NAME: KOLAWOLE GABRIEL AYOOLA

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Write short notes on the following:

**-** **SPERMATOGENESIS**

Gametogenesis is the process whereby a haploid cell (n) is formed from a diploid cell (2n) through meiosis and cell differentiation. Gametogenesis in the male is known as spermatogenesis and produces spermatozoa.

Spermatogenesis, the origin and development of the sperm cells within the male reproductive organs, the testes. The testes are composed of numerous thin, tightly coiled tubules known as the seminiferous tubules; the sperm cells are produced within the walls of the tubules. Within the walls of the tubules, also, are many randomly scattered cells, called Sertoli cells, that function to support and nourish the immature sperm cells by giving them nutrients and blood products. As the young germ cells grow, the Sertoli cells help to transport them from the outer surface of the seminiferous tubule to the central channel of the tubule.

Sperm cells are continually being produced by the testes, but not all areas of the seminiferous tubules produce sperm cells at the same time. One immature germ cell takes as long as 74 days to reach final maturation, and during this growth process there are intermittent resting phases.

The immature cells (called spermatogonia) are all derived from cells called stem cells in the outer wall of the seminiferous tubules. The stem cells are composed almost entirely of nuclear material. (The nucleus of the cell is the portion containing the chromosomes.) The stem cells begin their process by multiplying in the process of cell duplication known as mitosis. Half of the new cells from this initial crop go on to become the future sperm cells, and the other half remain as stem cells so that there is a constant source of additional germ cells. Spermatogonia destined to develop into mature sperm cells are known as primary sperm cells. These move from the outer portion of the seminiferous tubule to a more central location and attach themselves around the Sertoli cells. The primary sperm cells then develop somewhat by increasing the amount of cytoplasm and structures called organelles within the cytoplasm. After a resting phase the primary cells divide into a form called a secondary sperm cell. During this cell division there is a splitting of the nuclear material. In the nucleus of the primary sperm cells there are 46 chromosomes; in each of the secondary sperm cells there are only 23 chromosomes, as there are in the egg. When the egg and sperm combine and their chromosomes unite, the characteristics of both individuals blend and the new organism starts to grow.

The secondary sperm cell still must mature before it can fertilize an egg; maturation entails certain changes in the shape and form of the sperm cell. The nuclear material becomes more condensed and oval in shape; this area develops as the head of the sperm. The head is covered partially by a cap, called the acrosome, which is important in helping the sperm to gain entry into the egg. Attached to the opposite end of the head is the tailpiece. The tail is derived from the secondary sperm cell’s cytoplasm. In the mature sperm, it consists of a long, slender bundle of filaments that propel the sperm by their undulating movement. Once the sperm has matured, it is transported through the long seminiferous tubules and stored in the epididymis of the testes until it is ready to leave the male body.

**- SEMEN**

Semen can also be called seminal fluid, it is the fluid that is emitted from the male reproductive tract and that contains sperm cells, which are capable of fertilizing the female eggs. Semen also contains other liquids, known as seminal plasma, which help to keep the sperm cells viable.

In the sexually mature human male, sperm cells are produced by the testes; they constitute only about 2 to 5 percent of the total semen volume. As sperm travel through the male reproductive tract, they are bathed in fluids produced and secreted by the various tubules and glands of the reproductive system. After emerging from the testes, sperm are stored in the epididymis, in which secretions of potassium, sodium, and glycerylphosphorylcholine (an energy source for sperm) are contributed to the sperm cells. Sperm mature in the epididymis. They then pass through a long tube, called the ductus deferens, or vas deferens, to another storage area, the ampulla. The ampulla secretes a yellowish fluid, ergothioneine, a substance that reduces (removes oxygen from) chemical compounds, and the ampulla also secretes fructose, a sugar that nourishes the sperm. During the process of ejaculation, liquids from the prostate gland and seminal vesicles are added, which help dilute the concentration of sperm and provide a suitable environment for them. Fluids contributed by the seminal vesicles are approximately 60 percent of the total semen volume; these fluids contain fructose, amino acids, citric acid, phosphorus, potassium, and hormones known as prostaglandins. The prostate gland contributes about 30 percent of the seminal fluid; the constituents of its secretions are mainly citric acid, acid phosphatase, calcium, sodium, zinc, potassium, protein-splitting enzymes, and fibrolysin (an enzyme that reduces blood and tissue fibres). A small amount of fluid is secreted by the bulbourethral and urethral glands; this is a thick, clear, lubricating protein commonly known as mucus.

