

## MALE HUMAN REPRODUCTIVE ANATOMY

This topic is treated in two parts. The first part is labeled Penile Anatomy and focuses on the penis, with comparisons to female homologous tissues. The second part is labeled Semen Plumbing and focuses on the anatomical features involved in transporting sperm from testes to meatus.

### PENILE ANATOMY

The penile glans is the distal pink portion of the penis. It is grown from the same embryological tissue that becomes the clitoral glans in females. The Glans Clitoris is erectile, meaning that it fills with blood when the owner is sexually stimulated.

The body or shaft of the penis comprises 3 major erectile components: the two corpora cavernosa, and the spongiosum. In the female, these tissues are erectile as well, but with some differences.

- \* The female cavernosa are deep erectile tissues connecting the glans to the ischiopubic ramus.
- \* The Spongiosum forms two erectile tissues on either side of the midline and vagina inside the Minor Labia.
- \* The Glans Clitoris is erectile; the Glans Penis is not.

The ischiocavernosus muscle attaches the corpora cavernosa to the (ischiopubic ramus of the) pelvis in both males and females. In females, the ischiocavernosus muscle assists with clitoral erection. In males, it connects the crus penis (curved base of corpora cavernosa) to the ischiopubic ramus of the pelvis. The penis is also attached to the pubic symphysis by the suspensory ligament.

In males, the bulbospongiosus muscles join together at the ventral midline of the corpus spongiosum, and surround the base of the penis. They aid in emptying of urine from urethra, and rhythmically spasm to ejaculate semen. In females, these muscles are separated in the middle by the vagina and act to constrict the vaginal opening.



**Figure 1** Relative sizes of penis and glans clitoris. Here, the glans is erect and the hood retracted.  
[https://commons.wikimedia.org/wiki/File:Penile-vaginal\\_in\\_tercourse\\_3\\_-\\_painting.png](https://commons.wikimedia.org/wiki/File:Penile-vaginal_in_tercourse_3_-_painting.png)  
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In males, the urethra starts at the bladder, passes through the prostate, then enters the bulbospongiosum end of the corpus spongiosum, and ends at the urethral meatus below the tip of the glans penis. Note that the glans in males and females arises embryologically from the spongiosum tissue. In males, the corpus spongiosum forms a distinct ridge along the ventral aspect of the penis. In females, this same erectile tissue (spongiosum) is found within the labia minora and forms the vestibular bulbs on either side of the vaginal opening.

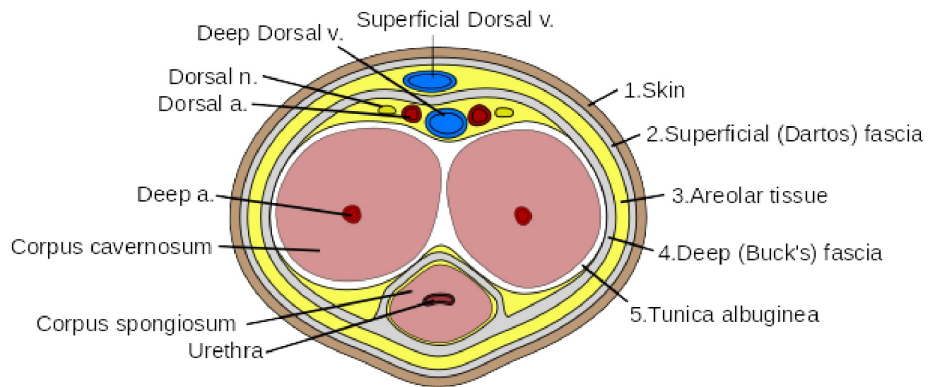
The twin corpora cavernosa form the majority of the penis. They are the two columns of erectile tissue which, along with the spongiosum erectile tissue, expand the penis to its full erect and rigid size. Each corpus cavernosum is made mostly of smooth muscle that actively contracts when not relaxed by the parasympathetic nervous system, and is stretched by blood pressure. It also has structures called trabeculae, which are made of collagen and smooth muscle. The cavernous hollow spaces and trabeculae are lined with endothelial cells (same cells that line our arteries and veins), which prevent the blood from clotting.

The tunica albuginea surrounds the corpora cavernosa. Buck's fascia surrounds most penile structures, including the tunica, and especially the deep dorsal vein.

During the full erection phase, the deep dorsal vein is partially crushed between the tunica and

Buck's fascia. This limits the flow of blood out of the penis, and raises blood pressure. During the rigid erection phase, the ischiocavernosus and bulbospongiosus muscles contract and maximally compress the spongiosum and penile veins which causes a further increase in blood pressure within the penis.

