Understandings:

1. Explain the main similarities in spermatogenesis and oogenesis.

2. Explain the main differences in spermatogenesis and oogenesis.

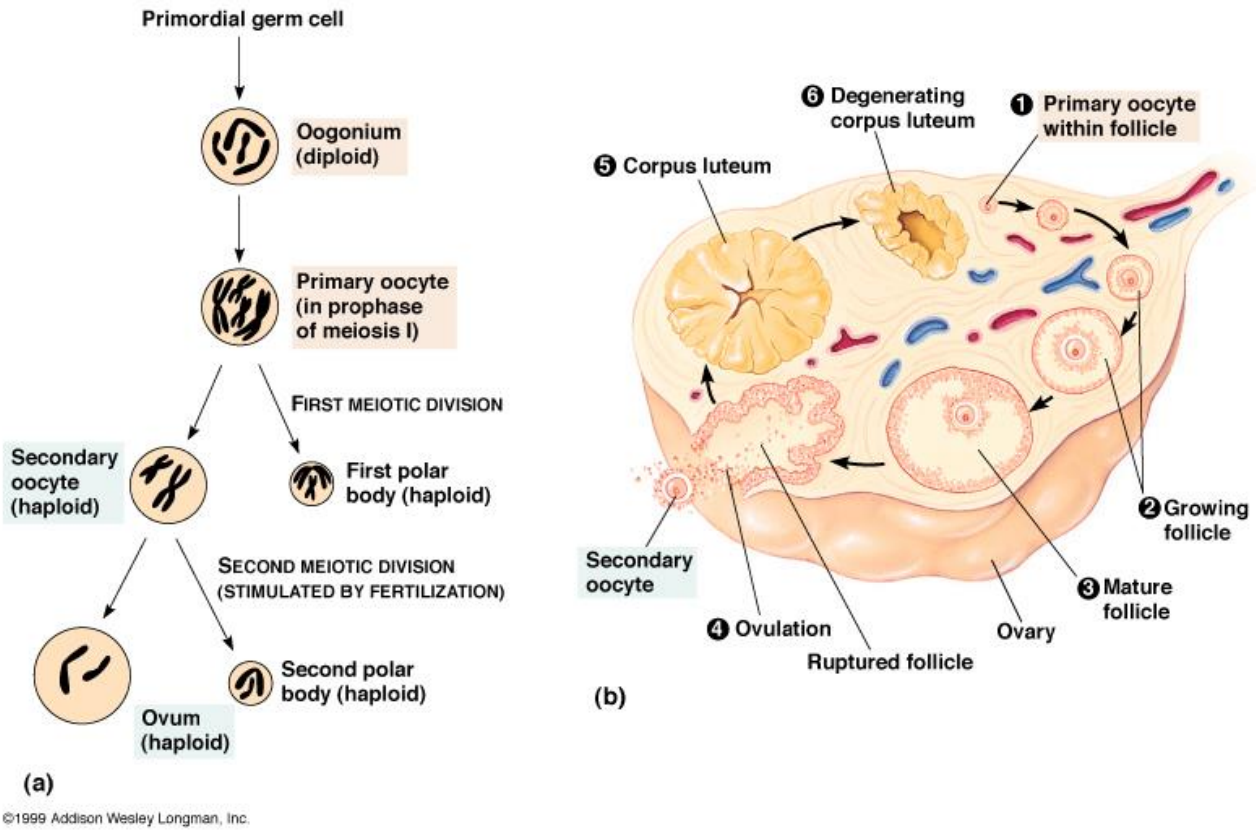
Extra notes

- The syllabus tells us to explain the similarities and differences between spermatogenesis and oogenesis, but I think it would be better to just understand each of the processes first. Then, the similarities and differences would be more easily identifiable and discussable.

1. Explain the process of oogenesis.

- Okay, after I have explained this, you will understand that women are indeed complicated (woah take it easy it is a half-joke).

Oogenesis literally means oocyte/egg creation. This happens in the ovaries.