Essential to sperm motility (self-movement) are small quantities of potassium and magnesium, the presence of adequate amounts of oxygen in the plasma, proper temperature, and a slightly alkaline pH of 7 to 7.5. Sulfate chemicals in semen help prevent the sperm cells from swelling; and fructose is the main nutrient to sperm cells.

The total volume of semen for each ejaculation of a human male averages between 2 and 5 ml (0.12 to 0.31 cubic inch); in stallions the average ejaculate is about 125 ml (7.63 cubic inches). In human beings each ejaculation contains normally 200 to 300 million sperm. Semen frequently contains degenerated cells sloughed off from the network of tubules and ducts through which the semen has passed.

**-TESTOSTERONE**

Testosterone is an androgen hormone produced by the adrenal cortex, the testes (in men), and the ovaries (in women). It is often considered the primary male sex hormone. Testosterone stimulates the development of male secondary sex characteristics (like body hair and muscle growth) and is essential in the production of [sperm](https://www.verywellhealth.com/healthy-sperm-2328531). In women, among other things, testosterone helps keep bones and the reproductive system healthy and contributes to the sex drive.

Healthy males who have gone through puberty have 15 times the levels of testosterone compared to a healthy female.

Testosterone imbalances can cause infertility in men and women. Low levels of testosterone in men can cause male infertility. High testosterone levels in women are associated with female infertility.1﻿

Testosterone levels can be evaluated with blood work. This is usually part of an infertility workup in men and women.

## **Hormonal Supplementation**

Testosterone is a potent steroid hormone whose chemical formulation is C19-H28-O2. Testosterone is also known as 17-beta-hydroxy-4-androstene-3-one.

Prescription testosterone is used to treat hypogonadism related conditions in men and delayed puberty in boys.

While off-label it might be used to treat perimenopause symptoms or a low sex drive, there are no U.S. Food and Drug Administration-approved (FDA) indications for testosterone prescription use in women.

Another area of medicine where testosterone is prescribed is for transgender men (people with a male gender identity and a female birth-assigned sex).

It is available as a gel, topical solution, a patch, an injection, a pellet (to be implanted), or oral capsule.

Brand names include Androderm, AndroGel, AndroGel Pump, Aveed, Axiron, Depo-Testosterone, First-Testosterone, First-Testosterone MC, Fortesta, Natesto, Striant, Testim, Testopel, Vogelxo, and Vogelxo Pump.

### **Risks of Supplementation**

Too much testosterone can cause infertility in both males and females. Testosterone supplementation can also increase the risk of stroke, hypertension, accumulation of red blood cells, heart attack, leg clots, pulmonary embolus and cancer. The FDA only approves its use for hypogonadism and does not recommend its use for low testosterone use due to aging. The Endocrine Society, on the other hand, supports its possible use in older men with confirmed testosterone deficiency, aiming to achieve a low-normal level of the hormone, but only after carefully reviewing the risks and benefits.

**-MALE ORGASM**

Top of Form

Bottom of Form

The male orgasm is a complex experience. The major function of the male orgasm is to [ejaculate](https://www.verywellhealth.com/facts-about-ejaculation-ejaculate-2329073) sperm, although not all men will ejaculate during an orgasm. Beyond delivering pleasure, the role of the female orgasm is less clear, although it may help move the sperm closer toward the ovum (egg).

In the 1950s, Alfred Kinsey, the first scientist to study human sexuality in detail, described the orgasm as "an explosive discharge of neuromuscular tension." In the years since those initial studies, we have come closer to understanding both the physiological and emotional components of the male orgasm, as well as the conditions that impede or promote it.

