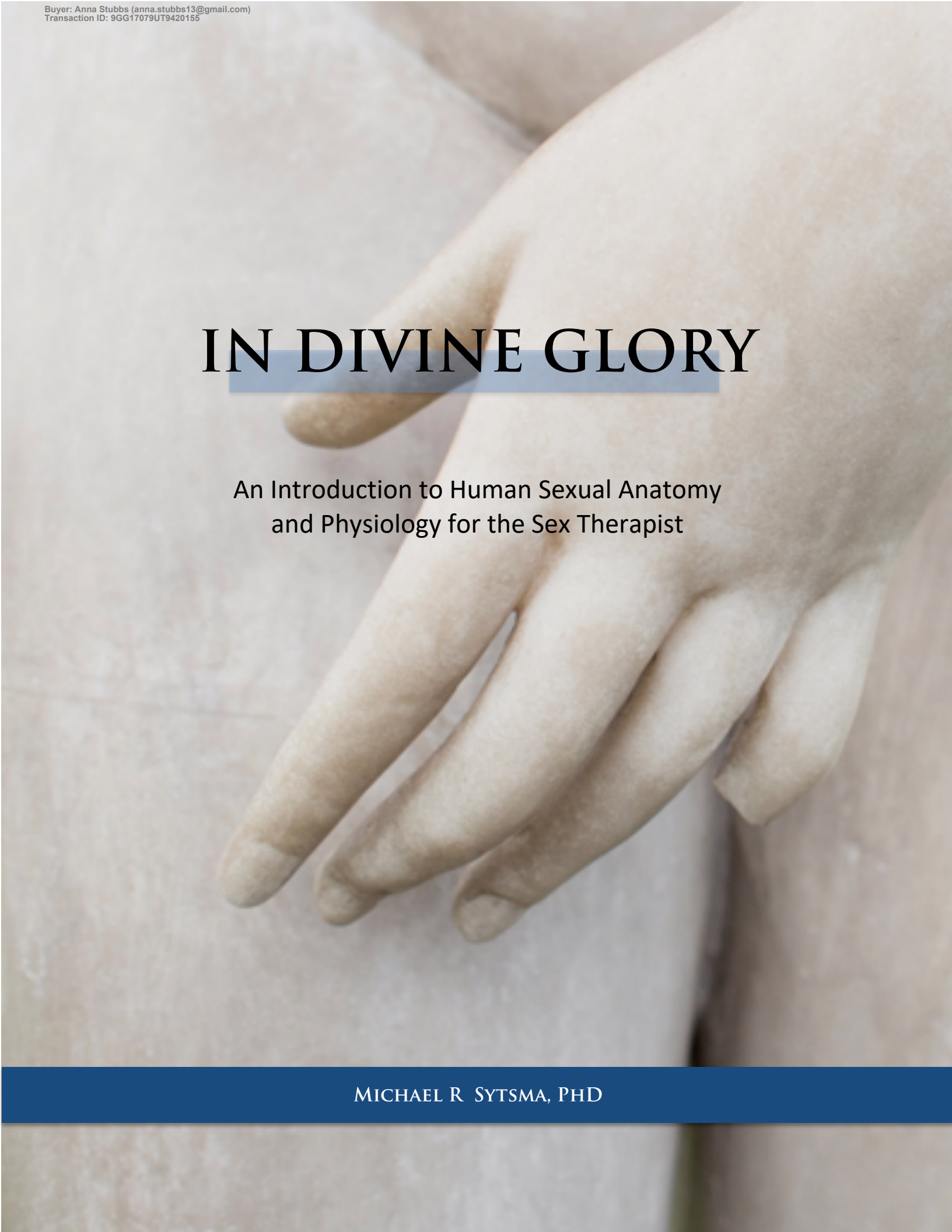

IN DIVINE GLORY

An Introduction to Human Sexual Anatomy and Physiology for the Sex Therapist

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The following is an early draft text for a manuscript initially written for the ISW intro classes to assist in teaching sexual anatomy/physiology.

I welcome edits, suggestions, comments, critiques, etc. on the content. Just email me at drmike@intimatemarriage.org.

A couple notes:

1. I am working on commissioning original drawings to illustrate.
2. The layout and visual "flow" of the text including paging, sidebars (blue boxes), and illustrations will be the last thing worked on (after illustrations are added). Please excuse any disruptions this causes in your reading.
3. There is enormous controversy on many points of sexual anatomy, especially in females. While sometimes I present different sides, at other times I picked a side. Many times the side I picked changed as new research came out. This will continue to be the case.
4. While subtitled "an introduction to anatomy and physiology", the current chapter is heavy on anatomy and very light on physiology. Even though they are totally separate fields and focuses, the intent is to add more physiology in future updates.
5. In purchasing this version, you gain access to future versions – generally free. Contact me for the latest version.

In Divine Glory

An Introduction to Human Sexual Anatomy and Physiology for the Sex Therapist

Preface

I have given them the glory that you gave me, that they may be one as we are one.

John 17:22 (NIV)

"Divine Glory" is a rich term in Christian theology. It reflects both the nature of God, but also that a reflection of this nature is present in us — His creation and image bearers. We reflect God's glory in who we are, but in our spirit and in our bodies.

"Glory" in Scripture

Old Testament

In the Hebrew scriptures, the most common word translated "glory" in English is *kavod* (כָּבוֹד).The basic meaning of the Hebrew word *kavod* is "heavy in weight"(Brand et al., 2003) and can refer to the weight of a burden, influence, or wealth. "In the Old Testament, glory may be applied to a finely crafted object in the sense of cleverness of design, intricacy of artistic work, and beauty" (i.e., Exod. 28:40)(Carpenter & Comfort, 2000). Giving glory recognizes goodness, beauty and honor. It is also contrasted as an antonym of shame.

New Testament

The New Testament uses the Greek word *doxa* (δόξα) for glory and points to the glory of God being expressed in the person of Jesus Christ (i.e., John 1:14 and Hebrews 1:3). Just as God's glory filled and sanctified the temple of worship, under the new covenant people become the temple of God (I Corinthians 6:19) and are the glory of God (Psalm 8:5, I Corinthians 11:7).

While history has been filled with those who see the flesh as negative, shameful and bad, scripture celebrates the human form. Our bodies are "finely crafted" works of craftsmanship with beauty and meaning that give great weight to them. In many ways, our sexuality *uniquely* reflects critical aspects of the glory of God.

This work is written, at its core, to celebrate the divine glory of our physical sexuality. Not just the simple fascination with bodies or parts, but to explore how our bodies illustrate and reflect the heart and glory of our God. It is my desire that you will be captivated by the beauty and complexity in our design and be in awe of the weight and wealth He has placed in our sexuality. That you would see His divine glory in the design of you, and especially in your sexual parts.

How long will you turn my honor and glory into shame?

– Psalm 4:2 (Amp)

Introduction

You made all the delicate, inner parts of my body
and knit me together in my mother's womb.
Thank you for making me so wonderfully complex!
Your workmanship is marvelous…

Psalm 139:13-14 (NLT)

We are truly "fearfully and wonderfully made" (Psalm 139:18), and nowhere is this more true than in our sexuality. The wonder of both the design and function of our sexuality and sexual anatomy and physiology is truly amazing. While we cover these parts in modesty and respect, they have great honor in God's design (I Corinthians 12:23).

Like the parts themselves, talking about human sexual anatomy is often filled with mystery, intrigue, myth and, of course, controversy. Some clearly believe that our "private parts" need to remain just that – private. They believe sexual parts are so sacred they should not be discussed in any way. Proponents of this argument might point to the Biblical model of not discussing sexual parts or of doing so with euphemisms or poetic language. Following this perspective, one should not discuss sexual parts with any specificity nor show pictures. Such things might lead to lust and causing someone to stumble.

On the other side is the reality that silence on the issue of sex, sexuality, and sexual anatomy and physiology causes a myriad of problems based solely in ignorance of God's grand design. Further, when the church is silent, it leaves a vacuum where the only voice present is that of the world.

Details and apologetics of such an argument are beyond the scope of this text. Instead, this text attempts to offer a close examination of sexual anatomy and physiology in a way that celebrates the wonder of it's design while honoring the sacredness of sexuality. Further, it is hoped that the reader catches a glimpse of why our sexuality is given special honor (I Corinthians 12:23) while studying the beauty of God's sexual design.

Anatomy – focuses on bodily structure.
Physiology – focuses on bodily function.

While much of sex happens in the brain and in the heart, and even more so, in the space between two people, understanding how the parts are designed to work is essential in enrichment and problem solving our sexuality. It is crucial that the sex therapist or sex educator have an accurate knowledge of sexual anatomy and sexual physiology.

A note to the non-medical student

Studying anatomy and physiology can quickly become overwhelming. Our bodies are intricately complex and the language used to describe it is often foreign to non-medical readers. Even though most students may need to read the chapter more than once to begin to understand it, the level of detail listed here is intentional. While simplified from most anatomy texts, it is still detailed enough to illustrate the complexity of sexuality. It also helps provide a framework for understanding what is designed to happen, and to problem solve when something is not working. Hang in there.

Male Sexual Anatomy

The primary visible male sexual anatomy includes the penis and the scrotum but there are also internal structures that are integral parts of sexual activity and reproduction. We will begin our discussion with the external parts.

Penis

"Clearly, the penis is a complex organ with many different parts, each specialized for a specific role"

(Taylor, Lockwood, & Taylor, 1996)

Michelangelo's "David" sculpture

Culturally, the *penis* is the primary male sexual organ. It is, at it's most rudimentary form, an inflatable organ capable of transferring sperm to the female during copulation. The body of the penis extends from the root inside the body and down the shaft to the end of the glans at the end. Externally, the penis is comprised of the shaft, glans, and foreskin (if uncircumcised).

From an engineering perspective, the penis is an amazing structure. While typically it is flaccid and unobtrusive, it needs to be able to become rigid enough to sustain the force needed to enter, and deposit sperm into, the vagina. Most primates (including great apes and chimpanzees) and other placental mammals* (including dogs, mice, seals, etc.) accomplish this with a rigid core (penile bone). The *baculum* (penile bone or os penis) resides in the animal's abdomen. For copulation, muscles slide the baculum into a sheath in the fleshy penis allowing for quick, rigid erections. In humans, the penis is designed to be flaccid and largely unobtrusive when not ready for intercourse. It does not contain bone or primary muscles but relies on a number of structures that allow the penis to perform it's primary sexual function of sperm delivery through hydrostatic pressure.

* Mammals without a baculum include spider monkeys, horses, donkeys, rhinoceros, marsupials, rabbits, cetaceans (whales and dolphins), elephants and hyenas.

Is there significance to the absence of a bone in the male penis?

Why might God create other primates with a baculum (penile bone) but not humans? Maybe he didn't.

> *21So the LORD God caused the man to fall into a deep sleep; and while he was sleeping, he took one of the man's ribs and closed up the place with flesh. 22Then the LORD God made a woman from the rib he had taken out of the man, and he brought her to the man.*
>
> (Genesis 2:21-22, NIV)

One theory suggests the rib wasn't the bone God used to create Eve. Ziony Zevit (professor of Biblical literature) and Scott F. Gilbert (biology professor) point out (Gilbert & Zevit, 2001) that the Hebrew noun translated "rib" (צֵלָע – tsela) can mean structural support – as in the rib of a body, rib of a hill (2 Samuel 16:13), side room (I Kings 6:5,6), or planks in buildings (I Kings 6:15,16). If *tsela* scriptures' euphemistic way of referencing the bacula, it would help explain why man does not have one (yet has all his ribs).

"When rendered into Greek, sometime in the second century BCE, the translators used the word pleura, which means "side," and would connote a body rib (as the medical term pleura still does). This translation, enshrined in the Septuagint, the Greek Bible of the early church, fixed the meaning for most of western civilization, even though the Hebrew was not so specific" (p.284).

They go on to point out that, "In addition, Genesis 2:21 contains another etiological detail: "The Lord God closed up the flesh." This detail would explain the peculiar visible sign on the penis and scrotum of human males—the raphé . In the human penis and scrotum, the edges of the urogenital folds come together over the urogenital sinus (urethral groove) to form a seam, the raphé. If this seam does not form, hypospadias of the glans, penis, and scrotum can result. The origin of this seam on the external genitalia was "explained" by the story of the closing of Adam's flesh. Again, the wound associated with the generation of Eve is connected to Adam's penis and not his rib. A rib has no particular potency nor is it associated mythologically or symbolically with any human generative act. Needless to say, the penis has always been associated with generation, in practice, in mythology, and in the popular imagination. Therefore, the literal, metaphorical, and euphemistic use of the word tzela make the baculum a good candidate for the singular bone taken from Adam to generate Eve" (284.)

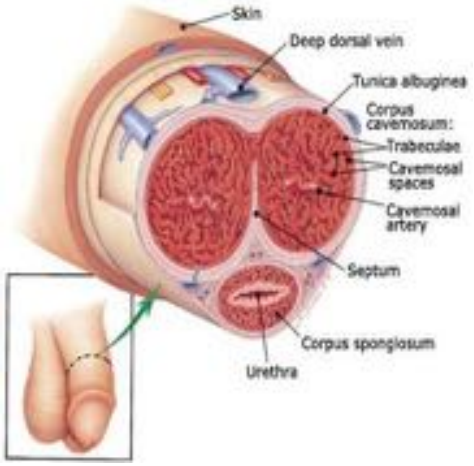
Walrus Baculum

While there may be strong hermeneutic arguments against this perspective (i.e. "took *one of* the man's ribs"), even if God didn't remove Adam's baculum to create Eve, its absence in humans must be intentional. Why would God create man without a baculum?

In mammals with a baculum, muscles slide it into a sheath in the penis allowing for almost instant erections. A male can inseminate a female with limited physical and no emotional arousal. Without the baculum, there is the possibility for a longer time to achieve erection as well as more involvement from the mind. Relational aspects have the chance to have far more bearing on arousal than just the presence of pheromones. It is possible that the absence of a baculum allows sex to be more emotional and relational for the male.

