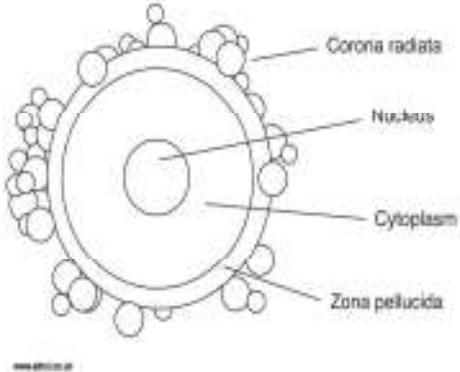


## Certified Fertility Counselor Course-Session 4- Egg (Ovum) and Sperm

### Structure of a Human Egg

The human egg is one of the largest cells in the body, yet measuring at 0.12mm in diameter.



An egg that is developing in the follicle is not visible to the naked eye or via any current available imaging equipment. There are a few terms regarding a human egg. An immature egg is called an Oocyte and a mature egg is called an Ovum. There are four main parts of the human ovum:

Nucleus - The Nucleus is the heart of the egg and contains most of the genetic material in the form of chromosomes (23 chromosomes to be exact). This is where the genes sit. Because the egg cell

only has one set of chromosomes it is referred to as a haploid cell.

Cytoplasm - The Cytoplasm is a gel-like substance that holds all the cells' internal structures called organelles. This keeps the cell alive and functioning properly.

Zona Pellucida - The Zona Pellucida is the outer membrane of the egg cell. This structure helps sperm enter the egg through its hard outer layers. The egg wall hardens with age and could be a cause for non-fertilization of the egg.

Corona Radiata - The Corona Radiata surrounds the egg and consists of about two to three layers of cells from the follicle. They attach to the outer layer of the egg. These work together with the Zona Pellucida and provide vital proteins to the egg.

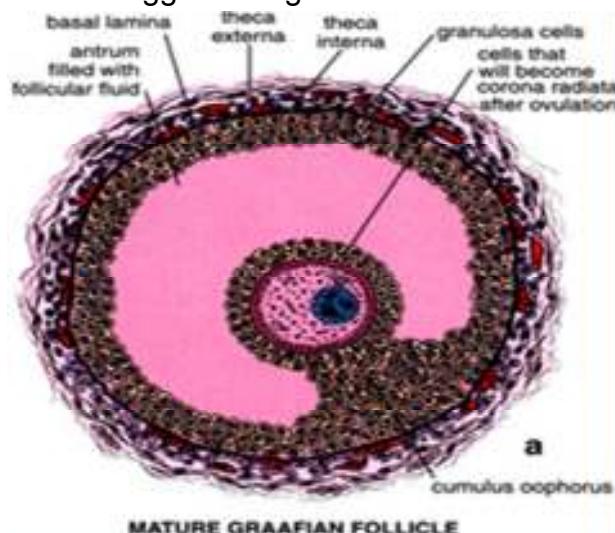
The hormones luteinizing hormone, follicle stimulating hormone, and estrogen help develop a mature egg inside the follicle. There are a total of 5 million granulosa cells (Corona Radiata) inside each follicle that surround the Zona Pellucida.

About thirty-six hours before ovulation, luteinizing hormone will be at its highest production. Luteinizing hormone then begins thinning out one area of the follicle. The follicle then opens like an eggshell, causing the antrum fluid to start slowly dripping out first. Eventually the egg then slowly oozes itself out of the follicle onto the surface of the ovary. Many people believe that the egg shoots out of the follicle, when in fact, it's quite the opposite.

A unique sugar molecule known as SLEX is highly abundant on the outer layer of the egg. Because of this it is able to attract sperm immediately once in the fallopian tubes. However, this unique sugar molecule could be the missing link of why couples cannot conceive. A study in August of 2011 explained that this molecule is what binds the sperm and egg once they meet, discovering that this could be the reason why couples suffer from unknown infertility.

## The Egg's Journey

Now the egg is sitting on the surface of the ovary and is flattened and surrounded by granulosa cells which were the sticky cells that were forming as the follicle was maturing the egg. The mass gummy material surrounding the egg is called Cumulus Oophorus which can be seen in figure A.