The male orgasm is a complex system involving multiple hormones, organs, and nerve pathways.

The hormone testosterone, produced in the testicles, plays a central role by enhancing the sexual desire (libido) that leads to arousal, erection, and ultimately orgasm. By contrast, low testosterone not only decreases a man's energy and mood, it makes him less responsive to sexual stimuli, both physical and mental.1﻿

With that being said, a man often only requires physical stimulation to achieve arousal, while women typically need physical and mental stimulation to achieve the same.

Men differ from women in that their orgasms—the climax of the sexual response—come on faster and are shorter than women's. By and large, the male orgasm will last for five to 10 seconds. Women will last 10 to 15 seconds on average, although some have reported orgasms that last as long as a minute (a virtual impossibility for men).

The male ejaculate, [semen](https://www.verywellhealth.com/facts-about-semen-an-indication-of-health-status-2328524), is comprised of sperm cells and seminal fluid, the latter of which contains phosphorylcholine (an enzyme that aids in fertility) and fructose (which provides fuel for sperm). The average volume of semen expelled by a healthy man is around a teaspoon.

## **4 Phases of the Male Orgasm**

The route to ejaculation in men is actually delineated by four distinct phases, of which orgasm is the third. While the duration and intensity of these phases can vary, the experience will proceed in a strictly specific way.

The model was first outlined by William Masters and Virginia Johnson in their 1966 book, [Human Sexual Response](https://www.jstor.org/stable/3811418).

### **Arousal**

Arousal is the stage in which physical, sensory, and emotional cues prompt the brain to release a neurotransmitter known as acetylcholine. This, in turn, triggers the release of nitric oxide into the arteries of the penis, causing them to expand and rapidly fill with blood. The resulting erection is generally accompanied by changes in respiration, increased overall muscle tension, and the retraction of the scrotal sac.

### **Plateau**

Plateau is the phase immediately preceding orgasm in which the voluntary thrusts of the body, specifically the pelvis, suddenly become involuntary, increasing both in intensity and speed.2﻿ It is at this stage that the heart rate increases to between 150 and 175 beats per minute, accompanied by a marked rise in blood pressure and body temperature.

Traces of seminal fluid ("pre-cum") may leak from the urethra. The release of pre-ejaculatory fluid is more than just incidental; it alters the pH of the urethra so that the sperm has a better chance of survival.3﻿

All told, the plateau phase lasts between 30 seconds and two minutes.

### **Orgasm**

The orgasm phase is divided into two parts. The first, known as emission, is the stage where ejaculation is inevitable. This is immediately followed by the second stage, ejaculation, in which strong contractions of the penile muscle, anus, and perineal muscles help propel the semen from the body.4﻿

During orgasm, the reward center of the brain (specifically the cerebellum, amygdala, nucleus accumbens, and ventral tegmental area) is flooded with neurochemicals, inciting the intense emotional response associated with an orgasm.

At the same time, the [lateral orbitofrontal cortex](https://www.verywellhealth.com/the-frontal-lobes-2488715) located behind the left eye shuts down entirely. This is the part of the brain that plays a central role in judgment and self-control. The effect explains why people often describe an orgasm as a state where "nothing else matters."

### **Resolution and Refraction**

Resolution is the phase following orgasm where the penis starts to lose its erection. This is often accompanied by feelings of extreme relaxation or even drowsiness.

Refraction, also known as the refractory period, is the stage following climax when a man is unable to achieve another erection even with stimulation. In younger men, the refractory period may be as short as 15 minutes. In older men, it may last as long as an entire day.

## **Male Multiple Orgasms**

"Multiorgasmic" is a term used to describe the ability to have more than one orgasm within the span of minutes or seconds.5﻿ The orgasm may not involve actual ejaculate but must include the physiological and emotional components of ejaculation.

According to research from the [Department of Urologic Sciences at the University of British Columbia](https://linkinghub.elsevier.com/retrieve/pii/S2050052115000542) in Canada, only around 10 percent of men in their 20s and less than 7 percent of men under 30 are considered multiorgasmic.