Corpus Cavernosum.

The *corpus cavernosum* (plural corpora cavernosa) is essentially a pair of vascular tubes of erectile tissue and is the primary structure responsible for erections in the human male. Toward the base, root, or *crus of the penis* the corpus cavernosa splits into a wedge shaped pair of crura, which attach the penis to the pubic bone on each side of the ischio-pubic ramus. Moving away from the root, the corpus cavernosa lie along the dorsal side (top) of the penis and constitutes the bulk of the shaft, or body, of the penis. Blood enters through the cavernous artery in the center of each chamber, passes through the cavernosal spaces, and exits along the outside of the chamber through the emissary veins.



A cross section of the corpus cavernosa shows the vascular space of the corpus cavernosum is surrounded by collagenous tissue called the *tunica albuginea*. This collagenous tissue also crosses through the vascular space (trabeculae of corpora cavernosa of penis) creating a sponge like appearance and providing structure that keeps the corpus cavernosum in it's non-circular shape. A concentration of the trabeculae in the center divides the corpus cavernosa into the two chambers (corpora cavernosa) while being porous enough to keep the pressure even between them.

References to "penis" in scripture:

Deut 23:1 - שָׁפְכָה - *shopkah*
From a word that references a pipe for pouring out, "shopkah" seems to directly reference the penis. This Hebrew word is only used here in scripture.

Deut 25:11 - מָבֻשׁ – *mabush*
Translated as "private parts" (NIV) and "genitals" (KJV). This Hebrew word is only used here in scripture.

Ezekiel 23:20 - בָּשָׂר – *basar*
A common word in scripture (used 267 times) that literally means "flesh" and is typically translated as "flesh", "meat", or "body". In this passage, it is typically seen as a euphemism for male genitals and translated as "flesh" (KJV), "genitals" (NIV), or "members" (NRSV).

The tunica albuginea wrapping the corpus cavernosa is bi-layered in a unique design called an "axial orthogonal array" which has "the highest flexural stiffness of any fiber-reinforced system" (Kelly, 2007, p. 255). The fibers of the inner layer are wrapped in a circular fashion around the corpus cavernosa with the outer layer of fibers lateral to the penis at a 90º angle to the inner layer. This design allows the penis to be flexible and unobtrusive when deflated as the fibers are folded. "Folding gives the wall tissue nonlinear material properties. Unstressed folded tissue is compliant, but as the tissue is stretched and its integral fibers straighten its stiffness increases. Ultimately, the stiff fibers are loaded in tension and resist further extension of the tissue" (Kelly, 2007, p. 255). When rigid, the longitudinal fibers resist forces that would shorten or lengthen the penis and circumferential fibers resist forces that would bulge or crimp the penis. Together, they also help resist bending forces.

In addition to the trabeculae providing structure, an internal view of the corpus cavernosum would show the deep arteries, vascular spaces, smooth muscle cells, and exterior veins. The arteries are designed similar to a corkscrew allowing them lengthen without damage during erection (Mulcahy, 2006). Blood flows in through one of the deep arteries of the penis that run through the center of the corpus cavernosum, through the vascular spaces and out through the dorsal vein.

While the penis does not have a muscle in it, in healthy men, 40%-52% of the corpora cavernosa is smooth muscle tissue (Wespes et al., 1991). This muscle tissue is controlled by the parasympathetic nervous system (meaning, in part, that we cannot willfully control it) and is key to penile erection.

Is the penis a muscle?

If the corpus cavernosa are 40%-52% smooth muscle tissue (Wespes et al., 1991), isn't it fairly accurate when it's called a "love muscle"?

Not really. There are three types of muscle tissue in the body. Cardiac tissue is in the walls of the heart and is involuntary. Skeletal muscles attach to the skeleton and are under voluntary control (like our biceps and finger muscles). Smooth muscle tissue is involuntary and found particularly in blood vessel walls, and in the walls of organs like the intestines and uterus.

Generally, a "muscle" references a skeletal muscle (e.g., your deltoids). So, unless you call other organs like your liver a muscle, it's not accurate to call the penis a muscle. The pubococcygeus muscle wraps around the penis at it's base and can indirectly move the penis, but the penis itself does not contain a muscle that has any voluntary control.

Breaking a penis.

While there is no bone in the human penis that can be broken, the human penis can fracture. When firmly erect, extreme lateral pressure or bending puts longitudinal fibers on one side of the penis into tension while compressing the fibers on the opposite side. Large enough forces cause failure of the tunica albuginea. This can result in a rupture of the fibers and penile fracture.

Patients report "a sharp, cracking sound with severe pain followed by immediate detumescence (loss of erection), rapid swelling, discoloration and deformity of the penis" (Dincel et al., 1998, p. 18). The tunica albuginea is typically successfully repaired with surgery (Koifman, Barros, Júnior, Cavalcanti, & Favorito, 2010; Nugteren et al., 2010).

While frequency is not fully known, it typically happens to younger men (firmer erections) during aggressive intercourse or masturbation. One recent study also showed a correlation between penile fractures and sex under stressful situations (Kramer, 2011). Almost half of the penile fractures in their study occurred during an extramarital affair and 68.7% were during an "atypical scenario" including "out-of-the-ordinary locations for sexual intercourse, e.g., cars, elevator, the workplace, and public restrooms" (p. 3414).

Corpus spongiosum.

The single *corpus spongiosum* lies in the medial space (ventral groove) below the corpus cavernosa. It is also erectile tissue that undergoes vasodilation (widening of the blood vessels and increased blood flow) during erection, but it is not responsible for penile rigidity. It has a thinner (about a fourth of the thickness of that surrounding the corpus cavernosa) and more flexible tunica albuginea (tunica albuginea of the spongiosum). While the corpus cavernosa becomes firm during erection, the corpus spongiosum stays softer to protect and cushion the urethra during

intercourse allowing the passage of the ejaculate.

The base of the corpus spongiosum, between the crura, is called the bulbo spongiosum and is where the urethra enters. The corpus spongiosum lies in the ventral groove of the corpus cavernosa through the shaft and expands to a cap covering the end of the corpus cavernosa called the glans of the penis.

Glans penis. The tip of the penis is called the *glans penis* and ends in the opening of the urethra called the *meatus*. The glans penis is covered by the prepuce, or foreskin, in uncircumcised men. In some men, the glans is significantly larger than the shaft of the penis while in others it is similar, or smaller, than the shaft. The glans has abundant nerve endings from the perineal nerve and dorsal nerve of the penis.

The base of the glans is the *coronal ridge*, which is particularly sensitive in most men. It often has *pearly penile papules* arranged symmetrically around the coronal ridge.

Pearly penile papules around the coronal ridge

Typically developing after puberty, these papules are often a source of concern for men or their sexual partners and are sometimes mistaken for an STD. Actually, pearly penile papules are rather common, quite benign, and appear to have no specific purpose (Agrawal, Bhattacharya, & Singh, 2004).

At the underside of the coronal ridge is the frenulum of prepuce of penis, typically just called the *frenulum*. This is a fibrous strand of tissue that attaches the prepuce to the bottom of the glans. While overall, the glans is the most sensitive part of the penis (followed by the underside of the penis shaft), the frenulum is the most sensitive part of the glans for most men (Schober, Meyer-Bahlburg, & Dolezal, 2009).

Urethra.

The *urethra* is a long tube that extends from the base of the bladder, through the prostate and penis and ends in the *meatus*, or urethral opening. The urethra transports both urine and ejaculate out of the body.

While it is one continuous tube, the male urethra is generally divided into three sections. The *prostatic urethra* is the section that passes through the prostate gland and contains the prostate and ejaculatory ducts. The *membranous urethra* is a short section from the end of the prostate to the base of the spongiosum. Finally, the section of the urethra that passes through the penis (contained in the corpus spongiosum) is typically referred to as the spongy urethra and contains the ducts for the bulbourethral and urethral glands.

In a relaxed (non-aroused) state, the male urethra forms an "S" shape. Data on the normal length of the male urethra is quite varied (Kohler, Yadven, Manvar, Liu, & Monga, 2008; Krishnamoorthy & Joshi, 2012) but a study of 109 US men (Kohler et al., 2008) found a mean length of 8.78" (s.d. = .94", range: 5.9" – 11.42"). Compared to the typical length of the female urethra (1.6"), the male urethra is quite long. While the length and shape can make inserting a catheter more difficult in men, its length does help prevent urinary tract infections.

The urethral opening, or meatus, typically appears as a slit in the tip of the glans penis and stays closed to protect from infection. Hypospadias is when the urethra opens somewhere along the ventral side of the penis (under side of the penis - along the urethra) before the tip of the penis and occurs in about .3% to .4% of male births though it

appears to be on a dramatic rise in frequency (Salm, 2003). In *epispadias*, the urethral opening occurs on the dorsal side (top) of the penis and is far more uncommon (.0008%).

Fascia. The corpus cavernosa, corpus spongiosum, and deep dorsal vein are wrapped in the fascia penis, often called Buck's fascia. Just below the skin is another layer of fascia, the superficial penile fascia (Dartos fascia), wrapped around the fascia penis, the superficial dorsal vein and other superficial veins, arteries and nerves. This fascia is an extension of the abdominal and scrotal fascia and contains abundant smooth muscle fibers. The dorsal arteries present between the fascia penis and the superficial penile fascia primarily provide blood flow to the skin and glans and contribute little to erection.

Suspensory ligaments. There are two ligaments at the base of the penis. The suspensory ligament of the penis attaches to the pelvis and holds the penis close to the body. It also supports the penis when erect. This ligament can be torn or injured resulting in the penis hanging down when erect. Some penis lengthening surgeries cut this ligament allowing for more of the penis to hang outside the body giving the appearance of a longer penis.

The penis is also supported by the fundaform ligament. This ligament attaches to each side of the pelvis, runs along the side and bottom of the penis forming a sling. It also extends down to the scrotum.

Prepuce. While the outer covering of skin is a critical part of the structure of the penis, the prepuce, or foreskin, is a rather unique part of skin on the penis. The prepuce is a specialized tissue that marks the boundary between mucosa and skin similar to the eyelids, and lips. Extending from the shaft of the penis, the skin extends beyond the glands to fold back on itself ending just below the coronal ridge. Just under the skin is the extension of the dartos fascia, a layer of smooth muscle that keeps the prepuce pulled around the end of the penis when cool and relaxes to allow the glans to be exposed when aroused. The nerves on the inside of the prepuce are highly sensitive, much like those of the lip, fingertip, or coronal ridge. This is contrasted with the nerves of the glans, and the rest of the skin on the penis, which are less detailed in their sensations (Cold & McGrath, 1999; Morris L. Sorrells et al., 2007).

Phimosis is the inability to withdraw the foreskin behind the glans of the penis. When first born, the prepuce in 96% of males does not retract over the glans. Physiologic phimosis is thus normal in young males though some parents become highly concerned and attempt to encourage retraction with possible damage to the penis. The prepuce of most males retracts by three years of age though it can persist into adolescence. Approximately 2% of males will experience phimosis throughout life with no resultant consequences (Shahid, 2012). Only a small percentage (0.6% of boys 15 and younger) experience pathologic phimosis, which is typically resolved through use of topical steroids or circumcision.

Cutting the ligament to increase penis length?

One option offered to men wishing to increase the length of their penis is to surgically cut the suspensory ligament. Research on this procedure indicated the following:

> "Division of the penile suspensory ligament or other augmentation techniques may increase penile length but usually not to a degree that satisfies the patient. Men with penile dysmorphic disorder often have unrealistic expectations regarding the outcome of surgical intervention and should be encouraged to seek psychological help primarily, with surgery reserved as the last resort." (Li et al., 2006)

Big enough?

A primary cultural question centers on whether a man's penis is large enough. One study showed that 45% of men believe their penis is not large enough and only .02% believed it was too large (Lever, Frederick, & Peplau, 2006). In contrast, 84% of women were satisfied with their partner's penis size with 14% (mainly those who rated their partner's penis as abnormally small) wishing his penis was larger and 2% wishing it was smaller (Lever et al., 2006).

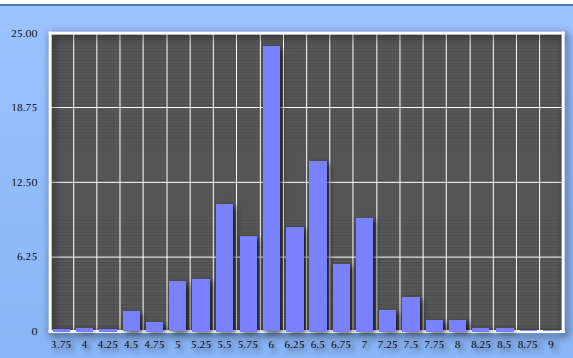
With this high level of concern, the marketplace is rich with products promising to increase penis size. While most of these do not work and many are actually harmful, some men do seek more surgical routes. One study of men seeking surgical solutions to lengthen their penis found that most had normal size penises (Mondaini et al., 2002).

Male concerns with not being large enough appears to begin in childhood when they begin comparing themselves to others boys (who may be at differing stages of development) or to pornographic images (Mondaini et al., 2002). Female concerns increase consistent with the number of partners doubling for those who have had multiple partners (Stulhofer, 2006). This suggests greatest satisfaction for those who are monogamous and take delight in their spouse rather than comparing themselves (or their spouse) to another.

While this is a fascinating cultural study, especially in light of the many spam emails on increasing penile size, science has sought to answer the "am I normal?" question. The result is a number of studies with varying answers (reviewed by Wylie & Eardley, 2007).

"Flaccid penile length is just under 4 cm [about 1.5 inches] at birth and changes very little until puberty, when there is marked growth" (Wylie & Eardley, 2007, p. 1450). The age at which this growth occurs can vary widely (Schonfeld, 1943) and be a source of concern for some boys. Of men complaining their penis was too short, 63% stated their concern began in childhood after comparing themselves to friends and 37% said it began in adolescence after comparing themselves to others in pornography.