Elastin shrinks under the contraction of the cavernosal muscle cells, when the penis is not filled with blood under pressure; and elastin stretches when blood pressure increases and muscle cells relax. Collagen doesn't shrink as much or stretch as much. So, penises with more elastin look smaller when flaccid, but expand more than penises with more collagen. Penises with more collagen look bigger when flaccid, but don't expand much when full of blood. Dr. Aaron Spitz<sup>1</sup> calls penises with more collagen "showers" because they look bigger when collapsed. He calls penises with more elastin "growers" because they expand more as they fill with blood.



**Figure 2** Penile blood flow and structure. There is a pair of arteries (not shown) on either side of the urethra, in the spongiosum.

[https://commons.wikimedia.org/wiki/File:Penis\\_cross\\_section.gif](https://commons.wikimedia.org/wiki/File:Penis_cross_section.gif)

Authors: Trudoholic, McStrother

The same tissue that forms the male scrotum forms the female labia majora. The line that joins the two labia in males is visible on the scrotum. The embryological tissue that forms testes in males, forms ovaries in females.

The tunica and Buck's fascia are stronger than steel against the stretching force of blood pressure, but both can become damaged by the penis being bent when rigid, and a rigid penis can be broken. This most severe form of Peyronie's Disease results when such a tear occurs, and the penis may bend at a sharp angle. Pain and dysfunction follow. More common lesser forms of Peyronie's Disease result in curvature of the penile shaft that does not cause pain and does not cause dysfunction. Such cases are caused by scarring of penile tissue.

Blood enters the penis through 6 arteries. Fortunately they are 3 pairs of arteries, so we only need to remember three names.

- 1) The two Dorsal arteries.
  - 2) The two Cavernosal arteries.
  - 3) The two Spongiosal arteries
- All three paired arteries are side-by-side.

There are two veins you should also remember. They too are paired, but one is deep and the other is superficial. Both are near the top (dorsal) side of the penis, and the superficial dorsal vein is often plainly visible.

**HOMEWORK Test your comprehension and retention, Open book, open internet.**

Sketch penis and scrotum from top (dorsal), side (lateral), and ventral view.

Sketch a cross section of the penile shaft, including arteries, veins, Buck's fascia, and tunica albuginea.

- 1 What is erectile tissue?
- 2 Name three erectile tissues in women:
- 3 Name two erectile tissues in men:
- 4 What are the curved bases of the Cavernosa called?
- 5 What muscle connects the Ischium to the Cavernosa?
- 6 What pair of muscles compress the bulb of the Spongiosum?
- 7 What is inside the Spongiosum?
- 8 What do the Bulbospongiosus muscles do?



**Figure 3** Erect penis bent left by Peyronie's disease. [https://commons.wikimedia.org/wiki/File:Bent\\_penis\\_erected\\_peyronies.jpg](https://commons.wikimedia.org/wiki/File:Bent_penis_erected_peyronies.jpg)  
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- 9 Where does the embryological spongiosum tissue end up in your (female) body?
- 10 Where did it go in my body?
- 11 What are the largest erectile tissues in my body?
- 12 Is elastin stretchy?
- 13 Why is my penis so small when it is not full of blood?
- 14 What tunic surrounds the Cavernosa?
- 15 Why is there a line down the middle of my scrotum?
- 16 What important vein gets crushed between \_\_\_\_\_ fascia and the \_\_\_\_\_  
\_\_\_\_\_?
- 17 What are the three pairs of main arteries in the penis?
- 18 Name the obvious vein on the upper surface of the penis.



## SEMEN PLUMBING

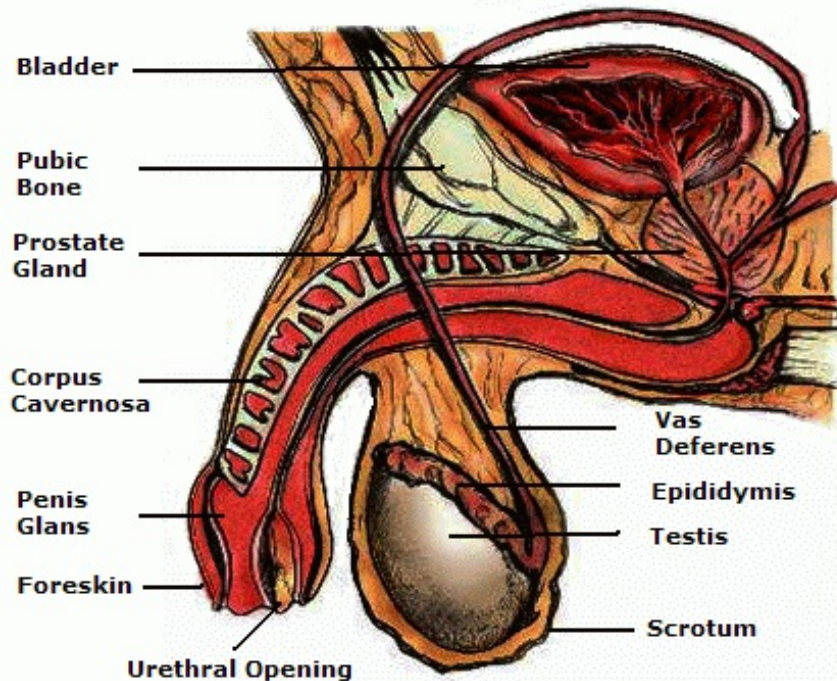
How do sperm get from testicles to meatus? And what glands contribute to semen? Semen is not all sperm; it's less than 5% sperm. What is the other stuff, and why is it in there?

