**GREEN GRACE IGBOGI**

**18/MHS07/021**

**PHARMACOLOGY**

**PHS 212 ASSIGNMENT**

**QUESTIONS**

**Write short notes on the following:**

1. **Spermatogenesis**
2. **Testosterone**
3. **Semen**
4. **Male orgasm**
5. **Male infertility**
6. **SPERMATOGENESIS**

Spermatogenesis is the process by which [haploid](https://en.m.wikipedia.org/wiki/Haploid) [spermatozoa](https://en.m.wikipedia.org/wiki/Spermatozoa) develop from [germ cells](https://en.m.wikipedia.org/wiki/Germ_cell) in the [seminiferous tubules](https://en.m.wikipedia.org/wiki/Seminiferous_tubules) of the [testis](https://en.m.wikipedia.org/wiki/Testis). This process starts with the [mitotic division](https://en.m.wikipedia.org/wiki/Mitosis) of the [stem cells](https://en.m.wikipedia.org/wiki/Stem_cell) located close to the basement membrane of the tubules. These cells are called [spermatogonial stem cells](https://en.m.wikipedia.org/wiki/Spermatogonial_Stem_Cells%22%20%5Co%20%22Spermatogonial%20Stem%20Cells). The mitotic division of these produces two types of cells. Type A cells replenish the stem cells, and type B cells differentiate into primary [spermatocytes](https://en.m.wikipedia.org/wiki/Spermatocyte). The primary spermatocyte divides meiotically ([Meiosis](https://en.m.wikipedia.org/wiki/Meiosis) I) into two secondary spermatocytes; each secondary spermatocyte divides into two equal haploid [spermatids](https://en.m.wikipedia.org/wiki/Spermatids) by Meiosis II. The spermatids are transformed into spermatozoa (sperm) by the process of spermatogenesis. These develop into mature spermatozoa, also known as [sperm cells](https://en.m.wikipedia.org/wiki/Sperm). Thus, the primary spermatocyte gives rise to two cells, the secondary spermatocytes, and the two secondary spermatocytes by their subdivision produce four spermatozoa and four haploid cells.

Spermatozoa are the mature male [gametes](https://en.m.wikipedia.org/wiki/Gamete) in many sexually reproducing organisms. Thus, spermatogenesis is the male version of [gametogenesis](https://en.m.wikipedia.org/wiki/Gametogenesis), of which the female equivalent is [oogenesis](https://en.m.wikipedia.org/wiki/Oogenesis). In [mammals](https://en.m.wikipedia.org/wiki/Mammal) it occurs in the [seminiferous tubules](https://en.m.wikipedia.org/wiki/Seminiferous_tubules) of the male [testes](https://en.m.wikipedia.org/wiki/Testes) in a stepwise fashion. Spermatogenesis is highly dependent upon optimal conditions for the process to occur correctly, and is essential for [sexual reproduction](https://en.m.wikipedia.org/wiki/Sexual_reproduction). [DNA methylation](https://en.m.wikipedia.org/wiki/DNA_methylation) and [histone modification](https://en.m.wikipedia.org/wiki/Histone_modification) have been implicated in the regulation of this process. It starts at [puberty](https://en.m.wikipedia.org/wiki/Puberty) and usually continues uninterrupted until death, although a slight decrease can be discerned in the quantity of produced sperm with increase in age (see [Male infertility](https://en.m.wikipedia.org/wiki/Male_infertility)).

Spermatogenesis starts in the bottom part of seminiferous tubes and, progressively, cells go deeper into tubes and moving along it until mature spermatozoa reaches the lumen, where mature spermatozoa are deposited. The division happens asynchronically; if the tube is cut transversally one could observe different maturation states. A group of cells with different maturation states that are being generated at the same time is called a spermatogenic wave.

1. **TESTOSTERONE**

Testosterone is the primary [male](https://en.m.wikipedia.org/wiki/Male) [sex hormone](https://en.m.wikipedia.org/wiki/Sex_hormone) and [anabolic steroid](https://en.m.wikipedia.org/wiki/Anabolic_steroid). In male humans, testosterone plays a key role in the development of [male reproductive](https://en.m.wikipedia.org/wiki/Male_reproductive_system) tissues such as [testes](https://en.m.wikipedia.org/wiki/Testes) and [prostate](https://en.m.wikipedia.org/wiki/Prostate), as well as promoting [secondary sexual characteristics](https://en.m.wikipedia.org/wiki/Secondary_sexual_characteristic) such as increased [muscle](https://en.m.wikipedia.org/wiki/Muscle) and [bone](https://en.m.wikipedia.org/wiki/Bone) mass, and the growth of [body hair](https://en.m.wikipedia.org/wiki/Androgenic_hair). In addition, testosterone is involved in health and well-being, and the prevention of [osteoporosis](https://en.m.wikipedia.org/wiki/Osteoporosis). Insufficient levels of testosterone in men may lead to abnormalities including frailty and bone loss.