The typical length and girth for a penis does not change much from study to study though it is larger in studies that rely on self-report vs. researcher measurement. While Lynn (2013) showed greatest



length in Negroids, intermediate length in Caucasians, and smallest in Mongoloids and (Son, Lee, Huh, Kim, & Paick, 2003) showed a difference in Korean men, meta studies suggest average penis length does not vary based on ethnicity (when controlling for height) (Wylie & Eardley, 2007) (Veale, Miles, Bramley, Muir, & Hodsoll, 2015), which is contrary to many myths. Additional mythology states penis length can be predicted by foot size, hand size, or other corollary body parts. Research has been unable to consistently support any of these myths. The correlation with overall height is the only connection consistently shown. Essentially showing that a longer overall body probably equates to a longer penis.

Based on a recent meta-study of over 15,000 men (Veale, 2015), the average flaccid (not erect) penis is about 3.6" long (9.16 cm, s.d. of 1.57 cm) but has wider range of variability than an erect penis. This means a smaller flaccid penis will tend to grow more during arousal than a larger flaccid penis.

Average erect length is 5.17 inches (13.12 cm, s.d. = 1.66 cm). Typical girth, or circumference (measurement around the outside of the penis, typically mid-shaft), for an erect penis is 4.59 inches (11.66 cm, s.d. = 1.10 cm).

In terms of satisfaction, one study showed that only 51% of men are satisfied with the size of their flaccid penis vs 83% of their erect penis (Morrison, Bearden, Ellis, & Harriman, 2005).

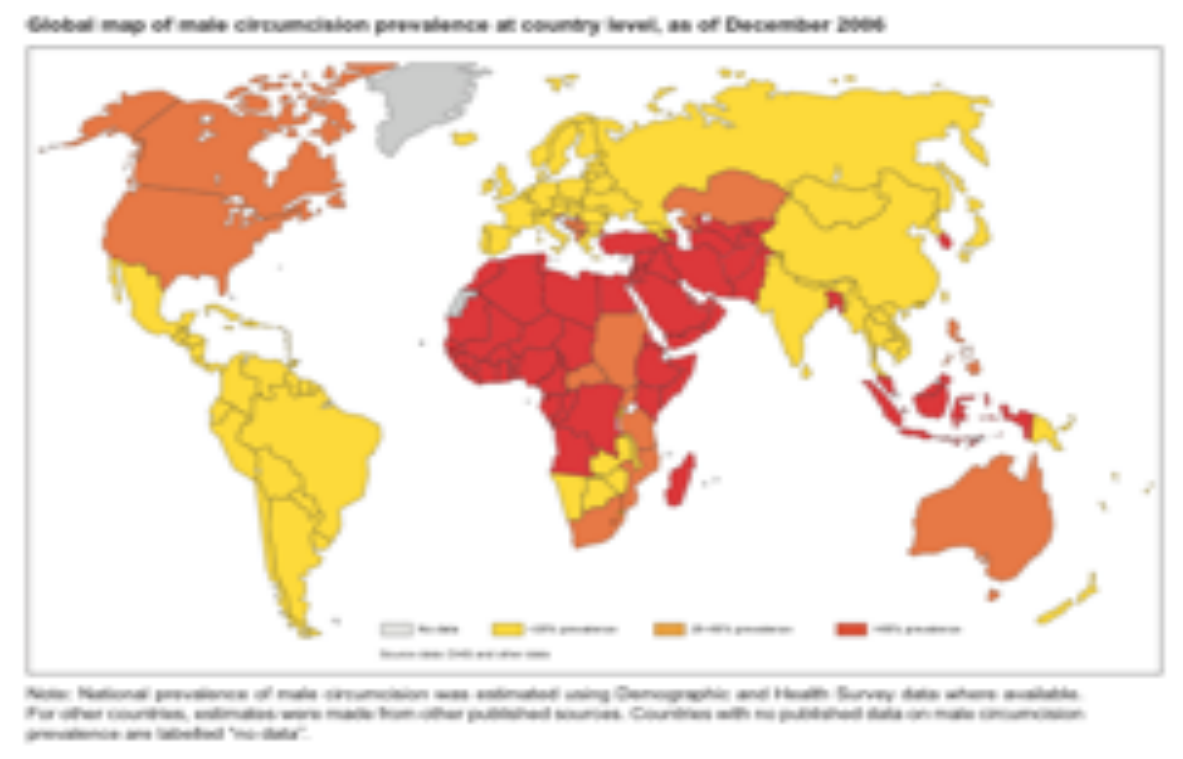
One common concern for men is that their partner will not be satisfied. When women were asked if they found penis length important, 55% stated penis length unimportant and 22% totally unimportant. Only 20% stated penis length was important and 1% very important (Francken, van de Wiel, van Driel, & Weijmar Schultz, 2002). Responses to the importance of girth were similar with women who believed length was important, marking girth as important also.

Circumcision

Male circumcision is the removal of the prepuce. It is one of the oldest and most common surgical procedures and is done for health, culture, and religious reasons. It is estimated that 30% of males are circumcised world-wide with the bulk of them (2/3) being Muslim. (Weiss, World Health Organization., Joint United Nations Programme on HIV/AIDS., & London School of Hygiene and Tropical Medicine., 2008).

A quick scan of the internet reveals heated debate on the issue of circumcision. Opponents point to the role the prepuce and see circumcision as mutilation and robbing a man of and important part of God designed (or evolutionary progress) sexual function. Proponents see circumcision as important for decreasing the risk of STI's, especially HIV. The World Health Organization (WHO), the Joint United Nations Programme on HIV/AIDS (UNAIDS), and the London School of Hygiene and Tropical Medicine recently reported "there is now conclusive evidence that male circumcision significantly reduces risk of HIV infection in men" (Weiss et al., 2008). Others argue that for men who prevent STI's through monogamy, or are otherwise not at risk of contracting them, circumcision has more downside than benefit. In one of the more recent professional policy statements, the American Academy of Pediatrics recently recommended circumcision of male infants after many years of opposing the practice.

> "Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks and that the procedure's benefits justify access to this procedure for families who choose it. Specific benefits identified included prevention of urinary tract infections, penile cancer, and transmission of some sexually transmitted infections, including HIV" (Baker, 2012)



Circumcision as a mark of faith?

While circumcision is practiced for many reasons, one of the most common is religious.

Judiasm. While not a new procedure to the world (Brand, England, & Draper, 2003, p. 299), God instituted circumcision as a mark of the covenant He made with Abraham and his decedents (Genesis 17:1-14). Abraham and every male in his household was circumcised at that point (scripture records that Abraham was 99 years old when he was circumcised). God established that all future male members of Abraham's family be circumcised on the eighth day of life. God reaffirmed this when He instructed the entire nation of Israel to be circumcised before going into the Promised Land since no male had been circumcised since leaving Egypt (Joshua 5:2-8). This tradition is continued with close to 100% of Jewish males in Israel, UK, Ireland, and the USA being circumcised today.

Islam. Pointing to being descendants of Abraham also, Muslims make up the largest group of people who circumcise. While not specifically required by the Qur'an, it is traditional in following Abraham's example and is required of anyone making the hajj to Mecca (one of the five pillars of the Islamic faith). The global spread of Islam is credited with the prevalence of modern circumcision around the world (Weiss et al., 2008).

Christianity. Being Jewish, Christ was circumcised on the eighth day (Luke 2:21), but this did not set the standard for the Christian faith. At the start of the Christian church, scripture records an early disagreement over circumcision. Converted Jews held that unless one was circumcised, they could not be saved and become Christians (Acts 15:1). The apostle Paul (writer of much of the New Testament scripture) taught that circumcision was meaningless under the new covenant of Christ (I Corinthians 7:19; Galatians 5:6, 6:15) and that there was no distinction between the circumcised and uncircumcised (Colossians 3:11). Instead, it is faith that justifies (makes righteous) both the circumcised and uncircumcised (Romans 3:30). Christians are the true circumcision (Philippians 3:3) and are "circumcised with a circumcision not performed by human hands" as their "whole self ruled by the flesh was put off when [they] were circumcised by Christ" (Colossians 2:11). Paul spoke strongly against circumcision by Christians. He identified it with mutilation and pagan cutting (Philippians 3:2) which was forbidden by God (Leviticus 21:5). Under the direction of Simon Peter (the recognized leader of the early Church), circumcision was removed as a mark of the faith (Acts 15). Baptism and the Lord's Supper (Communion) became external marks of the covenant for the Christian church. In 1442, the Catholic Church spoke strongly against circumcision (Tanner, 1990).

> "*Therefore it strictly orders all who glory in the name of Christian, not to practise [sic] circumcision either before or after baptism, since whether or not they place their hope in it, it cannot possibly be observed without loss of eternal salvation*"
>
> (Pope Eugene IV, 1442).

Today, while circumcision is practiced as part of the faith in a few Christian groups (i.e., Ethopian) (Weiss et al., 2008), most denominations and official teachings seem to be silent. Culture, tradition, personal preference of the parents, and health issues seem to be the primary determinants of circumcision in Christian homes rather than doctrine.

Scrotum

Hanging below the penis is the other external male sexual organ, the ***scrotum***. The scrotum is essentially a loose, dual chambered, pouch of fatless skin and fascia that contains the two male *testes,* or *testicles*. A homologue of the labia majora in females, the scrotum typically develops a light covering of hair during puberty. It has a line running vertically up the center (from the anus to the base of the scrotum) called the raphe scroti (Latin for "seam of the scrotum"), or Vesling's line, that marks where the folds that would have been the labia came together during fetal development.

The fascia of the scrotum (Dartos fascia) is an extension of the superficial penile fascia and Scarpa's fascia in the abdomen. Filled with smooth muscle cells, the Dartos fascia involuntarily contracts and expands working with the cremaster muscles to pull the testicles closer or, by relaxing, allow them to drop further away from the body. As the Dartos fascia contracts, the skin on the scrotum appears thicker and more wrinkled. With age, the smooth muscle tissue looses tone allowing the scrotum to hang more loosely and the scrotum to appear smoother.

It is believed one of the major functions of the scrotum is to serve as a temperature regulator for the testicles. Spermatogenesis (formation of the sperm) occurs most effectively at 95º-96.8º Fahrenheit (35º-36º Celsius), which is a couple degrees lower than the normal human body temperature of 98.6º (37º Celsius). As the scrotum relaxes, it expands allowing for increased surface area (cooling) and dropping the testicles further away from normal body heat. If the testes, or testicles become too cool, it pulls the testicles up tight against the body for increased warmth while decreasing surface area.

It has also been theorized that the design of the scrotum and external position of the testes is to protect them from the internal pressure of the body. If they were internal (like the homologous ovaries) they would be subject to "concussive hydrostatic rises in peritoneal pressure" as we jump and leap (Chillón et al., 1995). A sudden increase in pressure to the testicle would force it to expel the developing sperm before they are mature. Having them in the scrotal sack separates them from internal body pressure.

Could your laptop hinder your fertility?

In a study reported in *Human Reproduction*, researchers found that males holding a working laptop computer in their laps resulted in a significant increase in scrotal temperature due to the heat of the laptop combined with body position (Sheynkin, Jung, Yoo, Schulsinger, & Komaroff, 2005). As scrotal hyperthermia had been previously shown to be a factor in male infertility, they concluded that "Long-term exposure to [laptop computer]-related repetitive transient scrotal hyperthermia is a modern lifestyle feature that may have a negative impact upon spermatogenesis, specifically in teenage boys and young men. Further studies of such thermal effects on male reproductive health are warranted" (p. 452). In other words, it may be worth keeping the laptop on the desk or counter rather than in your lap.

Testes

Wrapped in fascia and the cremaster muscles are the male gonads, or testes (singular is testis or testicle). Homologous to the ovaries, the testes have two main functions after puberty — to produce testosterone and sperm (spermatogenesis). As such, they belong to both the endocrine and reproductive systems in our bodies.

The word "testes" is from the Latin "testis", which means "witness". Beliefs on the origin of the word reflect both the pairing (early witnesses were in pair) and that an early form of swearing something to be true (witnessing) involved placing your hand on the testicle of the one you are swearing to.

Initially, the gonads (undifferentiated testes—or ovaries) begin development in the abdomen of the fetus. If the fetus has two X chromosomes, the gonads will develop into ovaries. In the male, the SRY gene found on the Y-chromosome initiates the sex differentiation process that causes the fetal gonadal tissue to develop into a testicle. Beginning in the third month of fetal development the testes decend from high in the posterior fetal abdomen down through a passage called the "inguinal canal" and into the scrotum. They have generally descended by the time of birth (97% in full-term – much less in premature births) or within the first three months after birth.

Undescended Testes

Cryptorchidism, from the Greek "kryptos" meaning "hidden" and "orchis" meaning "testis", is the failure of the testes to fully descend into the scrotum. While reportedly on the rise, it is diagnosed in about 1-2% of males and is generally treated with surgery during early childhood to help prevent infertility and other associated problems. (Anguiano A & et al., 1992)

In a healthy adult male, the average size of each testicle is about 2" x .8" x 1.2". Each is composed of 250-350 lobes separated by connective tissue and contained within a tough membrane (tunica albuginea). Each lobe contains fine coiled *seminiferous tubules* lined with *sertoli cells*. The sertoli cells provide support, protection and nourishment while the sperm cells develop. Sertoli cells also provide a blood-testes barrier that prevent blood from entering the seminal vesicles. Additionally, this barrier prevents the body from recognizing the sperm as foreign (since each sperm cell is genetically unlike all the other cells in the body, having only ½ the complement of genetic material) and developing antibodies that attack and destroy the sperm.

Leydig cells are found between the seminiferous tubules in the testes and produce testosterone.

The epididymis is 5-10 mm thick and lined with cilia and microvilli that slowly move the sperm through it's length. This journey takes 8-17 days during which time the sperm mature.

Vas Deferens

The vas deferens (plural: *vasa deferentia*, also called the *ductus deferens*) are the two ducts connecting the left and right epididymis to the ejaculatory ducts that transport sperm in preparation for ejaculation. Each tube is about 18" long and has dense walls and a very small canal.