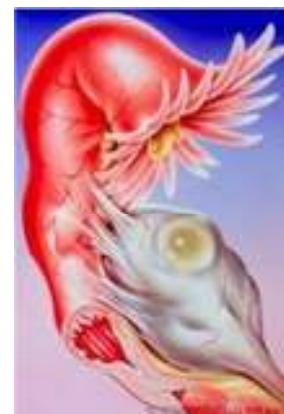


Cumulus Oophorus plays a crucial role in what happens to the egg after this point. It makes it possible for the fallopian tube to pick up the egg.

The fallopian tube is connected at one end to the inside of the uterus. The other end, which is closest to the ovarian surface, widens and opens up like a funnel. The end of the funnel

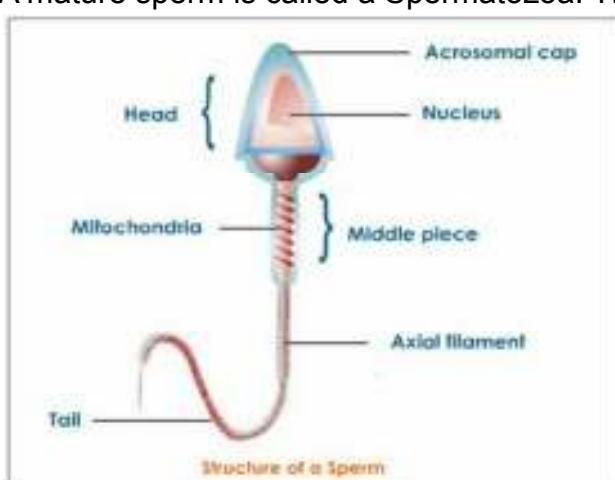
has hundreds of little fingerlike projections called fimbria. Muscle fibers within the fallopian tube cause it to wave and contract moving toward the egg and ovary. Anything that interferes with this tubal movement can disrupt the ability to pick up the egg, preventing fertilization. When the fimbria on the end of the funnel comes in contact with the Cumulus Oophorus surrounding the egg, it will stick to them, if a successful egg is picked up and moved into the fallopian tube.

Once the egg is inside the tube, the sticky mass of cumulus cells and the egg stay in what's referred to as the ampullary portion of the fallopian tube (the wide funnel like area) for six to twenty four hours unless sperm is there waiting. If no fertilization occurs at that time, the egg dissolves back into the body.



## The Structure of Sperm

A mature sperm is called a Spermatozoa. This is the smallest cell in the body, measuring about 100 times smaller than the ovum at 0.04mm long and 0.004mm wide. Like the ovum cell, the sperm cell also has a nucleus which contains the other 23 chromosomes, making this cell a haploid cell as well. The nucleus is located in the head of the spermatozoa.



Acrosomal Cap - The Acrosomal Cap is a cap like structure at the anterior end of the spermatozoa that produces enzymes aiding in egg penetration. It's also called acrosome, head cap.

Mitochondria - Middle piece of the sperm cell which supplies the sperm energy.

Axial Filament - Connects the tail to the mitochondria. This consists of a thin layer of cytoplasm and an outer smooth plasma membrane. The axial filament is formed of nine pairs of longitudinal fibers which extend up to the tip.

Tail - The tail of the sperm is basically the axial filament. However the tail is used to propel itself through the fallopian tubes.

Sperm are kept inside the testicles which are made up of two primary systems: the seminiferous tubules and the epididymis. The seminiferous tubules are a series of tiny tubes. They are so tiny in fact that there are hundreds coiled up inside each testicle. These tubules are lined with millions of Sertoli cells, each of which is intended to support and nurture a single spermatocyte as it develops and grows. Much like the woman's ovulatory maturation process, a spermatocyte starts out as an immature cell without a head or tail, each contained within its own Sertoli cell. The Sertoli cell makes the nutrients and raw materials that are necessary for the spermatocyte to mature.

It will take 72 days for one spermatocyte to develop and mature, slowly with a head, middle piece, and tail. At the completion of its growth, the spermatocyte detaches from the Sertoli and floats out into the seminiferous tubule, which leads it toward the center of the testes and into a "collecting" station called the rete testis. After remaining in the rete testis for a short period of time, it then moves into the head of the epididymis. Because it's not yet motile, it will be carried along by various mechanisms within the rete testis.