Testosterone is a [steroid](https://en.m.wikipedia.org/wiki/Steroid) from the [androstane](https://en.m.wikipedia.org/wiki/Androstane%22%20%5Co%20%22Androstane) class containing a [keto](https://en.m.wikipedia.org/wiki/Ketone%22%20%5Co%20%22Ketone) and [hydroxyl](https://en.m.wikipedia.org/wiki/Hydroxyl) groups at positions three and seventeen respectively. It is [biosynthesized](https://en.m.wikipedia.org/wiki/Biosynthesis) in several steps from cholesterol and is converted in the liver to inactive metabolites. It exerts its action through binding to and activation of the [androgen receptor](https://en.m.wikipedia.org/wiki/Androgen_receptor). In humans and most other [vertebrates](https://en.m.wikipedia.org/wiki/Vertebrate), testosterone is secreted primarily by the [testicles](https://en.m.wikipedia.org/wiki/Testicles) of [males](https://en.m.wikipedia.org/wiki/Male) and, to a lesser extent, the [ovaries](https://en.m.wikipedia.org/wiki/Ovaries) of [females](https://en.m.wikipedia.org/wiki/Female). On average, in adult males, levels of testosterone are about 7 to 8 times as great as in adult females. As the metabolism of testosterone in males is more pronounced, the daily production is about 20 times greater in men. Females are also more sensitive to the hormone.

In addition to its role as a natural hormone, testosterone is used as a [medication](https://en.m.wikipedia.org/wiki/Medication) in the treatment of [low testosterone levels in men](https://en.m.wikipedia.org/wiki/Male_hypogonadism), [transgender hormone therapy](https://en.m.wikipedia.org/wiki/Transgender_hormone_therapy) for [transgender men](https://en.m.wikipedia.org/wiki/Transgender_men), and [breast cancer](https://en.m.wikipedia.org/wiki/Breast_cancer) in women Since [testosterone levels decrease as men age](https://en.m.wikipedia.org/wiki/Andropause), testosterone is sometimes used in older men to counteract this deficiency. It is also used illicitly to [enhance physique and performance](https://en.m.wikipedia.org/wiki/Performance-enhancing_substance), for instance in [athletes](https://en.m.wikipedia.org/wiki/Athlete).

|  |
| --- |
| Testosterone |
| The chemical structure of testosterone. |
| A ball-and-stick model of testosterone. |

1. **SEMEN**

Semen, also known as seminal fluid, is an organic [fluid](https://en.m.wikipedia.org/wiki/Fluid) that contains [spermatozoa](https://en.m.wikipedia.org/wiki/Spermatozoon). It is secreted by the [gonads](https://en.m.wikipedia.org/wiki/Gonad) (sexual glands) and other sexual organs of [male](https://en.m.wikipedia.org/wiki/Male) or [hermaphroditic](https://en.m.wikipedia.org/wiki/Hermaphrodite) [animals](https://en.m.wikipedia.org/wiki/Animal) and can [fertilize](https://en.m.wikipedia.org/wiki/Fertilization) the [female](https://en.m.wikipedia.org/wiki/Female) [ovum](https://en.m.wikipedia.org/wiki/Ovum). In humans, seminal fluid contains several components besides spermatozoa: proteolytic and other enzymes as well as fructose are elements of seminal fluid which promote the survival of spermatozoa, and provide a medium through which they can move or "swim". Semen is produced and originates from the [seminal vesicle](https://en.m.wikipedia.org/wiki/Seminal_vesicle), which is located in the pelvis. The process that results in the discharge of semen is called [*ejaculation*](https://en.m.wikipedia.org/wiki/Ejaculation). Semen is also a form of genetic material. In animals, semen has been collected for cryoconservation. [Cryoconservation of animal genetic resources](https://en.m.wikipedia.org/wiki/Cryoconservation_of_animal_genetic_resources%22%20%5Co%20%22Cryoconservation%20of%20animal%20genetic%20resources) is a practice that calls for the collection of genetic material in efforts for conservation of a particular breed.

1. **MALE ORGASM**

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. 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.

### **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.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.

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.

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.

1. **MALE INFERTILITY**

Male infertility refers to a male's inability to cause [pregnancy](https://en.m.wikipedia.org/wiki/Pregnancy) in a fertile female. In humans it accounts for 40–50% of [infertility](https://en.m.wikipedia.org/wiki/Infertility). It affects approximately 7% of all men. Male infertility is commonly due to deficiencies in the [semen](https://en.m.wikipedia.org/wiki/Semen), and [semen quality](https://en.m.wikipedia.org/wiki/Semen_quality) is used as a surrogate measure of male fecundity.

Causes of male infertility are:

* Age
* Abnormal set of chromosomes
* [Centriole](https://en.m.wikipedia.org/wiki/Centriole)
* [Neoplasm](https://en.m.wikipedia.org/wiki/Neoplasm), e.g. [seminoma](https://en.m.wikipedia.org/wiki/Seminoma)
* [Idiopathic](https://en.m.wikipedia.org/wiki/Idiopathic) failure
* [Cryptorchidism](https://en.m.wikipedia.org/wiki/Cryptorchidism)
* [Trauma](https://en.m.wikipedia.org/wiki/Physical_trauma)
* [Hydrocele](https://en.m.wikipedia.org/wiki/Hydrocele)
* [Hypopituitarism](https://en.m.wikipedia.org/wiki/Hypopituitarism) in adults, and hypopituitarism untreated in children (resulting in growth hormone deficiency and proportionate dwarfism.)
* [Mumps](https://en.m.wikipedia.org/wiki/Mumps)
* [Malaria](https://en.m.wikipedia.org/wiki/Malaria)
* [Testicular cancer](https://en.m.wikipedia.org/wiki/Testicular_cancer)
* Defects in [USP26](https://en.m.wikipedia.org/wiki/USP26) in some cases
* [Acrosomal](https://en.m.wikipedia.org/wiki/Acrosomal) defects affecting egg penetration
* [Idiopathic oligospermia](https://en.m.wikipedia.org/wiki/Oligospermia) - unexplained sperm deficiencies account for 30% of male infertility.