Vasectomy

The vasectomy is a typical male sterilization procedure in which the vas deferens are severed (and generally sealed through cauterization, plugs, or caps) just before they leave the scrotum. (See the "Birth Control" section for more information.)

The vasa deferentia pass from the epididymis, out of the scrotum and up into the abdomen. Taking a circular path, they loop over the pubic bone and bladder descending on the anterior side of the bladder to enter the *prostate*. As they enter the *prostate* they join with the duct of the *seminal vesicles* to form the *ejaculatory ducts*.

Congenital Bilateral Absence of the Vas Deferens

CBAVD is present in about 95 percent of men with cystic fibrosis, an inherited genetic disorder. It is responsible for 1%-10% of cases of infertility in men and is associated with an absence of seminal fructose. (Anguiano A & et al., 1992; Chillón et al., 1995; Jequier, Ansell, & Bullimore, 1985)

Seminal Vesicles. The seminal vesicles are glandular ducts, each about 2" (5 cm) long. They produce a thick, gel like alkaline secretion (ph 7.4) that is high in fructose (presumably as fuel for the sperm). This fluid makes up 50%-70% of the ejaculate and is stored in the vesicles until arousal. In addition to fructose, the seminal vesicles produce a number of other substances designed to assist the sperm including antigens (to protect them from the female immune system), a number of motility enhancers, and a unique protein that is responsible for the initial thickness of the ejaculate (Gonzales, 2001).

The wall of the seminal vesicles has strong smooth muscle cells allowing them to force the fluid out. Surgery for prostate cancer will usually include removal of the seminal vesicles along with the prostate in order to insure that the cancer has not involved them as well.

The typical ejaculate is between 3 and 5 milliliters and contains over 15 million sperm per milliliter (Cooper, 2010). There is concern that sperm count is decreasing at the rate of 1-2% per year in Western culture (Rolland, 2013). Explanations provided for this vary from toxins in the environment, diet and lifestyle changes, to cell phone usage.

Ejaculatory Ducts. The *ejaculatory ducts* are the end of the *vasa deferentia* and form the junction of the seminal vesicle duct and the vas deferens. Both ejaculatory ducts empty into the single urethra.

Prostate. The prostate gland is a pyramid-shaped structure about the size of a walnut that surrounds the urethra as it emerges from the bladder. It is composed of glandular and fibro-muscular tissue and can be felt during a rectal exam. The prostate has two primary roles, the first of which is to produce about 30% of the ejaculate fluid, a fluid generally thinner than that produced by the seminal vesicles. The second role is to serve as a valve for the bladder, essentially a gatekeeper between the urinary tract and the reproductive tract preventing the mixing of urine and ejaculate. During ejaculation, the top zone of the prostate contracts closing the neck of the bladder preventing urine from passing out and ejaculate from flowing up into the bladder (retrograde ejaculation).

Fairly small at birth, the prostate grows during puberty and is susceptible to many disorders, including inflammation, enlargement (benign prostatic hyperplasia), and cancer. Prostatitis (inflammation of the prostate) may be acute, with sudden onset of intense symptoms, or chronic, varying in intensity and duration of illness. Most cases of prostatitis are caused by infectious agents (i.e., bacteria), especially in the acute disease. Often the offending bacteria is sexually transmitted. Chronic prostatitis is not as well understood and the infectious causes are often unclear.

Benign Prostatic Hyperplasia (BPH), a "highly treatable" (Burnett & Wein, 2006) benign enlargement of the prostate, can cause symptoms such as urinary hesitancy, frequent urination, painful urination, increased risk of urinary tract infections, and urinary retention. The risk begins at about age 35 with BPH present in 8% of men by age 40. Up to 15%-25% of men age 50-65 have symptoms and BPH is present in more than 50% of men over 60 years old. While it can often be

treated with medications, a quarter of men require surgical intervention (Thorpe & Neal, 2003).

Prostate cancer is currently the third most common cancer in men world-wide and the most common male cancer in the US, with a half-million new cases each year (Hyun, 2012). Three-quarters of these cases occur in men over 65 years old with a much higher prevalence for men in developed countries (worldwide, prevalence is highest in the US and Canada) (Quinn & Babb, 2002). While risk factors continue to be identified (i.e., risk goes up in middle-aged men in direct relation to the number of female sexual partners they had but not with frequency of sexual intercourse (Rosenblatt, Wicklund, & Stanford, 2001)), the cause of prostate cancer is unknown. There are also no proven preventative measures (Quinn & Babb, 2002). If caught at an early stage, prostate cancer is largely curable with a combination of radiotherapy and prostatectomy. The American Cancer Society reports 5-year survivability at 100% and 15-year at 91% (American Cancer, 2012) with survivability expected to continue to climb as newer detection and treatment methods are developed.

Prostate cancer is typically treated with radiation/chemotherapy and/or surgery to remove the prostate. Any of these treatment methods can dramatically effect an individual's sexual functioning. Whether it be from increased depression and anxiety (Korfage, Essink-Bot, Janssens, Schröder, & de Koning, 2006), medicine impact, nerve damage, incontinence, or inorgasmia, prostate cancer can radically change an individual's sexual functioning in as many as 86% of men with prostate cancer (Howlett et al., 2010). Men who have had the prostate (and typically seminal vesicles) removed or destroyed from radiation are typically able to return to orgasms, but they are unable to ejaculate which dramatically changes the feel of the orgasm. Due to nerve damage, some experience permanent erectile dysfunction.

Can pregnancy occur from pre-ejaculatory fluid?

A common area of concern is if pre-ejaculatory fluid contains enough sperm to cause a pregnancy. Two limited studies (each with a small sample size) showed a lack of sperm in the pre-ejaculate (Ilaria et al., 1992; Zukerman, Weiss, & Orvieto, 2003) while another (Pudney, Oneta, Mayer, Seage, & Anderson, 1992) showed about a third contained "a few small clumps of spermatozoa" that were generally not motile. These studies would seem to counter Masters & Johnson's claim (without documenting their backing) of "large numbers of active spermatozoa in the pre-ejaculatory secretion" (Masters & Johnson, 1966, p. 211). A study completed in 2011 (Killick, Leary, Trussell, & Guthrie, 2011), however, found that 41% of their subjects had sperm in the pre-ejaculate at concentrations and motility comparable to the ejaculate samples, despite ensuring the urethra had been flushed several times since the last ejaculation. Because the volume of fluid in the pre-ejaculate is low, the number of sperm was quite low, but the researchers caution that they were "unable to say how this finding might translate into the chances of pregnancy if these samples of pre-ejaculate were deposited in the vagina except that the chances would not be zero" (Killick et al., 2011, p. 51).

Bulbourethral Glands. Below the prostate, at the base of the penis, are two pea-sized glands flanking the urethra homogolous to the Bartholin's glands in the female. They are often called Cowpers glands after a 17th century English surgeon named William Cowper. During sexual excitement they secrete an alkaline mucus-like fluid that functions as a lubricant for the semen and

neutralizes the acidity of urine residue in the urethra. It also provides some lubrication for the tip of the penis and helps neutralize the acidity of the vagina to help with sperm longevity (Chughtai et al., 2005). This pre-ejaculate (common slang: pre-cum), has been shown to transmit STI's (especially HIV, chlamydia, and gonorrhea) and possibly sperm (see side bar).

Urethral glands (also called Littre glands), are small glands that produce mucus. It is believed this mucus keeps the urethra lubricated and protects it from the effects of urine. While present along the length of the urethra, they are most plentiful in the section that passes through the penis (spongy urethra).

Female Sexual Anatomy

How beautiful you are and how pleasing,
my love, with your delights!

Song of Solomon 7:6 (NIV)

Venus Statue

While male sexual parts tend to be more external and visible, the majority of female sexual anatomy is internal. As with the section on male sexual anatomy, however, we will begin with a description of the external structures before proceeding to internal sexual anatomy.

The attention seeking kindergartener in the 1990 film *Kindergarten Cop* (Salem, 1990) reflected the common vernacular of difference between males and females in announcing, "boys have a penis and girls have a vagina." While this is accurate, it often leads to the erroneous belief that a vagina is simply an inverted penis. In reality, the female body is far more intricate and intriguing.

Despite modern advances in research technology, female sexuality is intricate enough that there remain several areas of mystery, especially related to female sexual anatomy and physiology. This leads to significant misinformation in the public as well as professional disagreement and debate on definition and discussion (V. Puppo, 2011). The overall message is clearly the beauty and mystery of God's design in the pinnacle of His creation.

What follows is a description of this mystery based on current research and thought. It is subject to change with ongoing discovery and debate.

Vulva – External Female Genitalia

The most accurate to reference to female genitalia is the *vulva*. Vulva (Latin for "covering") is the name for the external structures between the legs from the mons pubis to the anus. This entire region has a rich blood and nerve supply.

Historically, the vulva was often called the "pudendum". According to Oxford Dictionaries, "pudendum" comes from Latin pudenda (membra) '(parts) to be ashamed of'" (pudendum, 2012). It is a sad commentary that we would reference female genitalia with "shame".

The only modern use of "pudendum" is in referencing the pudendal nerves, arteries, and veins (these bilateral structures serve the external genitalia of both male and female).

Female genitalia have often been compared to flowers in art and poetry.

Orchids of the Clitoria genus and Red Calla Lilly are two common examples.

Mons Pubis

The *mons pubis* (Latin for "pubic mound") is a rounded cushion of adipose (fatty tissue) and loose connective tissue located on top of the pubic symphysis bone. It is sometimes called the mons veneris, meaning "mound of Venus" for the Roman goddess of love and beauty. The mons pubis is rich in nerve endings containing more touch receptors than the clitoris (though fewer pressure receptors) and for some women can be a source of sexual excitement. The fat in the mons pubis (and the labia majora) is particularly estrogen sensitive. As such, it is often larger shortly after birth due to the residual effect of maternal estrogens. During early childhood it tends to lose fat and remain smaller until puberty when the increase in estrogen prompts it to enlarge again and become covered with pubic hair. During aging, and the decrease of estrogens, the covering of pubic hair becomes sparse and the subcutaneous fat decreases again. (Farage & Maibach, 2011)

The fat in the mons pubis is typically resistant to diet and exercise. Instead, the design provides for a rather permanent cushion to the pubic bone, even with great weight loss. This can be of great concern for some young women when the fashion is toward tighter fitting clothing (see "Am I Normal" sidebar).

While partially or fully removed in some cultures, the hair on the mons pubis serves to provide additional padding and friction reduction. It serves as a lubricant during intercourse and in protecting sensitive tissue from rubbing by clothing. At the top of the mons pubis, the pubic hair tends to end abruptly in a straight horizontal line forming a triangle of hair (often called the female escutcheon) in about 75% of females. In

males, and up to 25% of females, the hair line is typically prolonged in the median line toward the umbilicus (Hornstein, Schwerin, & Sloane, 2013). The lack of a defined female escutcheon in women may be a hereditary trait or might be the sign of a higher androgen level. At the bottom, the mons divides into the two labia majora at the anterior commissure of the labia majora.

"Female" in scripture

When God created mankind, scripture initially states "male and female He created them" (Genesis 1:26). The Hebrew word used for "female" is נְקֵבָה - *neqebah* (Strong, 2009 #5347). According to Strong, this Hebrew word comes from the word נָקַב - *n,qab*, which means to *puncture*. Many Old Testament scholars believe this to be a reference to the vagina.

Conversely, when this passage is quoted in the New Testament (Matthew 19:4, Mark 10:6) the Greek word θῆλυς - *thēlus* is used (Strong #2338) which comes from a word (θη- *thē-*) meaning *to suckle*, a reference to breast.

Labia Majora

The *labia majora,* or major lips, are two rounded pads of adipose (fatty) tissue that lie on both sides of the *pudendal cleft* (vulvar slit). They are typically covered with sparse hair on their outer pigmented surface. In an unaroused state, they may appear somewhat wrinkled on the outside. The inner surface is smooth, shiny, and hair free with a liberal supply of sebaceous glands (see next box for explanation). Like the mons pubis, the labia majora have abundant nerve endings.

Just under the skin, the labia majora contain a fascia rich with smooth muscle fibers similar to the dartos muscle in the male. This fascia is temperature sensitive contracting and expanding much like the male scrotum (the homologous tissue) though to a lesser degree. Underneath this is the estrogen sensitive adipose tissue (extension of the mons pubis).

It appears the primary purpose for the labia majora is to help protect the vestibule. For some females, the labia majora totally hide the structures in the pudendal cleft when in a non-aroused state. For other females, the clitoris and/or labia minora may protrude beyond the labia majora.

Sebaceous Glands. While not a structure in themselves, the entire vulva is filled with sebaceous glands. These glands produce sebum – a mixture of oils, triglycerides, cholesterol, and waxes. Sebum protects the skin by lubricating, waterproofing, and creating a protective layer that repels urine, menstrual flow, and bacterial infections. Like sebaceous glands on other parts of the body, they can become blocked causing sebaceous cysts – a small nodule, often painful, about the size of a small pea (similar to a pimple). Typically, they will drain spontaneously and disappear within a few days. If they become infected, they may require medical treatment.

Labia Minora

The *labia minora,* or inner lips, are two thin, hairless skin folds just inside the labia majora. The labia minora are composed of fat-free elastic tissue that contains a high number of nerves that are very sensitive to light touch (like those in the facial lips and the male coronal ridge).

Additionally, the labia minora may contain venous sinuses (blood spaces) that fill with blood during arousal. The number and size of these cavities is extensive in some women and hardly present in others (Meston, Levin, Sipski, Hull, & Heiman, 2004). Unlike the clitoris, the labia minora do not have the smooth muscle tissue or trabecular vascular tissue that allows the clitoris to be

erectile. Instead, the high level of elastin allows them to swell and fill with blood during sexual excitement (Ginger & Yang, 2011). This arousal typically causes a color change and can increase the size of the labia minora by two to three times their unaroused state.