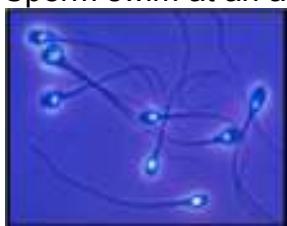
The epididymis lies outside the testicle, alongside the testicular process. In reality, the tubules within the epididymis are approximately twenty feet in length, but they are so tiny (1/300<sup>th</sup> of an inch in diameter) they can still fit into a small space. After the completion of its growth in the seminiferous tubule, the sperm enters the head of the epididymis and over a period of one to three days it moves through its entire length down to the epididymal tail. It's within the epididymis that the sperm becomes mature. Having reached the tail of the epididymis the mature sperm will move into the ejaculatory duct, awaiting ejaculation.

The initial contractions during orgasm come from the epididymis and the ejaculatory duct. They move the mature sperm up into the area of the prostatic urethra. There the accessory glands of the male reproductive tract, the seminal vesicles, contract and expel a large amount of seminal fluid, which then pushes the sperm through the prostatic urethra. Along the way the prostate gland contributes additional fluid, which combines with the seminal vesicle fluid to form "ejaculate", a thick substance that moves the sperm into the urethra of the penis.

Each ejaculate will contain about 5% spermatozoa, which is about 300,000 million sperm, filling about a teaspoon amount. On an average, a man will produce 150-1,000 sperm a day. Over the course of a man's life, he will have produced over 12 trillion sperm.

## Life of the Sperm

Sperm swim at an average rate of 0.12 inches per minute (1 to 44mm or 25 to 50 microns per second). Because it takes 72 days for one spermatozoa to mature, the temperature is required to remain three to five degrees below normal body temperature. This is why the testicles are formed on the outside away from the body. Sperm cells cannot develop or function if their temperature is higher than 93F or 94F. The normal core body temperature is 98F.



Sperm contains small amounts of more than thirty elements, including fructose, ascorbic acid, cholesterol, creatine, citric acid, lactic acid, nitrogen, vitamin B12, and various salts and enzymes.

Since sperm need to remain at a certain temperature it is advisable that when trying to conceive that the following be avoided:

- Jockstraps and tightly fitted underwear
- Hot tubs
- Hot showers
- Saunas

Hot tub exposure will create a motility of zero, and a depressed count for at least two weeks, however tend to restore between four to six weeks back to pre-hot tub exposure temperature. Riding a bike, regularly exercising, swimming and other activities that cause a man to sweat is perfectly okay, this is because the body has natural sweat glands and the testicles will naturally cool themselves down.

As mentioned before, pH balance can have a great effect on sperm. When the sperm cell, which is accustomed to balanced acidic/alkaline conditions with a pH of 7.2 enters in the vagina, it then faces a hostile environment. The vaginal canal is extremely acidic, most of the time the pH balance in the vaginal canal is a 3 or 4. One of the jobs of the "ejaculate" is to maintain a balanced pH. Unfortunately this protection is somewhat short lived. The coagulum is attacked by the acidity of the vagina, and by the high temperature of the vaginal canal, and the thick fluid becomes liquefied within 3 to 5 minutes. Once that occurs, the sperm which have the ability to swim, quickly begin searching for a protected environment, which is the cervix assuming it is open around ovulation. Fertile cervical mucus provides a way for the sperm to swim out of the ejaculate and into the cervical canal. Now if the normal cervical mucus is not present, or the pH is too acidic in the cervical mucus or reproductive tract, the sperm won't be able to enter the cervix and will die in the vaginal canal.

It takes approximately 15 to 20 minutes for the sperm to reach the egg assuming conditions are right. Normally after intercourse many women tend to "leak" out. However what she feels is left over liquefied seminal fluid, which was never intended to move up into the upper reproductive tract. The mucus in the cervical canal works as a filter to eliminate abnormal sperm.