Each testicle is jam packed with seminiferous tubules, sertoli cells, and leydig cells. The average man produces 250 million mature sperm each day<sup>2</sup>. Sertoli cells nurse infantile sperm until they can graduate to an epididymis, one of which is attached to each testicle. Sperm maturation takes about 11 weeks before they are ready to swim the vas deferens. Leydig cells of the testes secrete Testosterone.

Sperm that graduate from the epididymis leave the scrotum via the vas deferens in the spermatic cord. The vas deferens contracts during ejaculation to speed them along. The spermatic cord comprises the vas deferens; 3 arteries: testicular, cremasteric, & vas; the pampiniform plexus (veins); 2 nerves: cremaster & sympathetic; and 2

lymphatics: testis & epididymis; all surrounded by the cremaster muscle. The swimmers continue along the vas deferens, enter the abdomen, and travel up the front side of the bladder, over the top, and down the back side of the bladder.

Behind the bladder and adjacent to the prostate, a pair of small glands called Seminal Vesicles link the vas deferens from each testicle with the ejaculatory duct inside the prostate. The seminal vesicles manufacture and store roughly 70% of seminal fluid. Sperm make up about 5%, and the prostate provides the rest by forceful ejection into the urethra. Semen is an alkaline fluid



**Figure 4** How Sperm get to the Penile Meatus: Testis, epididymis, vas deferens, seminal vesicles (shown but not labeled), prostate, Cowper's gland, urethra, meatus. Note the suspensory ligament (not labelled) attaching the penis to the pubic symphysis. [https://commons.wikimedia.org/wiki/File:Penis\\_Anatomy2.gif](https://commons.wikimedia.org/wiki/File:Penis_Anatomy2.gif) Kelly8, CC BY-SA 3.0 <<http://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons

that is rich in fructose and nutrients for sperm<sup>1</sup>. Sperm accumulate in the seminal vesicles until they are ejaculated or until they overflow the vesicles, enter the urine, and are expelled with urine. It usually takes 2-4 days for seminal vesicles to refill completely after ejaculation. Full seminal vesicles cause men to think more about sex and feel more sexual desire<sup>3</sup> than when the vesicles are relatively empty.

Before ejaculation occurs, the pea-sized Cowper's gland, (just downstream of the prostate) ejects a clear mucoid fluid into the urethra ahead of the seminal fluid. This pre-cum is a buffered solution that neutralizes any acidic remnants of urine in the urethra.

Immediately before ejaculation, the prostate gland shuts off its connection to the bladder so that semen cannot enter the bladder. During ejaculation, the prostate and seminal vesicles forcefully eject the sperm-laden seminal fluid into the urethra.

**HOMEWORK Test your comprehension and retention. Open book, open internet.**

Sketch the path of sperm from testicle to meatus, including all 5 glands (I count a pair of glands as one gland) and the bladder.

How long does that journey take?

How many sperm does one scrotum export per day?

- 1 Name the tubules that fill the testicles.
- 2 What do the sertoli cells do?
- 3 What cells make testosterone?
- 4 How many sperm do the testicles and epididymi produce each day?
- 5 What do the seminal vesicles do?
- 6 What kind of sugar is found in semen?
- 7 How many weeks does it take to get from testicle to meatus?
- 8 Why doesn't semen flow into the bladder?
- 9 What does the Cowper's gland produce?
- 10 What does the secretion do?

1. Spitz, Aaron MD, *The Penis Book: A Doctor's Complete Guide to the Penis--From Size to Function and Everything in Between*, Paperback – February 20, 2018

2. David M. de Kretser, ... Moira O'Bryan, in *Endocrinology: Adult and Pediatric (Seventh Edition)*, 2016

3. Weisstanner, C., et al, 5/27/2022 - Distended Seminal Vesicles Are Involved in Specific Cerebral Sexual Arousal: A Pilot Study Using Functional Brain Imaging in Young Healthy Men, *EUROPEAN UROLOGY OPEN SCIENCE* 42 (2022) 10–16

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<sup>1</sup> Also amino acids, Vitamin C, P, K, flavins, and prostaglandins.