The labia minora vary greatly from female to female in size, shape and color. (See "Am I Normal?" sidebar.) They also change in size and color depending upon age, menstrual cycle, pregnancy, and state of sexual arousal.

There is great variation in female vulvas as seen in these castings of female vulvas from *The Great Wall of Vagina* (McCartney, 2011)

At the top, the labia minora merge to form the *clitoral prepuce* (clitoral hood), a structure homologous to the prepuce of the penis. It varies greatly in size from female to female fully covering the glans clitoris in some women and barely being present in others. It contains glands that produce smegma and can occasionally develop adhesions to the clitoris.

The labia minora join again below the clitoris forming the *clitoral frenulum*. They then extend down parallel to the labia majora surrounding the urethra and vaginal opening to join again at the posterior limit of the vaginal opening merging into the skin of the labia majora in a frenulum often called the *fourchette* (or posterior commissure of the labia minora).

Am I Normal?

One of the most common questions from especially younger women is some variation of "Do my genitals look normal?" In a sex and porn saturated society, many women have already compared themselves and may experience anxiety over how they look. This is evidenced, in part, by the increase in cosmetic genital surgery for women. The American Society for Aesthetic Plastic Surgery reported a 5.5% increase in "vaginal rejuvenation" surgery from 2010 to 2011 (American Society for Aesthetic Plastic Surgery, 2011) despite research showing that all of the women presenting for such surgery in one clinic had normal sized labia [[reference]].

"The increased demand for cosmetic genitoplasty may reflect a narrow social definition of normal, or a confusion of what is normal and what is idealized" (Liao & Creighton, 2007). Most women presenting for genital plastic surgery seem to be seeking smaller genitals (in contrast to men). Theories for this tend to be that social pressure (especially exposure to porn) has idealized a seek a "flattened genital surface with labia so small that they are completely hidden by the labia majora" (Liao & Creighton, 2011). This reflects a prepubescent aesthetic.

While the internet makes it easy to find pictures of female genitals, those that are displayed may not be representative of the norm. Norms for male genitals are widely available and have been published as early as 1899 (as cited by Lloyd, Crouch, Minto, Liao, & Creighton, 2005) but norms for females are far more elusive.

For those who seek surgical methods to meet an "ideal" look for themselves or their partner, the trade off might be a decrease in genital sensation and sexual responsiveness.

> "Given the generous vascular and innervation patterns within the labia minora, as well as evidence that the tissue is sexually responsive, there is good reason to believe that alteration of the labia minora can change sexual responsiveness. Exenterative procedures, such as vulvectomy, reduction labiaplasty, and certain forms of female circumcision, can have a deleterious effect on the sexual response by ablating the substrate through which sexual sensations enter the central nervous system" (Ginger & Yang, 2011).

Vulvar Vestibule

The *vulvar vestibule* is the space enclosed within *Hart's line* (named after gynecologist and researcher David Berry Hart - 1851-1920). Hart's line is a visible boundary between the typical looking skin (keratinized squamous epithelium) on the outside of the labia minora and the shiny mucosa (non-keratinized epithelium) on the inside of the labia minora. The vulvar vestibule extends from the clitoris, down hart's line on each labia minora to the forchette and in to the hymenal ring (see illustration). It contains the openings of the urethra, vagina, and Bartholin's glands. The hairless mucosa is slick having very limited keratin content. This makes it more permeable to fluid and microorganisms.

The vestibule is a common area of pain for women with one recent study showing 28% of women reporting a history of pain in the vestibule (Reed, Crawford, Couper, Cave, & Haefner, 2004). The causes of vestibular pain are varied and often enigmatic. (Will be covered in more detail in the sexual pain section.)

While the vestibule is only skin deep, it is highly responsive to direct stimulation and a central part of female sexuality. Just under the skin of the vestibule is erectile tissue composing the root of the clitoris.

Clitoris

The *clitoris* is one of the primary sexual organs in the female. Homologous to the penis (developing from the same embryonic tissue) it has some similarities in structure to the penis including a glans, corpra cavernosa, and a rich blood and nerve supply. Yet, like women are unique from men, the clitoris is unique from the penis in some critical ways.

Often the most erotically sensitive part of the female body, the clitoris has around 8,000 nerve fibers, double those in the penis (Manassiev & Whitehead, 2004). It is the primary source of orgasm for most women.

Typically, the small, visible glans of the clitoris is referred to as the "clitoris" with assumption that the glans constitutes the whole of the organ. In reality, the glans is a small part of a larger organ made up of the glans, shaft, crura, and bulbs[†].

Glans clitoris. The glans of the clitoris is the only part of the clitoris that is external and visible and often referred to as *the clitoris*. It is about 3.4 mm by 5.1 mm (Verkauf, Von Thron, & O'Brien, 1992) and composed of corpus spongiosum tissue extending from the vestibular bulbs (van turnhout, Hage, & van Diest, 1995)[‡]. While indirect stimulation is typically essential for sexual pleasure, the glans is often too sensitive for direct stimulation (O'Connell, Eizenberg, Rahman, & Cleeve, 2008).

The prepuce of the glans clitoris, or *clitoral hood* covers the glans of the clitoris. Similar to the foreskin of the glans penis in the male, the clitoral hood protects the glans. At times during sexual arousal, the glans may extend beyond the clitoral hood and at other times retract beneath the hood.

The clitoral hood wraps around the sides of the clitoris and each side meets at a point called the frenulum between the glans and the urethral opening (meatus). While the skin is continuous, this marks the top of the labia minora (O'Connell et al., 2008).

Clitoral Shaft. The shaft of the clitoris contains two corpora cavernosa. Typically 2.3-3 cm long (.9"-1.2"), they are similar to the

[†] The boundary of the clitoris is debated in the field. Some include only glands, root, and crus. Others include these plus bulbs and spongiosum surrounding the urethra.

[‡] This is an area of disagreement in the field as some do not believe the glans is spongiosum tissue (i.e., Manassiev & Whitehead, 2004).

corpus cavernosa in the male penis, being filled with vascular spaces and smooth muscle fibers, wrapped in the tunica albuginea (O'Connell et al., 2005).

Two muscles (ishiocavernosus and bulbocavernosus) contract during sexual excitement compressing the dorsal vein (the only exit for clitoral blood) facilitating engorgement and erection (Hornstein et al., 2013)

Crura. As in the male penis, the corpus cavernosa in the shaft split to form two crura. The crura of the clitoris wrap along the sides of the vaginal opening (introitus).

Clitoral Bulbs. Traditionally called "vestibular bulbs", these bulbs are arranged like saddlebags hanging over and to the sides of the urethra and vaginal opening. Composed of erectile tissue, they are not enclosed in a tunica albuginea and are similar to the corpus spongiosum in the male (Ginger & Yang, 2011).

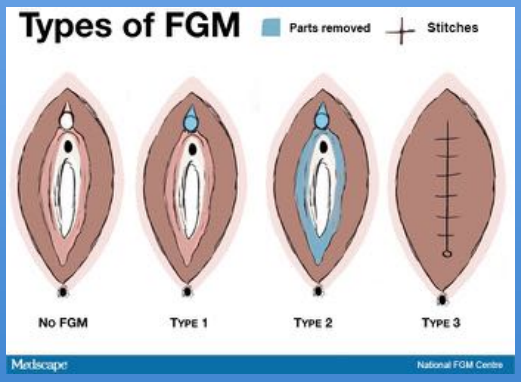
Individual differences, age, and possibly hormone levels will vary the size of the bulbs (Ginger & Yang, 2011). Lacking the tunica albuginea, the bulbs can swell significantly under arousal (Suh et al., 2003). With their position just under the skin of the vestibule, this can give the appearance and sensation of fullness in the vulva.

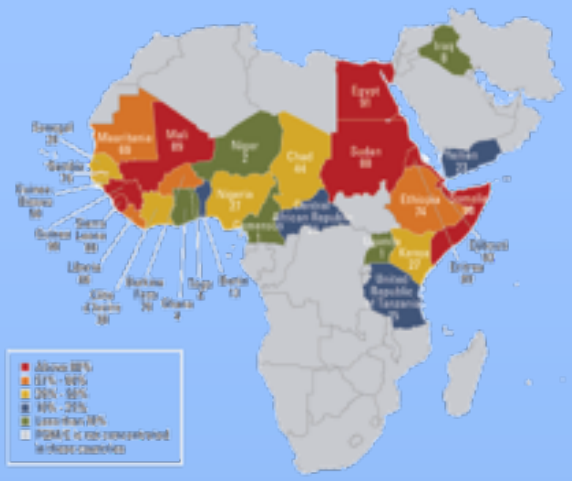
Female Genital Mutilation

Female Genital Mutilation (FGM) "includes procedures that intentionally alter or cause injury to the female genital organs for non-medical reasons" (Organization., 2018). It is performed for various cultural, religious and social reasons. While often associated Islam, it has been practiced in various religions without support from sacred writings. Research shows ethnicity is more correlated with the practice than religion. Cultures vary on the age at which it is performed. In some, the procedure is performed during infancy (Fund, 2019) but others wait until adulthood. There are four main types:

1) *Clitoridectomy* is the partial or total removal of the clitoris.
2) *Excision* is the partial or total removal of the clitoris and the labia minora, with or without removal of the labia majora.
3) *Infibulation* is cutting and repositioning the labia to create a seal and narrow the vaginal opening.
4) Other types of procedures. pricking, piercing, incising, scraping and cauterizing the genital area.

Occurrence of FGM is concentrated in a swath in Africa from the Atlantic Coast to the Horn of Africa but it can be found in other regions of the world, particularly in communities that have immigrated from high incidence cultures.





(Organization., 2018)

The various forms of FGM are typically performed by traditional practitioners who may use objects like a razor blade, knife, or piece of sharp glass. In a few cultures, health care professionals perform the procedure. In Egypt, over three quarters are performed by a physician (Organization., 2018).

The impact of FGM to the women can be quite varied and range from minor scarring to severe sexual and physical problems. Infection and even death are also possible. More difficult to measure are the potential psychological and image impacts.

Despite the possible costs and strong international move to eliminate FGM, support for it remains high in cultures that practice FGM. This continues to shift as the majority of males and females in practicing countries state support of the practice ending. This support increases with wealth and education. Younger individuals are less supportive of FGM than older men and women.

Urethra

Between the clitoris and the vagina is a small elevation with the opening of the urethra in the center. While the *urethra*, and urethral opening (meatus), is not generally considered sexual, they are a part of the vulva and have been the focus of some controversy in sexual anatomy (O'Connell et al., 2008; V. Puppo, 2011). The primary purpose of the urethra is to transport urine outside the body from the bladder.

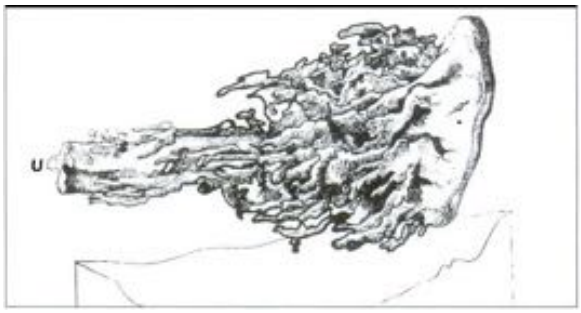
The distance between the clitoris, urethral orifice, and vagina has been shown to predict ease of orgasm in some women (Wallen & Lloyd, 2011) with shorter distances being more predictive of orgasm. It is possible that the shorter distance results in more direct and indirect stimulation of the clitoris during intercourse.

During intercourse, it is not uncommon for the urethral opening to be pulled in and out during thrusting. This action, combined with the knowledge that the female urethra is only about 4 cm (1.6") long (Salonia et al., 2010) makes urinary tract infections more common in females, especially after an increase in sexual frequency (Nicolle, Harding, Preiksaitis, & Ronald, 1982). It is typically recommended that women void their bladder shortly after intercourse to flush the urethra of any microorganisms that might have entered the urethral orifice during sex.

Like the male urethra, the female urethra is surrounded by spongy tissue that engorges with blood during arousal but is not erectile in nature (Ginger & Yang, 2011; Yang, Cold, Yilmaz, & Maravilla, 2006).

Female Prostate

In the mid 1600's, Dutch physiologist Reinier de Graaf identified an erogenous zone in females he compared to the male prostate that produced "female semen" (De Graaf, 1672). Gynecologist J.W. Huffman (Huffman, 1948) made a mold of these glands from eleven post-mortem women showing the layout of these glands (see illustration).



Drawing of the glands surrounding the urethra ("U").

While historically referenced as Skene's glands and paraurethral glands, these terms do not reflect recent understanding and in 2002 the Federative International Committee on Anatomical Terminology (FICAT) removed these names using only "*female prostate*" in the official Histological Terminology text.

The modern recognition of this collection of glands as the female prostate has been largely credited to the work of Slovakian

Honeymoon Cystitis

While less frequent in a culture where sex occurs before the honeymoon, "honeymoon cystitis" is still fairly common. In addition to the general vasocongestion during arousal, penile thrusting can cause general irritation as well as facilitate the movement of bacteria up the urethra. All this can cause cystitis, or inflammation in the bladder. Most of the time this is a result of bacteria infecting the bladder (80% Escherichia coli and 11% Staphylococcus spp) and is usually easily treated with an antibiotic (Kanematsu et al., 1991). Symptoms include burning or pain on urination, urinary frequency, residual urine sensation, cloudy, discolored or foul smelling urine, and sometimes generalized pain in the vulva or lower abdomen. Treatment should be sought before the infection spreads to the kidneys.

forensic pathologist Milan Zaviačič (Zaviačič, 1999; Zaviačič et al., 2000). While others had discussed it, Zaviačič identified four different types of female prostate.