## Hormones Involved with Sperm and Male Fertility

Much like women, men have just about the same hormone structure for their fertility. Although not the same, there are certain similarities between the hormonal process of men and women. In both female and male, the hypothalamus releases Gonadotropin Releasing Hormone (GnRH) into the system about every 60 to 90 minutes. In both cases this GnRH triggers the pituitary gland to release two additional hormones, luteinizing hormone (LH) and follicle stimulating hormone (FSH). However, the FSH and LH that are released produce very differently in both sexes. In a man, the FSH that is released from the anterior pituitary stimulates cells in the testicles to grow, mature, and release male germ cells (sperm). Concurrently, the LH secretion from the pituitary stimulates unique cells in the testicles called Leydig cells, to produce the primary male hormone, testosterone. It's testosterone that causes male sexual characteristics such as muscular development, facial hair, and deepening of the voice.

Because FSH and LH serve two entirely different purposes in the male reproductive system, it's possible for one to cause problems while the other does not. For example, if only the release of FSH which directs the growth of sperm is deficient, a man will then have an infertility problem, yet not have any change in characteristics such as normal ejaculatory function, beard growth, body shape or sex drive. For any of those particular characteristics to be affected, it's only LH which directs the production of testosterone that is deficient.

## Quality, Quantity, Motility and Healthy Sperm

A lot of couples who go through infertility issues will have their sperm checked for abnormalities, quantity, and quality. Certain factors in a man's lifestyle will affect his sperm production and counts.



Quantity is the number of sperm cells present in one milliliter of semen. In healthy semen an analysis will show tens of millions of sperm cells in just one milliliter. In reality only 200 sperm reach the destination (egg cell) out of the average 300 million produced.

Quality is containing a healthy structure and shape. A good quality sperm cell has an oval head and a long tail. It is possible for a man to produce a good amount of sperm in the ejaculate, however have abnormal sperm.

Motility is basically the ability for the sperm cells to swim forward. Sperm cells need to be able to move forward to the egg in the fallopian tube, so the semen analysis will be able to show if the sperm is able to swim and wriggle around. There are times where a man's semen is too thick, causing the sperm to be immobilized.

## **When going in for a semen analysis they will test for the following factors:**

- Fructose Level - This is a sugar in semen that provides sperm with energy.
- Liquefaction Time - When ejaculation occurs it is first a gel-like substance that gradually turns into liquid. The semen analysis will measure how long it takes the semen to turn to liquid.
- pH Level - This will measure alkaline or acidity of semen.
- White Blood Cell Count - These are not normally found in healthy semen.

Keeping sperm healthy consists of exercising regularly, eating well (keeping pH balance in semen at a good level), taking vitamins and minerals especially through food (zinc is especially good for sperm health), avoiding stress, quit smoking/drinking and avoiding prescription medication as this can have an effect on sperm, and watch the temperature of the scrotum.

If an infection is located where the fluid component of the ejaculate is manufactured, white blood cells may be found in the ejaculate which will affect the sperms' motility and the ability to fertilize the egg. Infections inside the urethra and penis can also affect sperm quality. It's important for the male to keep all areas clean, and from infections.

## CERTIFIED FERTILITY COUNSELOR COURSE - SESSION 4 – QUESTION & ANSWERS

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

PHONE: \_\_\_\_\_

FAX: \_\_\_\_\_

E-MAIL: \_\_\_\_\_

Please be sure to fill out the information above, complete the test and e-mail it back to us at [myeggandme@amandabears.com](mailto:myeggandme@amandabears.com). We will grade your question & answer session and will let you know if we have any questions or concerns.

1. How big is the egg cell?
2. What is an immature egg called, and a mature egg called?
3. Name the four main parts of the human egg and what their functions are
4. Explain how the egg comes out of the follicle, and what main hormone helps this.
5. How long does the ovum live for?
6. What is the Cumulus Oophorus, and what is its role?
7. How big is the sperm cell?
8. What's a mature sperm called?
9. What are the structures of a sperm, and their functions?
10. A sperm is not a haploid cell. T/F
11. In the sperm, where is the nucleus located and what does it contain?
12. What are the testicles two primary systems?
13. What's a stertoli cell?
14. How long does it take for a sperm cell to mature?
15. In a brief summary, what is the process it takes for the sperm cell to mature?
16. How much spermatozoa will each ejaculate contain?
17. How fast do sperm swim?
18. What is the temperature for sperm cells to develop and mature?
19. What should be avoided for the sperm when trying to conceive?
20. What hormones are involved with the maturation of sperm?
21. What is quality, quantity, and motility?
22. What is tested in a semen analysis?
23. How many sperm will a man produce in his lifetime?