the prostate gland where it is joined by the ejaculatory ducts from the seminal vesicles; the prostate consists of 30-50 branched tubuloacinar prostatic glands – principally the main prostatic glands, located in the periphery of the prostate, but other glands are also present in the mucosal and submucosal layers around the urethra; the colliculus seminalis bulges into the urethra giving it a crescent-shaped appearance
corpora amylacea (Lt. “starch bodies”), found within the prostate gland acini, are characteristic of the prostate gland; they are generally round or oval shaped with a lamellated appearance; while not well understood, it is thought that they arise from layers of secretions deposited around shed epithelial cells; they increase with age and are associated with benign glands (they are not readily apparent in cancerous glands)
the **prostatic glands** have a highly-variable appearance but generally consists of pale, secretory columnar cells and dark, round basal cells; between the glands is a characteristic **fibromuscular stroma** consisting of intermingled smooth muscle fibers and connective tissue fibers.
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during erection, dilation of helicine arteries (small arteries and arteriole branches of the deep arteries), caused by parasympathetic stimulation and closure of the normal arteriovenous shunting, results in engorgement of the vascular sinuses which enlarge and compress venous outflow, resulting in erection of the tissue within the corpora cavernosa
the penile urethra travels within the corpus spongiosum which lacks the thick tunica albuginea that surrounds the corpora cavernosa; the lack of a thick connective tissue capsule prevents the corpus spongiosum from developing enough pressure during erection to occlude the urethra; the epithelium of the penile urethra is mostly pseudostratified or stratified columnar changing to stratified squamous in the most distal part

paraurethral glands (mucous)

vascular sinus
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Common Confusion:
Ductus deferens vs. Ureter

**Ductus (vas) deferens**: muscular tube that propels sperm from the ductus epididymis to the ejaculatory ducts of the seminal vesicles during ejaculation

Look for: (1) small lumen relative to thickness of tube wall; (2) thick muscularis composed of three layers: inner longitudinal, intermediate circular, and outer longitudinal; (3) lumen is lined by pseudostratified columnar epithelium with stereocilia

**Ureter**: muscular tube that conducts urine from the kidney to the urinary bladder

Look for: (1) large lumen relative to thickness of tube wall; (2) thick lamina propria between epithelium and muscularis; (3) muscularis generally composed of two layers which are not always well-defined: inner longitudinal and outer circular (an additional outer longitudinal layer is present near the urinary bladder); (4) lumen is lined by transitional epithelium
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<td>Sertoli cell</td>
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<td>Spermatogonium</td>
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