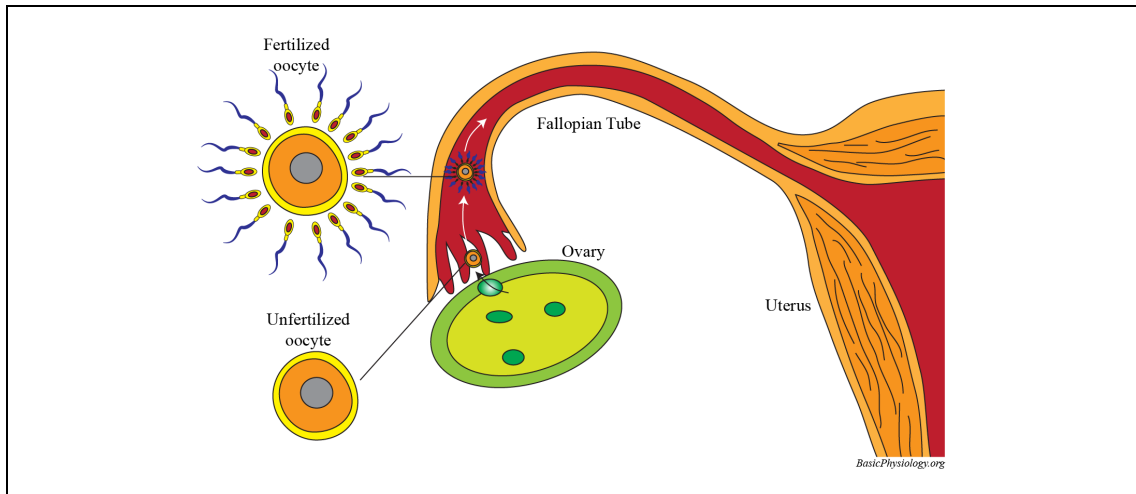


G.5. Fertilization

A. First step: Fertilization

<p>1. Once the ovary has released an oocyte, it is 'caught' by the fimbriae of the Fallopian tubes and starts to move into this tube.</p>	<p>2. This movement, by the way, is caused by the peristaltic contractions of the muscles in the Fallopian tube 'pushing' the oocyte towards the uterus cavity.</p>
<p>3. During this journey however, a lot of things can and must happen to this oocyte.</p>	<p>4. First of all, if the male companion has discharged sperm cells inside the female vagina, then these sperm cells will have swum into the uterine cavity and into the two Fallopian tubes.</p>
<p>5. If that is the case, then the sperm cells in the right tube (in the diagram) will encounter the oocyte and 'fertilize' it!</p>	<p>6. For this to occur however, the sperm cell has to penetrate the zona pellucida that surrounds this oocyte and reach the cellular membrane of the oocyte.</p>
<p>The diagram shows six stages of fertilization (A-F). Stage A: An oocyte with a red female pronucleus and a blue zona pellucida. Stage B: Sperm cells (blue) approaching the oocyte. Stage C: One sperm cell (blue) penetrating the zona pellucida, labeled 'Invading Sperm'. Stage D: The sperm cell is inside the oocyte, and the zona pellucida is now 'closed' (blue). Stage E: The sperm's DNA (blue) forms a male pronucleus, and the oocyte's DNA (red) forms a female pronucleus. Stage F: Chromosomes from both parents are visible, and a centrosome is forming.</p>	
<p>7. And, as you can see in the diagram, the sperm cells are not alone but is surrounded by hundreds, if not thousands of competitors!</p>	<p>8. The first sperm cell that manages to penetrate the zona pellucida and reach the cellular membrane of the oocyte will release enzymes from the acrosome that was located in the head of the sperm cell.</p>
<p>9. These enzymes will immediately 'harden' the zona pellucida so that the other sperm cells can no longer penetrate this shield. Simply put, the enzymes of the first sperm cell will slam the 'door' to the other sperm cells. They are too late!</p>	<p>10. Obviously, if there were no sperm cells waiting for an oocyte, then that oocyte will continue its journey on its own, along the tube, into the uterine cavity and, ultimately, to be shed outside with the monthly menstruation.</p>



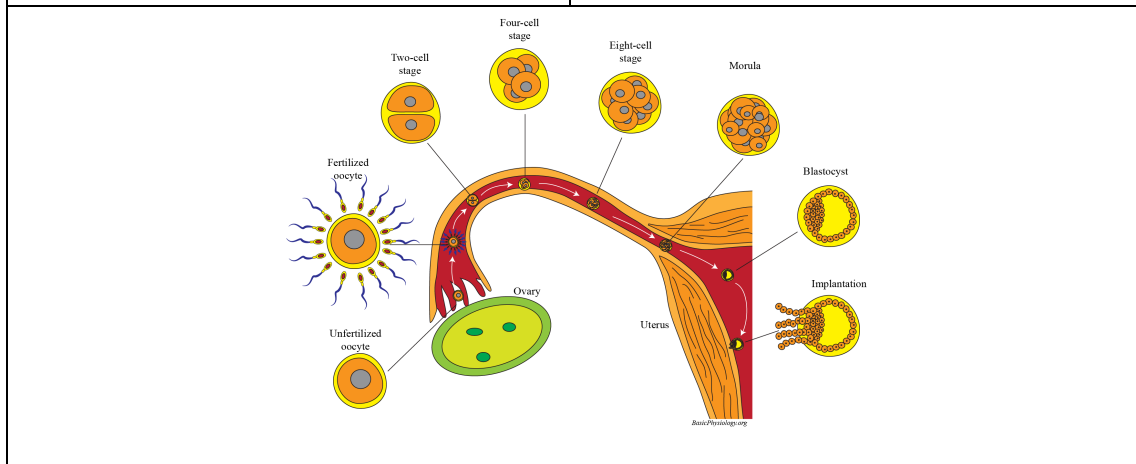
11.
By the way, please note that the unfertilized oocyte, when it leaves the ovary, is temporarily travelling in the peritoneal space. If, by bad luck, it is not caught by the fimbriae and transported into the Fallopian tube, it may get fertilized while wandering in the peritoneal cavity.