Yours is smaller

While there is great similarity in the homologous organs, those of the female tend to be smaller. This does not mean they are any less potent. The heart of a 40 year old female is about 35 g lighter and smaller than a male of the same age and size yet no one would say it is less important, or in any way inferior to the male heart. Similarly, the female prostate (or clitoris) cannot be considered inferior just because it is smaller than that of the male. (Zaviačič, 1999)

Roughly 1/10th to 1/4th the size of the male prostate (Zaviačič, 1999), it still contains all the same components (secretory cells, glands, ducts, smooth musculature) of the male prostate. The primary function of the female prostate appears to be to produce prostatic fluid. Tests of this fluid have shown it is identical to fluid produced by the male prostate (i.e., PSA, PSAP, fructose) [references]. In the female, it enters the urethra through a host of ducts (more than 2x that of the male) along the length of the urethra (Zaviačič, 1999). As in the male, "the female prostate discharges its contents through the urethra by mechanism of continual secretion or upon urethral expulsions" (Zaviačič, 1999, p. 30) that might be ejaculated during orgasm.

The second function of the female prostate appears to be neuroendocrine. While research is still underway, it appears the tissue contains specialized cells that release serotonin. One theory is this could be part of why some women find stimulation of the female prostate (through vaginal intercourse or digitally stroking of the front of the vaginal cavity) to be sexually arousing (Salonia et al., 2010).

Women need to be encouraged to enjoy what they find pleasurable and not set up finding the G-spot or experiencing orgasm or female ejaculation as a goal.

- B. Whipple(Jannini et al., 2010)

Bartholin glands

The Bartholin glands (greater vestibular glands) are small pea shaped glands at the 4 and 8 o'clock positions of the *introitus* (opening of the vagina) (Suh et al., 2003). Homologous to the to bulbourethral glands in males, it is generally thought that they provide moisture and lubrication to the vestibule. They stay largely unaffected during sexual arousal (Suh et al., 2003). The couple drops of fluid excreted during sexual arousal may help lubricate the vestibule but most of the fluid present during arousal is from the vagina.

Cysts of the Bartholin glands account for about 2% of gynecologic visits each year (Marzano & Haefner, 2004) as the duct becomes blocked. Often painless when small, a cyst may go unnoticed or be discovered as a small lump at the opening of the vagina. If it remains obstructed, it may become infected and tender. Spontaneous resolution often occurs with use of a warm compress or bath. Obstruction of the duct is often caused by common bacteria (e.g., *E. coli*), but can be associated with STI's (e.g., gonorrhea and chlamydia). If the cyst lasts for several days, appears infected, is especially painful, is combined with fever, or is otherwise suspicious, it should be assessed by a physician. Infected cysts need treatment (WebMD, 2011).

G Spot

Awareness of erotic areas inside the vagina are not new. In the modern era, De Graaf (1672)is credited with being the first to describe an erotic zone in the front vaginal wall (Jocelyn & Setchell, 1972). He also identified female ejaculation and associated it with this erotic zone.

In 1950 German gynocologist Ernst Gräfenberg wrote on *The Role of Urethra in Female Orgasm* stating "an erotic zone always could be demonstrated on the anterior wall of the vagina along the course of the urethra (Grafenberg, 1950). In the early 1980s writers named the erotic zone after Dr. Gräfenberg (Addiego et al., 1981; Ladas et al., 2005) calling it the "G-Spot". While their writing on the subject was compelling, there was a high degree of controversy in the field around the subject and specific anatomical structures making up the zone were not agreed upon. Skene's glands (Skene, 1880), the female prostate (Zaviacic & Whipple, 1993) and a host of other structures have been called the g-spot. Ostrzenski claims it is not a "spot" but a "a tiny anatomical structure within the anterior- distal vaginal wall" he discovered (Ostrzenski, 2012, 2019). Others claim the g-spot is a complex collection of structures including the urethra, the Halban facia, and internal clitoral structures—all of which can respond pleasurably to touch (Levin et al., 2016). Some still say the g-spot doesn't exist all together (Hines, 2001; Vincenzo Puppo & Gruenwald, 2012).

History and research appear to strongly suggest whatever it's anatomical structure is, there is an erotic area on the front side of the vaginal wall. The tissue in this area is capable of engorging with blood and responding favorably to touch. For some women, this seems to enrich their sexual experience and assist with orgasm. Other women find the sensation irrelevant, distracting, or even unpleasant.

One client stated her experience this way: "It seems it is more important to my husband that we find it to prove his sexual prowess. I'm not convinced my pleasure is really the goal here. I feel a bit more like a lab rat being experimented on than a wife being sexually cherished."

Others report the fun of discovery and the pleasure that comes from it. "It's amazing," one woman said after she and her husband discovered her g-spot. "I definitely don't want it every time, however. Sometimes it's too intense or too exhausting." Her husband had to learn that just because she could, didn't mean she wanted to.

Perineal Body

Between the vaginal opening and the anus is a pyramidal shaped block of fibromuscular connective tissue. This tissue is very elastic, often able to stretch without tearing, to permit passage of the fetus during childbirth. A physician may elect to cut through this tissue during childbirth in a procedure called an *episiotomy* to assist in childbirth. This procedure was used for many years to prevent tearing of the vaginal walls. More recently, techniques have been developed to thin out the vaginal opening so tears are less common, making episiotomies less routine childbirth. The World Health Organization and the American College of Obstetrics and Gynecologists discourage use of this procedure for routine childbirth (cited in Hornstein et al., 2013).

Vaginal opening

The opening to the vaginal canal is called the *introitus* (from the Latin meaning "to go inside"). Though typically almost closed in childhood, the introitus is highly elastic and capable of stretching to accommodate a tampon, penis, or the birth of a child. After childbirth, it usually returns to a normal resting state of 3-4 cm (1.2-1.6 inches) within a few weeks (O'Connell et al., 2008).

Hymen

Around the introitus is a thin membrane of fibrous connective tissue called the *hymen*. Named after Hymen, the Greek god of marriage, the name originally designated the bridal song (Hymen, 1873). The hymen has no known biological function, but the cultural and psychological significance is often high. Historically, the hymen has had great symbolic meaning: an intact hymen has been considered evidence of female virginity. It was believed that the tearing of the hymen on the wedding night would leave the presence of blood confirming her virginal status before and consummation of the marriage on the wedding night. The absence of hymen or of bleeding during initial penetration could be grounds for an annulment (dissolution) of the marriage or even death in some Islamic cultures.

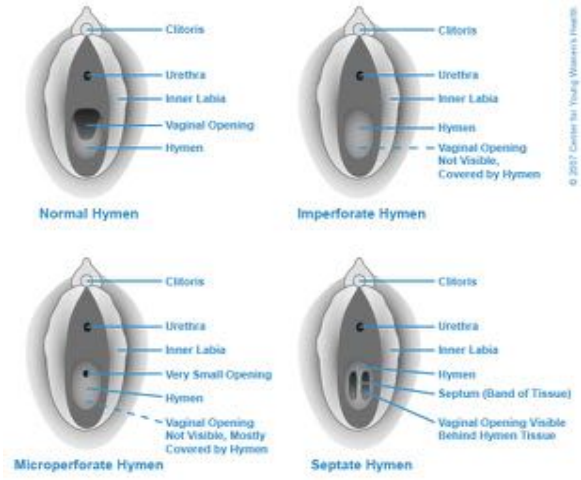
The developing fetus demonstrates a hymen from about five month's gestation. There are no significant racial differences, but the hymen changes significantly across the lifespan (Hegazy & Al-Rukban, 2012). In infants, the hymen tends to be thicker under the influence of maternal estrogen. It thins out during childhood becoming smooth and sometimes almost translucent.

The fibrous tissue of the hymen is partially elastic tissue (stretchy) and partially collagenous tissue (for strength) (Mahran & Saleh, 1964). During puberty it becomes more elastic. Even though it is more elastic, tampon use, masturbation, injury, or sports can perforate the hymen. This should not be reason to avoid tampons or sports however. One study of 300 adolescent females showed that while the hymen was perforated in 81% of sexually active girls, it wasn't disrupted significantly more in those who used a tampon than those who didn't. Nor was level of sports activity a predictive factor (Emans, Woods, Allred, & Grace, 1994).

Hymen Reconstructive Surgery

Hymenoplasty, hymenorrhaphy, or hymen reconstruction surgery is cosmetic surgery designed to reconstruct the hymen. Largely requested because of the value some place on the presence of the hymen it is sometimes performed after sexual assault. Illegal in most Muslim countries, it is available in the US and Europe. Some procedures also insert a gelatin capsule that breaks during intercourse and give the appearance of blood. While many consider the practice unethical in supporting deceit, others see it as possibly decreasing some of the mental effect of forced intercourse. (Cook & Dickens, 2009)

When present, hymens are quite different in appearance from female to female. They can be thin and almost translucent or thick and fleshy. They can have one or many small openings until it looks almost web-like. Hymens can also have one or several larger openings.



About 0.1-0.2% of women have an imperforate hymen where the hymen totally covers the opening of the vagina. This does not allow normal vaginal discharge, especially of menstrual flow and can become dangerous. Minor surgery is typically required to perforate the hymen in these cases (Schorge et al., 2008).

Female Ejaculation

Female ejaculation has been recognized even in ancient times. Early Chinese writing taught that while men had a limited supply of essence, women had a limitless supply (Korda, Goldstein, & Sommer, 2010). An Indian text from the 16th century (Ananga-Rang) shows areas of the vagina that, when stimulated, lead to the production of a great amount of "love juice" in the female.

Modern acceptance of female ejaculation has only been recent and controversial. In 1980, Ladas, Whipple, and Perry presented summaries of their findings at the annual Society for the Scientific Study of Sex (SSSS) conference (Ladas, Whipple, & Perry, 2005). Their subsequent book, *The G-spot and Other Discoveries About Human Sexuality*(Ladas et al., 2005) helped to bring conversation to the forefront.

"Women may expel various kinds of fluids during sexual arousal and at orgasm" (Zlatko Pastor, 2013, p. 1682). Recent research is differentiating between lubrication fluid (LF), female ejaculation (FE), the colloquial "squirting" (SQ), and coital incontinence (CI). "FE and SQ are two phenomena with different mechanisms" (Z. Pastor & Chmel, 2018, p. 621).

Lubrication fluid (LF) primarily originates from the vagina (see above) and is one marker of physical arousal. It includes "ultra-filtrate of blood plasma" along with secretions from Bartholin glands and female prostate that assist with lubrication (Z. Pastor & Chmel, 2018). Generally, it provides the "wetness" of arousal but a larger amount may be forced out of the vagina in a one-time pulse emission. "It may occur primarily after penis withdrawal or after coitus, and it is mostly a discharge (not gush) of accumulated LF" (Z. Pastor & Chmel, 2018)

Female ejaculation (FE) is the release of a small amount (few milliliters) of white, milky secretions (similar to male semen) that appear to be expelled from the female prostate. "FE often occurs without noticing a leakage of a larger fluid volume (unlike SQ). FE is perceived mainly as the feeling of wetness due to increased lubrication during orgasm" (Z. Pastor & Chmel, 2018).

Squirting (SQ) involves a much larger amount of liquid — even several ounces. In a small study of women who squirt during sex, researchers confirmed empty bladders before sexual activity but showed a rapid filling of the bladder during arousal. This fluid was expelled during orgasm and testing showed it was renal in nature (Salama et al., 2015) though may be highly diluted. "It is also noteworthy that squirting often results from the combination of direct mechanical stimulation of the anterior vaginal wall (around the so-called G-spot) and a facilitating emotional status, with extreme confidence and relaxation" (Salama et al., 2015, p. 665). It is unlikely she will be in this state if she feels pressure from her partner to respond in a specific way.

A third experience would include incontinence during sex (Coital incontinence). Researchers believe this is a separate process from female ejaculation or squirting (Salama et al., 2015) and often includes incontinence during penetration. It is more common with stress urinary incontinence (urination during sneezing, coughing, laughing, etc.)(Lau, Huang, & Su, 2017).

It is not known how many females do, or can, ejaculate or squirt during sex. Percentages range from 10% to 69% depending upon the study (Florian, Karl, Wolfgang, & Walter, 2007). Others propose that all women can ejaculate. Recent researchers (insert reference here) have found prostate fluid in the bladders of post orgasmic women who did not visibly ejaculate leading them to postulate that all women ejaculate but many experience retrograde ejaculations. It is also suggested that elderly women tend to loose the ability (Ladas et al., 2005).

The amount ejaculated is typically listed as between 1-5 ml (a few drops to a teaspoon) according to Zaviačič (1999) but others report larger amounts. Some(Rubio-Casillas & Jannini, 2011) have shown large amounts of ejaculate

may include fluid from the bladder as well as the female prostate.

While porn often shows women easily ejaculating large amounts, this is often staged and definitely not typical of most women. Damage can be done by self and spouse when under pressure to ejaculate. It is very possible that individual women may not have the internal structure to produce the ejaculate.

In a qualitative study of women's experience with ejaculation, researchers found a high level of shame and embarrassment in those who did not understand what was happening. For those who understood the process and were able to normalize it, and the fluid, they may experience exploration, wonder, and pride (L. Gilliland, 2009).

Additionally, even those who ejaculate may not see it as the climax of the sexual encounter. Subjects in Zaviacic's study "differentiated [ejaculation] from the sensations accompanying orgasm achieved by stimulation of the clitoris. These subjects stressed repeatedly that ejaculation does not represent the climax of their sexual response" (1999, p. 79).

As with locating a G-spot, multiple orgasms, or any other specific aspect of female functioning, it seems important that women are aware of the vast potential of their bodies, but are never put under specific pressure to perform.

However it happens, after the hymen is perforated, it remains present as folds, or tags of tissue around the introitus called *carunculae myrtiformes*. After childbirth, this is typically all that remains of the hymen. Post menopause, the absence of estrogen will cause any remnants of the hymen to shrink further and become very thin and often difficult to identify.

In reality, the presence or absence of an intact hymen has been shown to be a poor test of physical virginity. While the hymen tends to be thicker in a young girl due to the absence of estrogen, in some it is thin enough to be easily ruptured without intercourse meaning its absence is not definitive for sexual activity. Conversely, the hymen isn't always torn during sexual intercourse (Emans et al., 1994). Hornstien, et. al. (2013) reports that it can even be elastic enough to survive childbirth. Thus, its presence is not definitive for virginity.