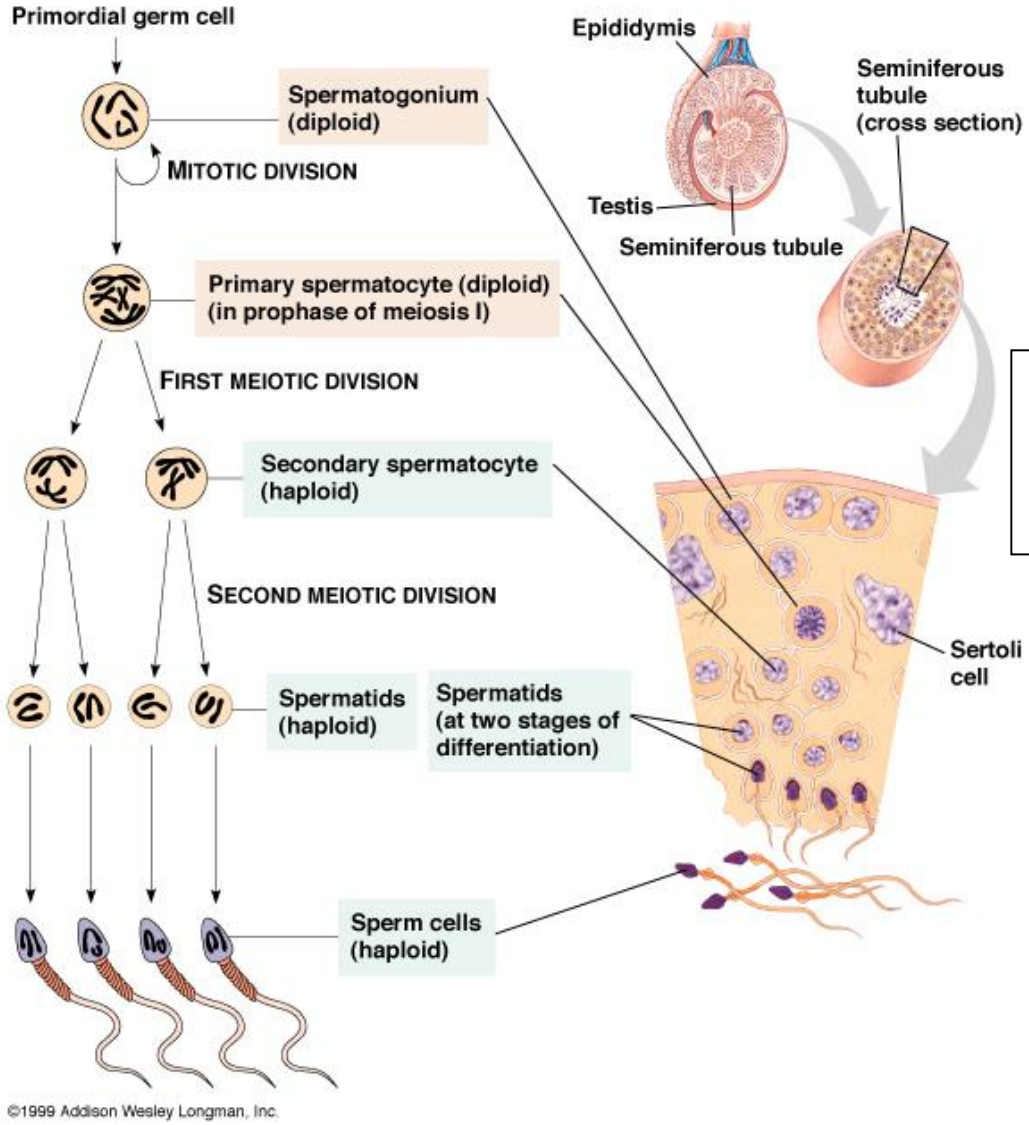
When the ladies were in the uterus, they had cells called germinal epithelial cells 2n. These are cells that form a thin inner layer (hence epithelial) in the gonads (hence germinal), in this case ovaries. These cells undergo mitosis to produce around 400,000 oogonia 2n. Oogonia grow. These oogonia start meiosis 1 up to prophase 1, and stops. The products are called primary oocyte 2n with four chromatids per chromosome pair. So when female babies are born, they are born with limited amount of primary oocytes (around 400,000) and produce no more.

