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1. Ovulation

Ovulation is the release of an egg from one of a woman's ovaries. After the egg is released, it travels down the fallopian tube, where fertilization by a sperm cell may occur.

Ovulation typically lasts one day and occurs in the middle of a woman's menstrual cycle, about two weeks before she expects to get her period. But the timing of the process varies for each woman, and it may even vary from month to month.

If a woman is hoping to become pregnant, she will want to keep track of when she may be ovulating. Knowing when a woman is ovulating each month is helpful because she is the most fertile — or able to become pregnant —around the time of ovulation.

Menstrual cycle and ovulation

At birth, a female fetus has 1 to 2 million immature eggs called oocytes inside her ovaries, which is all the eggs she will ever produce. By the time a girl enters puberty, about 300,000 of these eggs remain. Approximately 300 to 400 of the remaining eggs will be ovulated during a woman's reproductive lifetime.

A likely sign that a woman is ovulating is that she is having regular, predictable periods that occur every 24 to 32 days.

With every monthly menstrual cycle, a woman's body prepares for a potential pregnancy. The cycle is regulated by hormones, including the sex hormones estrogen and progesterone, as well as follicle-stimulating hormone and luteinizing hormone. Hormones play a key role in all stages of the menstrual cycle, allowing the ovum (egg) to mature and eventually be released.

When a mature egg leaves a woman's ovary and travels into the fallopian tube, a sperm cell can fertilize the egg. Sperm can live inside a woman's reproductive tract for about 3 to 5 days after sexual intercourse. For pregnancy to take place, a sperm cell must fertilize the egg within 12 to 24 hours of ovulating. The fertilized egg then travels to the uterus, or womb, where it can attach to the lining of uterus and develop into a fetus.

During ovulation, the walls of the uterus also thicken to prepare for a fertilized egg. But if the egg is not fertilized, the uterine lining is shed about two weeks later, causing menstrual flow to begin. But simply having her period does not always indicate that a woman is ovulating.

Many women have an ovulatory cycle (the buildup of the lining of the uterus) because they are making estrogen. But when the buildup gets to a certain level, the lining just sloughs off, and a woman can bleed quite heavily. When a woman ovulates, she also makes the hormone progesterone, which results in a more controlled bleed.

2. Differences between meiosis 1 and meiosis 2

First of all, meiosis is the cell division that takes place in the germ cell to generate male and female gametes, sperm and egg cells, respectively. Meiosis requires two cell divisions namely:

(i.) Meiosis 1 (reduction)

(ii.) Meiosis 2 (division)

Meiosis 1 signifies reduction because it reduces the ploidy level from 2n to n while meiosis 2 signifies division because it divides the remaining set of chromosomes.

Meiosis 1 involves 4 stages which are; prophase 1, metaphase 1, anaphase 1 and telophase 1.

The major events that takes place during prophase 1 include:

I. **Synapsis:** Homologous chromosomes align themselves in pairs.

II. **Crossing over:**

   a. Involves the interchange of chromatid segments between paired homologous chromosomes.

   b. Segments of chromatids break and are exchanged as homologous chromosomes separate.

III. **Chiasma formation:** As separation occurs, points of interchange are temporarily united and form an X-like structure, a **chiasma**.

- ✓ Metaphase1(Alignment): alignment of 46 homologous duplicated chromosomes at the metaphase plate (equitorial plate)

- ✓ Anaphase1 (Disjunction): separation of 46 homologous duplicated chromosomes from each other; ***centromeres do not split***
- ✓ Telophase1 (Cell division): formation of two secondary gametocytes (23 duplicated chromosomes, 2N).

Meiosis 2 also involves 4 stages which are; prophase 2, metaphase 2, anaphase 2 and telophase 2.

During **Prophase 2**

- nuclear envelopes dissolve
- spindle fibers reform
- Synapsis is absent
- Crossing over is absent

Metaphase 2 (Alignment): alignment of 23 duplicated chromosomes at the metaphase plate.