The multiorgasmic state can be classified in one of two ways:

* **Condensed**, in which two to four individual and defined orgasms occur within a few seconds to two minutes
* **Sporadic**, in which refraction is delayed and multiple orgasms can be achieved within the span of several minutes

Beyond age, there are several factors commonly noted in multiorgasmic men. These include the use of psychoactive drugs, having multiple partners, having novel sex partners, and the use of sex toys to enhance tactile stimulation.

6﻿What this suggests is that the ability to achieve multiple orgasms is the result of a heightened state of arousal rather than any unique hormonal or physiological response.

## **Male Orgasm Disorders**

Orgasm disorders differ from ejaculation disorders in that the latter refers to the actual emission of semen. Common ejaculation disorders include [premature ejaculation](https://www.verywellhealth.com/premature-ejaculation-2328534), [retrograde ejaculation](https://www.verywellhealth.com/is-a-generic-version-of-flomax-available-1124023) (in which semen is redirected to the bladder), and anejaculation (inability to ejaculate).

Retrograde ejaculation should not be confused with dry orgasm,7﻿ a condition in which very little semen is expelled during climax. Also known as orgasmic anejaculation, dry orgasm commonly occurs after bladder or prostate surgery, or as the result of low testosterone, sperm duct blockage, high blood pressure, or an enlarged prostate.

By contrast, [anorgasmia](https://www.verywellhealth.com/anorgasmia-causes-and-treatment-options-2328525) is a condition in which a man or woman is unable to achieve orgasm. Anorgasmia may be caused by psychological problems, such as stress, trauma, and performance anxiety, or physical ones, such as diabetes, hypertension, and hypogonadism (low testosterone). Prostate surgery ([prostatectomy](https://www.verywellhealth.com/is-orgasm-possible-after-prostate-cancer-treatment-2782000)) is also a common cause, as are certain medications such as [selective serotonin reuptake inhibitors](https://www.verywellhealth.com/serotonin-s-role-in-the-biology-of-ejaculation-4156268) (SSRIs[)](https://www.verywellmind.com/how-do-ssris-compare-to-maois-1066856?_ga=2.100815617.1811875598.1529451040-1453487952.1525879403) used to treat depression.

The treatment of anorgasmia depends on the underlying cause and may include psychotherapy, a change of medications, testosterone replacement therapy, or the use of Dostinex (cabergoline), a dopamine promoter that can alter the hormonal response in men with anorgasmia.

Unfortunately, erectile dysfunction drugs like Viagra (sildenafil) and Cialis (tadalafil) cannot treat orgasm problems, as their only function is to increase blood flow to the penis. They do not enhance libido and typically fail to work in the absence of sexual stimulation.

On the other hand, some men are able to enhance both an erection and orgasm with digital [prostate massage](https://www.verywellhealth.com/things-to-know-about-prostate-health-4066015). This is a technique in which a finger is inserted into the rectum prior to and/or during sex to manually stimulate the prostate gland. Located on the front wall of the rectum, the walnut-sized gland is considered by some to be the male G-spot.

**-MALE INFERTILITY**

Male infertility isn't something you hear much about on the news, so you may be surprised to know that male infertility is almost as likely as female infertility to be involved in a couple's inability to achieve pregnancy.

The good news is that most cases of male infertility can be resolved either by treating the problem or using fertility treatments. When this is not the case, a couple facing male infertility may turn to a sperm donor or adoption to help build their family.

About 10% - 15% of couples will not be able to achieve pregnancy after one year of unprotected intercourse. Out of this group, the following statistics on the cause of infertility generally apply:1﻿

* One-third of couples will discover fertility problems in only the man.
* One-third of couples will discover fertility problems in both partners or will have their infertility remain unexplained.
* One-third of couples will discover fertility problems in only the woman.

## **Diagnosis**

Male infertility is usually diagnosed by a [semen analysis](https://www.verywellfamily.com/understanding-semen-analysis-results-1960155). This relatively simple test involves the man providing a semen sample for a lab to evaluate. The lab uses this sample to measure the amount of semen and the number of sperm and to evaluate sperm shape and movement.