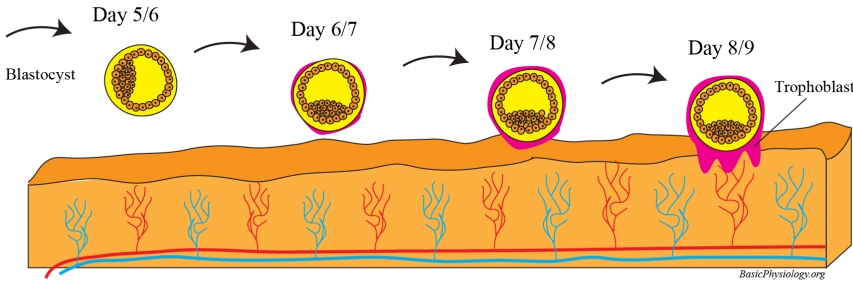
12.
This will lead to an **extra-uterine gravidity**, which is of course incompatible with a successful pregnancy. In this case, the embryo will surely die at a certain moment and expose the mother to dangerous complications.

B. Second step: Implantation

1.
So, now that the oocyte has been fertilized, now called a **zygote**, a whole new series of events will occur!

2.
The penetration of the sperm cell into the oocyte immediately induces the formation of meiosis II. So, the chromosomes from the sperm cell and that of the oocyte, both haploids, now form a new set of DNA. A new full-blown diploid nucleus has formed.



<p>3. But there is no time to be lost; a new individual has to develop!</p>	<p>4. This is done as the fertilized zygote starts the process by dividing into more cells; first two cells, then these two divides into four, then into 8, and then into 16 cells, all clustered together.</p>
<p>5. Meanwhile, while all this takes place, the zygote, is pushed along the Fallopian tube towards the uterus.</p>	<p>6. By the time it reaches the uterine cavity, which takes a few days (!), the zygote has reached more than 50-100 cells and is called a blastocyst.</p>
<p>Implantation</p>  <p>The diagram illustrates the process of implantation in four stages: Day 5/6, Day 6/7, Day 7/8, and Day 8/9. At Day 5/6, a blastocyst (a cluster of cells with a central cavity) is shown. At Day 6/7, it is shown moving towards the uterine wall. At Day 7/8, it is shown partially embedded in the uterine wall. At Day 8/9, it is fully embedded, and the outer layer of cells is labeled as the trophoblast. The uterine wall is shown as a cross-section with blood vessels and connective tissue.</p>	
<p>7. It takes an additional 1-3 days before actual implantation in the uterine wall occurs.</p>	<p>8. So, this implantation takes about 7-9 days after the actual ovulation of the oocyte in the ovary.</p>
<p>9. The implantation of the blastocyst is helped by another type of cell, the trophoblast cells. These cells secrete enzymes that digest and liquefy the neighbouring cells in the uterine wall, thereby creating a 'hole' in which the blastocyst can settle.</p>	<p>10. After successful implantation, the trophoblast and neighbouring uterine cells develop further to form the placenta.</p>

C. Third step: Pregnancy

1.
This will be discussed in another chapter! *Coming soon ...*

D. Twins: how does that happen?

<p>1. In some cases, not one but two babies are born (sometimes even more ...). In some pregnancies, this was expected but quite often, this is really a big surprise during delivery!</p>	<p>2. How does a twin pregnancy occur? The foundation occurs very early in the pregnancy, right after fertilization, while the zygote is still in the fallopian tube.</p>
<p>3. For example, once an oocyte has been fertilized by a sperm cell, and the zygote has started to divide into multiple cells, in some cases, the zygote may 'accidentally' dissociate from each other, thereby creating two separate zygotes.</p>	<p>4. These two zygotes can then further develop into two embryos and ultimately into two babies! These are called monozygotic twins, also called identical twins, since they share the same DNA (from mother and from father).</p>
<p>The diagram illustrates two pathways to twinning. On the left, under 'Identical (Monozygotic)', a single sperm cell fertilizes a single egg cell to form a zygote. This zygote then undergoes a division, resulting in two separate embryos. On the right, under 'Fraternal (Dizygotic)', two separate egg cells are each fertilized by a separate sperm cell, resulting in two separate zygotes, each of which develops into an embryo. The source 'BasicPhysiology.org' is noted at the bottom of the diagram.</p>	
<p>5. Another thing can also happen. Suppose that the mother secretes not one but two oocytes at the same time. These two could then both be fertilized by two different sperm cells, again creating a twin!</p>	<p>6. But this time, their DNA, originating from two different sperm cells, will be different from each other; creating a dizygotic twin, also called fraternal twins.</p>
<p>7. By the way, once a twin is created, this does not always mean that there will be two babies!</p>	<p>8. It has happened that such a twin-pregnancy had been discovered in the early stage of pregnancy but, after some time, one of the two twins has disappeared, probably due to malfunction of the placenta or something like that.</p>

9.

It is also possible that the dissociation of the two zygotes was not complete. In that case, the two twins will develop with some part of their bodies attached to each other (**conjoined** twins also called **Siamese** twins).

10.

It depends on which part or organ of the body is conjoined whether this pregnancy will deliver these twins and whether they will later be able to survive together! Sometimes, surgery can dissociate the twins. Fortunately, Siamese twins occur very rarely.