Anaphase 2 (Disjunction): separation of 23 duplicated chromosomes to form 23 single chromosomes; ***centromeres split***

Telophase 2 (Cell division): formation of four gametes (23 duplicated chromosomes, 1N).

3. STAGES OF FERTILIZATION

Oocyte Transport:

- During ovulation, the secondary oocyte with the escaping follicular fluid are expelled from the ovarian follicle
- (the fimbriated end of the uterine tube becomes closely applied to the ovary
- The fingerlike processes of the tube, fimbriae, move back and forth over the ovary
- As a result of:

I. sweeping action of the fimbriae

II. fluid currents produced by the cilia of the mucosal cells of the fimbriae; the secondary oocyte migrates into the funnel-shaped infundibulum of the uterine tube

- From the infundibulum, the secondary oocyte passes into the ampulla of the tube, mainly as the result of peristalsis-movements (alternate contraction and relaxation) of the wall of the tube.

Sperm transport

- Sperms are produced in the testes and they are temporarily stored in the epididymis
- from their storage site in the epididymis, (mainly in the tail of the epididymis), the sperms are rapidly transported to the urethra by the ductus(Vas) deferens
- by peristaltic contractions of the thick muscular coat of the ductus deferens
- (The accessory sex glands- seminal glands (vesicles), prostate, and bulbourethral glands-produce secretions that are added to the sperm-containing fluid in the ductus deferens and urethra

- From 200 to 600 million sperms are deposited around the external os of the uterus and in the fornix of the vagina during sexual intercourse
- The sperms pass slowly through the cervical canal by movements of their tails
- As semen moves in the cervical canal, an enzyme which is produced produced by the seminal glands called **vesiculase** coagulates(hardens) some of the semen or ejaculate and forms a **vaginal plug (barrier)** that may prevent the backflow of semen into the vagina
- Prostaglandins in the semen helps to stimulate uterine motility at the time of intercourse and assist in the movement of sperms to the site of fertilization in the ampulla of the tube
- Fructose is secreted by the seminal glands, is an energy source for the sperms in the semen

note

- When ovulation occurs, the cervical mucus increases in amount and becomes less viscid, making it more favorable for sperm transport
- Passage of sperms through the uterus and uterine tubes results mainly from muscular contractions of the walls of these organs

Capacitation

- Capacitation lasts for about 7 hours

For capacitation of sperms to occur,

- a glycoprotein coat and seminal plasma proteins are removed from the plasma membrane that overlies the acrosomal region of the spermatozoa.

- Only capacitated sperms can pass through the corona cells (corona radiata) and undergo the acrosome reaction.

Acrosome reaction

Note:

- The acrosome reaction occurs after binding to the zona pellucida
- The intact acrosome of the sperm binds with a glycoprotein (ZP3/ zona protein 3) on the zona pellucida
- This reaction causes the release of enzymes including hyaluronidase and acrosin, from the acrosome which are needed to penetrate the zona pellucida and this facilitate fertilization
- The **acrosome reaction** of sperms must be completed before the sperm can fuse with the oocyte.
- . Breakdown of the membranes at these sites produces apertures
- The changes induced by the acrosome reaction are associated with the release of enzymes, including hyaluronidase and acrosin, from the acrosome that facilitate fertilization.

4. DIFFERENCES BETWEEN MONOZYGOTIC AND DIZYGOTIC TWINS

MONOZYGOTIC TWINS	**DIZYGOTIC TWINS**
Form from single zygote	Form from two zygotes
Incidence is more common	Incidence is less common
Genetically identical	Genetically not identical
Twins are of the same sex	Twins are of the same or different sex
Resemblance is similar	Resemblance is like any other two siblings
Mostly diamniotic, monochorionic, with single placenta	Mostly have two amnions, two chorions and two placentas
Are often called conjoined twins	Not seen as conjoined twins