Ideally, the test should be performed at least twice to confirm [results](https://www.verywellfamily.com/what-if-your-semen-analysis-results-are-abnormal-1960164).

Most of the time, basic semen analysis is all that's needed to diagnose male infertility. However, further testing may include:2﻿

* A general physical exam by a urologist.
* Specialized semen analysis, including genetic testing of the sperm (looking for the presence of antibodies) and evaluation of immobile sperm (to see if they are dead or alive).
* Blood work to check hormone levels, usually of FSH and testosterone, but sometimes also LH, estradiol, or prolactin.
* [Genetic karyotyping](https://www.verywellfamily.com/genetic-karyotyping-1960122), if a recurrent miscarriage is a problem.
* Ultrasound.
* Post-ejaculatory urinalysis (urine testing), to check for retrograde ejaculation.
* Testicular biopsy.
* Vasography.

## **Symptoms**

If a couple doesn't get pregnant after a year of unprotected intercourse, both the man and woman should be evaluated.

Unlike female infertility (where [irregular periods](https://www.verywellfamily.com/anovulation-and-ovulatory-dysfunction-1959926) may hint at a problem), obvious symptoms are not common with male infertility.

In some cases, hormonal problems may be suspected if a man has abnormal hair growth, low libido, or other indications of sexual dysfunction.

Risk factors for male infertility include obesity, age (over 40 — yes, [men also have biological clocks](https://www.verywellfamily.com/does-age-affect-male-fertility-1959934)), current or previous infection of an STD, smoking, or excessive drinking. Some medications may also impair fertility.

## **Causes**

Potential causes of male infertility are:

* The complete absence of sperm (azoospermia)
* Low sperm count (oligospermia)
* Abnormal sperm shape (teratozoospermia)
* Problems with sperm movement (asthenozoospermia)
* Sperm that is completely immobile (necrozoospermia); the sperm may be alive and not moving, or they may be dead
* Problems with sperm delivery, due to sexual dysfunction, an obstruction, previous vasectomy, or retrograde ejaculation
* Problems with erections or other sexual problems

There are a variety of conditions that may lead to male infertility. The most common cause of male infertility is [varicoceles](https://www.verywellfamily.com/varicocele-and-infertility-1959923). A varicocele is a varicose vein found in the scrotum. The extra heat caused by the vein can lead to low sperm count and impaired sperm movement.

## **Options for Treatment**

Some causes of male infertility are treatable or correctable through surgery. Options for treatment may include:

* Treatment with antibiotics, in cases of infection
* Surgical correction, in order to remove a varicocele, reverse a vasectomy, or repair a duct obstruction
* Medications or [fertility drugs to improve sperm](https://www.verywellfamily.com/clomid-for-men-side-effects-and-success-rates-1959965) production

In cases where the above treatments are unsuccessful, or when the cause of male infertility is unknown or untreatable, IUI treatment or IVF treatment may be suggested.

[IUI treatment](https://www.verywellfamily.com/what-is-iui-treatment-1960187), where the sperm is transferred into the uterus via the cervix, is commonly used in cases of low sperm count or quality. [IVF treatment](https://www.verywellfamily.com/understanding-ivf-treatment-step-by-step-1960200) may be suggested if IUI is not successful or appropriate, or if female infertility is a contributing problem.

In some cases, your doctor may recommend a procedure known as [intracytoplasmic sperm injection (ICSI)](https://www.verywellfamily.com/what-you-should-know-about-icsi-ivf-1960209). Done as part of an IVF treatment, ICSI involves injecting a single sperm into an egg.

If sperm does not appear in the ejaculate, but they are being produced, the doctor may be able to take sperm directly from the testicles, or from the bladder (in cases of retrograde ejaculation), and use that sperm to fertilize an egg in the lab. This would be done as part of an IVF treatment.

However, if none of these options are available, or if they are unsuccessful, your doctor may talk to you about using a sperm donor, or consider adoption, to help build your family.