Despite medical observation that the hymen does not typically contain nerves or nerve endings sufficient to cause pain (Gellhorn, 1904; Mahran & Saleh, 1964), a popular cultural narrative is that first intercourse is very painful for the female because of the tearing of the hymen. Current research on the experience of pain with first intercourse seems to be absent in the literature (Weis, 1985). This has caused some speculation in the field that the pain is largely anticipatory or from other sources (e.g., stretching of the vagina and muscles). More research is needed in this area so we can better prepare couples.

Vagina

The vagina is the genital opening designed to accept a penis, the passage through which childbirth occurs, and a path for discharge of menstrual flow. If a woman is standing, it extends from the introitus (between the urethra and anus) upward toward the uterus at about a 45˚ angle toward her back. It's name appears to come from the Latin for "sheath" or "scabbard" (vagina, 2012), a place where a sword or dagger is kept.

The vagina is a fibromuscular organ of accommodation. At rest, there is great variation in the length of the vagina from female to female, but a typical length is about 9.6 cm (3.7") with a range of 6.5 cm (2.5") to 12.5 cm (4.9") (Lloyd et al., 2005). The

posterior wall of the vagina (toward her back) is longer than the anterior wall (toward her stomach) by 2-3 cm.

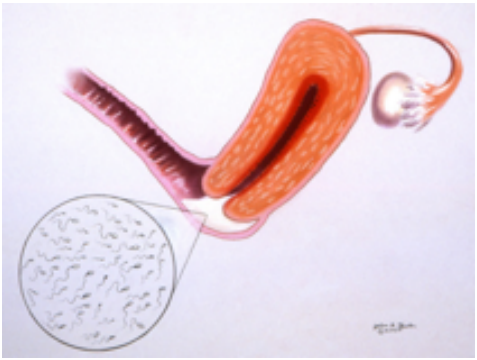
The vagina is typically closed as the walls rest against each other but it is able to stretch open to accommodate a tampon, penises of varying sizes, or the birth of even a large baby. Visually, the wall of the vagina is made up of many folds that appear like multiple ridges (mucosal rugae).

During arousal, the vagina opens up like an inflated balloon (vaginal tenting) as the rugae flatten out creating space for the penis and to receive the ejaculate.

When the male ejaculates during missionary position intercourse, the ejaculate pools near the opening of the cervix.

> During [the female's] orgasm, the cervix "searches and dips" into the seminal pool, and the orgasm-induced movements either facilitate the dipping, and/or the mixing of the cervical mucus with the pool, and/or increase the time that the cervix is in the pool. (Meston et al., 2004, p. 178)

It is believed that this facilitates sperm passage into the uterus and conception.



Seminal pool in posterior fornix of the vagina.

Inner (mucosa) layer.

The vaginal wall has three layers. The innermost (surface) layer is called the vaginal mucosa and has tissue similar to the tissue inside the mouth. In the vagina, this tissue is sensitive to estrogen and responds to estrogen by growing and maturing. Before puberty and after menopause, this layer is thinner and less flexible.

Estrogen also stimulates production of glycogen in the cells of the vaginal wall. The normal vaginal bacterial flora (mainly lactobacilli) converts this glycogen to lactic acid decreasing the pH in the vagina. The lower pH (3.5-4.5) is believed to be important in providing protection from infection by pathogenic bacteria (Ginger & Yang, 2011).

Lubrication of the vagina occurs by transudation (the walls of the vagina weep), supplemented with secretions from the cervix and the bartholin gland. When sexually aroused, vasocongestion increases the fluid pressure causing an increase in lubrication of the vagina. As estrogen is a key player in this process, post menopausal women often experience trouble with dryness in the vagina. Allergy and blood pressure medication can also cause vaginal dryness, which may produce symptoms with or without sexual activity.

Middle (muscularis) layer.

The middle layer of the vagina is muscle and connective tissue (called the muscularis). The smooth muscle tissue of this layer is both longitudinal and circular (Ginger & Yang, 2011).

Deep layer.

The deep layer of the vagina is covered by facia. The anterior wall of the vagina (toward the front of her body) is closely related to the bladder and urethra. The urethra essentially shares a wall with the lower two-thirds of the vagina with the bladder against the upper third. Toward the top, the cervix projects into the vagina.

Vaginal Lubrication during sexual arousal

During sexual arousal, the vagina produces a liquid that provides lubrication to allow for non-painful intercourse. This fluid is not produced by glands in the vagina as there are no glands present. Instead, vasocongestion and the increase in blood pressure causes the clear fluid to exude (transudate) through the vaginal walls. A lack of lubrication may be caused by a lack of vasocongestion (lack of arousal or sufficient blood pressure), drug interactions (especially antihistimines or some antidepressants), or decreased estrogen (as in menopause).

In the absence of natural lubrication, women can turn to artificial lubricants. There are several types of lubricants available. With all lubricants, individual preference is key. While some are better tolerated than others, slight variations in pH and sensitivity to specific ingredients can cause discomfort, infections, allergic reactions, and an environment that favors the growth of yeast.

Lubricants with any form of sugar have a high risk of causing a yeast infection. While not a problem for most women, some women find lubricants that contain glycerin contribute to yeast infections. While controversial, individual reports of many women seem to validate the link.

Additionally, most lubricants have been shown to impede sperm motility. Couples seeking to become pregnant should avoid lubricants or consider using lubricants known to be "fertility friendly". In this situation, women are advised to discuss this with a healthcare professional.

Common lubricant types:

Plant oils: Olive oil, coconut oil (more solid until warmed by the body), avocado oil, and aloe vera are common plant oils that can be used as lubricants. While some prefer them due to their "organic" nature, others find them irritating. Being natural, they can also become mediums for bacterial growth and go rancid. As they are oils, they should not be used with latex barriers (condoms/diaphragms).

Other oils: Petroleum jelly, mineral oil, and butter are examples of other oils used. An advantage of petroleum or mineral oils is that they do not promote the growth of bacteria and spoil (become rancid). Animal oils are particularly prone to quickly spoil. All oils are damaging to latex and should not be used with latex birth control. It is also essential that after the use of any oil-based lubricant the skin be thoroughly cleansed so that pores are not clogged with the oil or that it provides a medium for microbial growth.

Silicone based: These lubricants are made with minimal number of ingredients (primarily dimethicone, a quality silicone) and do not contain water. Being waterproof, they tend to remain very slippery for an extended period of time – even in the bath or shower. They rarely cause reactions in women and are safe with latex (but not with silicone based sexual aids). They are slippery enough that some find they remove too much friction decreasing sensual pleasure. As they are not water soluble, clean up can be difficult from cloth and skin.

Water-soluble: These are the most common type of lubricant. While glycerin may be the most common lubricant used in this category there are many others also. Carrageenan is a newer lubricant that has antimicrobial properties and has been shown to inhibit HPV transmission. Water-soluble lubricants are safe to use with condoms, but tend to dry out quickly loosing their lubricating ability and often leaving a residue. Some water-soluble lubricants last far longer than others.

Specialty lubricants: There are a host of lubricants marketed to specialty audiences (i.e., fertility friendly lubricants), and designed to have specific responses. Most are water-soluble lubricants with specialty ingredients. Scented and/or flavored lubricants are marketed for increased playfulness, sensuality, and for those who complain of the taste/smell of unflavored and unscented lubricants. Another common specialty lubricant is the warming lubricant. Infused with ingredients like mint, cinnamon, capsaicin, glycerol, or other chemicals designed to increase blood flow or create a warming or cooling sensation. While some appreciate the warming sensation, others strongly dislike it. The addition of other chemicals also increases the risk of sensitivity or allergic reaction.

The key to finding a lubricant that works for you may be playful experimentation. As always, we recommend starting with a conversation with your gynecologist.

The posterior wall of the vagina (toward the woman's back) is attached to the perineal body for the lower third, the rectum for the middle third, and the peritoneal cul-de-sac for the upper third (Manassiev & Whitehead, 2004). The recesses above the cervix are called fornices.

With aging, falling estrogen levels cause the vaginal walls to become thin, dry and less flexible. As a result of these changes, some older women find intercourse painful and may avoid having intercourse. Over the counter and prescribed medications can improve the flexibility and lubrication of the vagina.

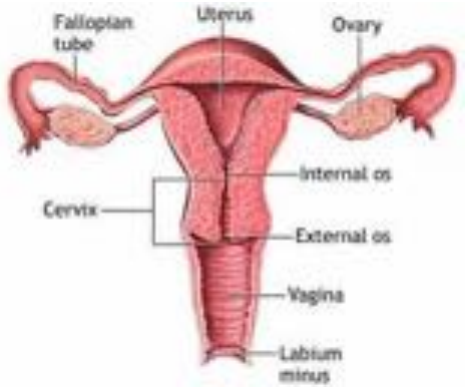
Changes in aging
Recent MRI's of genital change during arousal showed that while the clitoris, bulbs, and labia minora still engorged with arousal, the vagina showed little change. "Post-menopausal subjects did not have distinguishable mucosal rugae or clearly separate layers of the vagina, presumably due to atrophy and flattening of the vaginal walls" (Suh, Yang, Cao, Garland, & Maravilla, 2003). Thus, while a post menopausal women still responds sexually, changes in the vagina (largely due to estrogen decrease) may result in decreased lubrication, less flexibility, easier tearing and abrasion, increased risk for urinary track infections, and general discomfort during intercourse (Farage & Maibach, 2011). Couples who learn to expect more from connecting and sensual play than from intercourse may find it easier to maintain a satisfying sexual relationship.

Cervix

Toward the top of the vagina is the cervix, the opening of the uterus. From the Latin for "neck" (cervix, 2011), the word refers to the neck of the uterus. Approximately 2.5 cm long (1 inch), almost half of the cervix protrudes into the vagina and is called the portio vaginalis. In most women, the cervix is pointed down and toward her back. It is kept in place by ligaments attached to the walls of the pelvis and lower spine (sacrum).

For women who have not given birth, the rest of the cervix may comprise about one-half the length of the uterus. In women who have given birth, it may only comprise one-third the length of the uterus (Hornstein et al., 2013).

The cervix is primarily composed of connective tissue filled with smooth muscle fibers. The feel of touching the cervix is often compared to that of touching the tip of one's nose. During pregnancy, the cervix begins to soften preparing to open fully to allow for the passage of the baby.



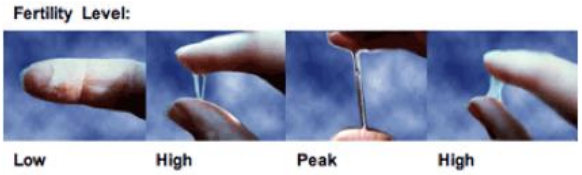
Historically, the cervix has not been thought to have much of a role in sexual response and was typically removed at the time of hysterectomy. Recent studies seem to show wide variation in women (for discussion see Bradford & Meston, 2006; Meston & Bradford, 2004; Meston et al., 2004) but the cervix may contribute to sexual arousal and orgasm in some women. Cutler et al (2000) reported that 35% of healthy women experienced pleasure and orgasm from penile stimulation of their cervix during intercourse.

In the middle of the cervix is an opening called the external os. In women who have not been pregnant, the os is a round dimple like opening about 3 mm across (Hornstein et al., 2013). For those who have given birth, or had the cervix forced open for a medical procedure

(i.e., abortion), it appears more like a slit. The os dilates during orgasm, presumably to assist in facilitating sperm passage through the cervix and into the uterus.

The external os leads to the cervical canal with the internal os on the other end opening into the uterus. The canal is lined with mucus-secreting glands.

Cervical mucus. Glands in the cervix secrete mucus that changes based on the levels of estrogen and progesterone present in the woman's body. This means the mucus changes depending upon where the woman is in her menstrual cycle and pregnancy. During most of her menstrual cycle the mucus is thick in texture creating a type of plug between the microbe rich vagina and the relatively sterile uterus. This plug has been shown to be both mechanical in blocking microbes from passing through the cervix into the uterus and above, and chemical in that it has antibiotic properties (Hein, Valore, Helmig, Uldbjerg, & Ganz, 2002).



Near the time of ovulation the mucus becomes thinner and less viscous. This provides for maximum sperm survival and penetrability at a time when she is most fertile. Changes in the viscosity of the cervical mucus allow for one method of testing for ovulation for couples seeking to predict and manage fertility (see Birth Control section).

During pregnancy, the constant presence of progesterone causes the cervical mucus to become increasingly thicker and form a plug. This cervical mucus plug protects the mom and fetus from infections that might progress up the vagina and into the upper reproductive track.

Yeast Infections

Genital / vulvovaginal candidiasis (VVC), often called simply a "yeast infection", occurs when there is an overbalance of candida (yeast) in the vagina. According to the CDC, 75% of women have at least one yeast infection during their lifetime (Centers for Disease & Prevention, 2013) . Candida are normal inhabitants of the mouth, gastro-intestinal track, and vagina. Typically, the body's balance keeps their growth in check. In the vagina, the lactobacilli are an important part of that balance. Introduction of an antibiotic (which kills the good bacteria keeping balance), can result in rapid growth of the candida (a yeast infection). Various other factors that alter the pH or balance of other microorganisms in the vagina can cause a yeast infection also (Sobel et al., 1998). While not officially listed as a Sexually Transmitted Infection by the CDC, having sex with someone who has a yeast infection can also be a cause.

There are other diseases and allergies (especially latex allergies) that can be mistaken for a yeast infection so ensuring an accurate diagnosis is valuable before starting over the counter medicines. Current medications are quite successful in treating yeast infections. Several studies have shown taking probiotics on a regular basis may help prevent outbreaks in those who have frequent infections or those who need to be on an antibiotic for other issues (Falagas, Betsi, & Athanasiou, 2006).

Cervical Cancer. The Center for Disease Control and Prevention (CDC) calls cervical cancer "the easiest female cancer to prevent, with regular screening tests and follow-up." (CDC, 2012a). Occurring most often in women over 30, the CDC reports over 12,000 women per year are diagnosed with cervical cancer in the United States alone (U.S. Cancer Statistics Working Group, 2013).

There are two types of screening currently available to women. The first is the human papillomavirus (HPV) test. HPV is considered a primary cause of cervical cancer. The International Agency for Research on Cancer (part of the World Health Organization) reported that studies showed "virtually all cervical cancers contained HPV DNA" (2007, p. 468). As such, one type of

Pap Test and Frequency Guidelines

There are three main organizations making recommendations to women on how often they should have a pap test: The American Cancer Society (Saslow et al., 2012), The U.S. Preventive Services Task Force (Moyer, 2012), and the American College of Obstetricians and Gynecologists ("ACOG Practice Bulletin Number 131: Screening for cervical cancer," 2012). While there are minor differences in their recommendations (CDC, 2012b), they are quite similar.

Virgins: There is a bit of disagreement in recommendations for women who have never had sex with anyone (same or opposite gender). According to the CDC, "women who have not had sexual exposures (e.g., virgins) are likely at low risk. Women aged >21 years who have not engaged in sexual intercourse may not need a Pap test depending on circumstances. The decision should be made at the discretion of the women and her physician" (CDC, 2012a)

Women under 21 years of age: These women should not be screened regardless of the age of sexual initiation or other risk factors.

Women age 21-65: Every 3 years. Every 5 years beyond age 30, and combined with an HPV test.

Women over 65 years old: No testing if there has been an adequate screening history. Additionally, screening is not necessary in women who have had a hysterectomy if the cervix was removed and the hysterectomy was for a benign (non-cancerous) condition.

screening for cervical cancer is to be screened for the presence of HPV. This is not recommended for women under 30 years old, and due to the lack of long-term data, it is recommended that it always coincide with a pap test.

The second is called a pap test (or pap smear – short for Papanicolaou test after the Greek doctor who invented it). A pap test involves collecting a sample of cells from the surface of the cervix. After the vagina is dilated using a speculum, a long endocervical brush, speculum, or similar tool is used to collect cells from the cervix. This process might be uncomfortable, but should not cause pain. The collected cells are then sent to a lab to be tested for abnormality that might suggest potential problems including early signs of cervical cancer. Abnormal results do not always suggest a problem and should be interpreted by a physician. Note that the pap test does not test for other kinds of cancer, STI's, or other diseases.

Uterus:

"Uterus" is the technical name for the female womb. It is the hollow muscular organ that accepts the fertilized ovum and houses it while the fetus grows and develops.

In a non-pregnant state the uterus lies in the pelvis between the bladder and the rectum in the lower abdomen. It looks like an upside down pear and is about the size of a fist. The upper, expanded, portion of the uterus is called the fundus (or body) and the lower, constricted, portion is the cervix (or neck). As with fist sizes, there can be great variation in the size of a non-pregnant uterus, but on average it is about 76 mm (3") long, 51mm (2") wide at the fundus and 25mm (1") at it's narrowest point. It has the ability to grow from about 57 grams (2oz) when non-pregnant to about 907 grams (2 lbs) immediately after delivery. It will typically return to its original size by about 6 weeks after giving birth (Hornstein et al., 2013).

Generally, the uterus extends from the cervix toward the woman's belly button and is slightly tipped forward (anteverted) toward the bladder. The actual position will vary depending on previous pregnancies, fullness of bladder or bowel, posture, and her genetics. In about 20% of women (M. N. Smith, 2012), the uterus is curved toward her back. This retroverted position is often called a "tipped" uterus. Historically, this was considered to be the cause of many problems (including

backache, cramps, and infertility) but modern science views it as a typical variation that rarely causes any trouble.

The walls of the uterus are about 13mm (.5") thick and composed of three layers: the endometrium, the myometrium, and the perimetrium. The inner layer or mucosa is called the **endometrium** and is rich in glands and blood vessels. The thickness of the endometrium varies with the age of the woman and the stage of her menstrual cycle. The endometrium is where the fertilized ovum (embryo) implants. The endometrium has two layers: the functional layer and the basilar layer. The functional layer has blood vessels that dilate in response to the hormones estrogen and progesterone. If fertilization does not occur, this layer will slough off during menstruation. The deeper endometrium is the basilar layer (or basalis). The basilar layer is a very thin, vascular, permanent layer. This layer is also influenced by the hormones estrogen and progesterone.

The middle layer is the **myometrium** and consists of bands of smooth muscle that contract during labor and orgasm. These muscles are very elastic and are capable of stretching to accommodate a newborn.

The perimetrium is the thin, outer layer of connective tissue that covers the uterus.

Three ligaments hold the uterus in place. The broad ligament covers the uterus and the round and uterosacral ligaments anchor the uterus anteriorly and posteriorly. With age, pregnancy, and other damage, these ligaments can weaken, stretch, or fail in holding the uterus in place causing uterine prolapse. This results in the uterus protruding into the vagina, and in extreme cases outside the vaginal opening.

The "Womb" in scripture

"From my mothers womb,
you have been my God."
~ Psalm 22:10b NIV

The Old Testament has two primary words that may be translated "womb". Job 3:11 uses both words.

The first is "*beten* (בֶּטֶן)", a broader term translated "womb" (i.e., Psalm 127:3 KJV), "belly" (i.e., Numbers 5:27 KJV), or "body" (i.e., Deut 28:4). While uncertain, it appears the root word might mean "hollow" referencing the abdominal cavity. The second, *"rechem* (רֶחֶם)", is a more specific reference to the uterus itself. The root of this word speaks to mercy, compassion, and protection.

In the New Testament, the Greek uses *koilia* (κοιλία) which references the abdominal cavity (e.g., Matthew 15:17, I Corinthians 6:13, Philippians 3:19), but was frequently used to speak of the womb (e.g., Luke 1:41, Luke 23:29, John 3:4, Galatians 1:15). The New Testament also uses *mētra* (μήτρα) which references motherhood (Romans 4:19).

In scripture, a fruitful womb often referenced God's favor (Deut 7:13), while a barren womb his displeasure (Genesis 20:18). With infertility rates as high as 6% in the US (Chandra, Copen, & Stephen, 2013), many couples, pastors, and counselors wrestle with the theology of infertility today.

Fallopian tubes

The *fallopian tubes* are named after a 16th century anatomist Gabriele Falloppio who thought they resembled tubas or curved trumpets. Also called oviducts or uterine tubes, they are a pair of very narrow (1mm-4mm in diameter), hollow tubes that are about 10 cm long (4") (Benjaminov & Atri, 2004). One end of each tube opens near an ovary and the other end of each tube opens into the uterus. The fallopian tubes curve over the top of each ovary. They are

Hysterectomy
A hysterectomy (from the Greek *hysteria*, or "womb", and *ektomia*, or "cutting out") is the surgical removal of the uterus. While the frequency is dropping 1% per decade, 20% of women in developed countries will have had a hysterectomy by age 55 (Domingo & Pellicer, 2009). The most common reasons for hysterectomies in the US are uterine leiomyoma ("fibroid tumors"), endometriosis, and uterine prolapse (Center for Desease Control and Prevention, 2008). Cancer, menorrhagia (unusually heavy and prolonged menstruation), and pain are other common reasons. The surgeon may remove just the fundus, the fundus and cervix, or (typically for cancer) the entire uterus and part of the vagina. Depending on the reason for the hysterectomy, an oophorectomy (removal of the ovaries) may also be part of the surgery. When the uterus with its attached cervix is removed, this is referred to as a "total hysterectomy". If the tubes and/or ovaries are also included, a "salpingo-oorphorectomy" has been added. If both tubes and ovaries are removed with the uterus, then we have a "total hysterectomy and bilateral salpingo-oophorectomy".

supported and enclosed in place by the broad ligament.

There are several sections to the fallopian tubes. The narrowest part of the tubes is called the interstitial and is located within the wall of the uterus. Slightly larger is the isthmus. It is next closest to the uterus and is the typical location for a tubal ligation. The ampula is next to the isthmus and is larger in diameter. It constitutes about half the length of the tube. The infundibulum is the trumpet shaped opening of fallopian tube that is closest to the ovary. It is open to the abdominal cavity and has finger-like projections called fimbria that surrounds the ovary.

The fallopian tubes are three layers thick. The serosa is the outer covering of the tubes. The second layer, the muscularis, has an outer layer of longitudinal smooth muscle and an inner layer of circular smooth muscle (the isthmus has an additional layer of longitudinal muscle sandwiching the circular muscle). The muscularis allows the tube to contract and move fluid through the tube.

The innermost layer is the mucosa layer. The mucosa has many folds (called plicae) – especially in the ampulia. The cells of the mucosa are specially designed to facilitate fertilization. The columnar ciliated epithelial cells, have hair like cilia that create a fluid flow moving sperm, egg and zygote (fertilized egg) (T. T. Smith, 1998). Secretory and peg cells produce fluid rich in nutrients and environmental stabilizers for sperm and zygote (Bardawil & Chelmow, 2012).

In addition to providing a pathway and nutrients for sperm, egg, and zygote, the fallopian tube plays an additional role in fertilization of the egg. While millions of sperm are present in a normal ejaculation, only thousands inter the isthmus. Even fewer enter the ampula. Many sperm adhere to the surface of the isthmus. The result is the fallopian tube serving as a "sperm reservoir". The fluid secreted by the mucosa extends sperm life and viability and thus the time available for conception after ejaculation. As the female hormones modulate this, her body effectively collects and maintains sperm until prime ovulation time (Lyons, Saridogan, & Djahanbakhch, 2006; T. T. Smith, 1998).

Conception generally occurs in the ampula. The zygote (fertilized egg) continues to travel through the fallopian tube for four to five days. The interstitial segment of the tube acts like a muscle sphincter. It holds the zygote and prevents it from being released into the uterus until it is ready for implantation.

Sometimes the zygote does not reach the uterus. Instead, it implants and begins to grow outside the uterus. This is called an ***ectopic pregnancy***. If fertilization does not occur, the egg dies within 24-48 hours. Sperm can live in the female genital tract from three to five days, making conception optimal if sperm are present within the tube and are awaiting ovulation. Intercourse occurring every 48 to 72 hours accomplishes this. Conception is very unlikely to occur once there are signs and symptoms of ovulation, as the ideal time for fertilization has passed.

The lining of the fallopian tube is continuous with the lining of the uterus (and vagina) and the abdominal cavity. This raises concern because infections in the vagina can potentially pass into the abdominal cavity causing pelvic inflammatory disease. Among other problems, pelvic inflammatory diseases can cause scarring of the fallopian tubes resulting in fertility problems.

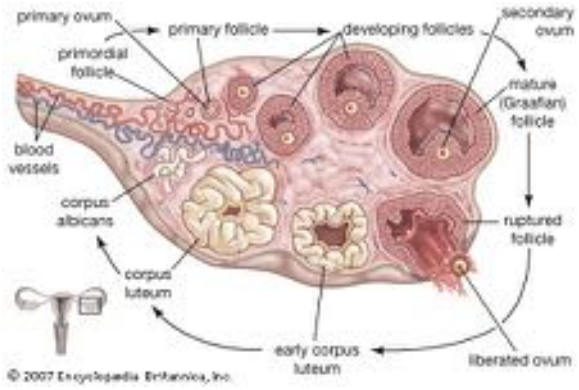
Ovaries

Suspended in the broad ligament and supported by three other ligaments, the ovaries lay on either side of the uterus. Homologous to the testes, the ovaries are the female gonads producing gametes (eggs) and hormones. Thus, like the testis, they are a part of both the reproductive and endocrine systems.

Although their size is dependent on production of a variety of hormones, they are often described as having the size and shape of almonds in the shell. Typically, they are approximately 3 cm (1.2") long, 1½ cm (.6") and 1 cm (.4") thick (Hornstein et al., 2013) and weigh in at about 6 gm (0.20 oz). Puberty, contraceptives, fertility treatments, and menopause can all dramatically change ovarian size.

Oophorectomy

The removal of the ovaries and can be partial with removal of one, or full with the removal of both. Recent studies have shown that removal of the ovaries before about 65 has significant health risks for women except in extreme cases like ovarian cancer (Shuster, Gostout, Grossardt, & Rocca, 2008).



The ovaries have an outer layer of protective cells called the germinal epithelium – misnamed early on due to the belief that this layer birthed the gametes. The internal structure of the ovary has an inner medulla, providing vascular support, and an outer cortex where ovum development occurs.

There is a wide variance in opinion on how many follicles (immature ovum) are present in the ovary of a newborn girl. Ranges are from about 150,000 to one million (Hornstein et al., 2013). At birth, the follicles contain an ovum paused in an early state of development and called a primary oocyte. At puberty, the follicle cells surrounding the oocyte begin to secrete estrogen. At the time a female reaches puberty the number of primary follicles has dropped to 50,000 or fewer (Hornstein et al., 2013). Typically, one

follicle per month fully develops and ruptures to release the ovum during ovulation. In about 80% of healthy women, this occurs monthly, with an ovum being released from one or the other of the ovaries as a chance event (much like flipping a coin). During the time a woman is fertile (puberty to menopause), she will produce between 300-500 mature follicles that, at ovulation, release an ovuum (egg).

Mittelschmerz
Some women experience pain with ovulation. This pain is called mittelschmerz from the German for "middle", as it is midway between menstruations, and "pain". This pain can be a mild twinge, to a high level of discomfort and can last from moments to several hours. It may alternate side to side, depending upon which ovary is ovulating, or may be more central to the abdomen. While the exact cause of the pain is unknown, for those who experience it, it can be a very predictable sign of ovulation.

Conclusion

No matter how you believe our sexual parts came to be, they are uniquely and intricately designed to not only perform the task of reproduction but of pleasure and connection. Learning the details of our sexual anatomy and physiology allows us to celebrate the beauty of our bodies without shame. It also increases our ability to pursue the connection and pleasure possible.

For the aspiring sex therapist, the more we know about how the design works when it is working well, the easier it is to problem-solve and develop effective interventions.

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