The next action happens during puberty. During puberty, primary oocyte grows a follicle, becomes mature and finishes meiosis 1. This will produce secondary oocyte n and a polar body (a small waste product). The menstruation cycle is basically when these secondary oocytes get released one by one.

But wait a minute…what about meiosis 2?! Glad you asked! Secondary oocyte starts with their meiosis 2 but stops at prophase 2 (very similar to previous situation!). This time, the meiosis is completed when the egg is fertilized. So in total, we would have one ovum (egg) and three polar bodies.
Note that we only have one big ovum because they need to feed the growing embryo!

2. Explain the process of spermatogenesis.

- Men are much simpler…(just admit it guys, we are pretty simple)



Cells that fill the gap between these seminiferous tubules are called Leydig cells.

Men produce sperms all the time. Like constantly. Spermatogenesis happens in seminiferous tubule. Inside the testis, there are a lot of tubes wired and tangled together. Those tubes are called seminiferous tubules. The picture shown is a cross section as you can see.

The steps happen in a straight-forward way. The genesis starts from the germinal epithelial cells. These undergo mitosis and produce spermatogonia 2n. Spermatogonia grow and undergo meiosis 1. At prophase 1, we call it to be primary spermatocyte (just like in oogenesis). Meiosis 1 is finished to produce secondary spermatocyte n.

Meiosis 2 occurs to produce 4 spermatids with n. Spermatids are attached to special cells called sertoli cells where they are nurtured and given characteristics of a spermatozoa/sperm cell. They are differentiated. They are detached and off they go!

Extra notes

- Deduce the similarities and differences between oogenesis and spermatogenesis.

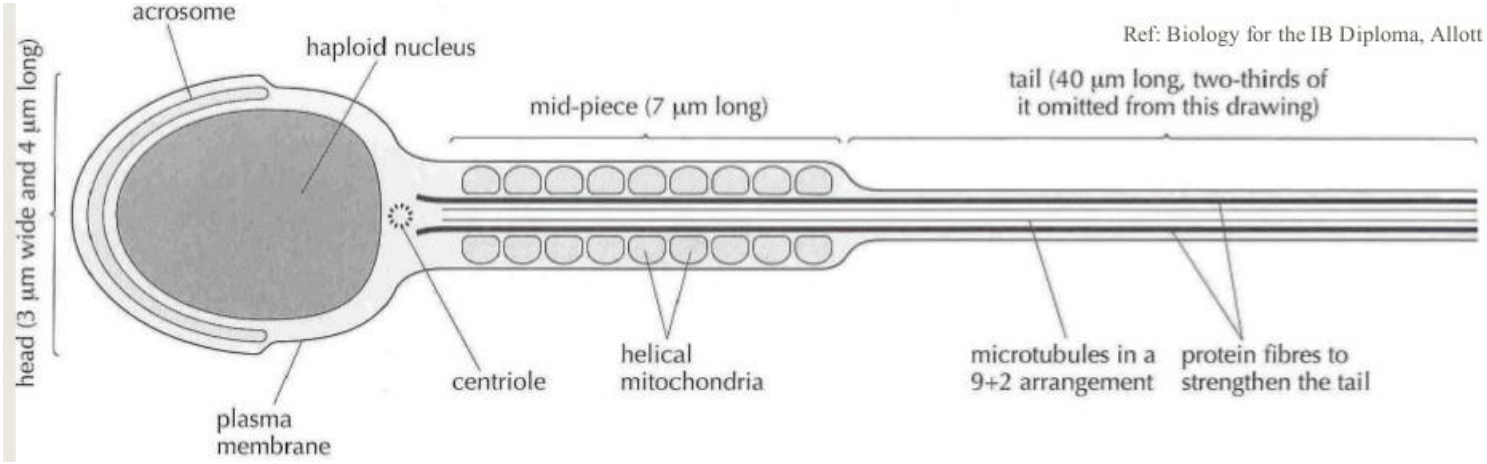
Woah! A lot of information above! But hopefully this will become clearer as we compare these processes.

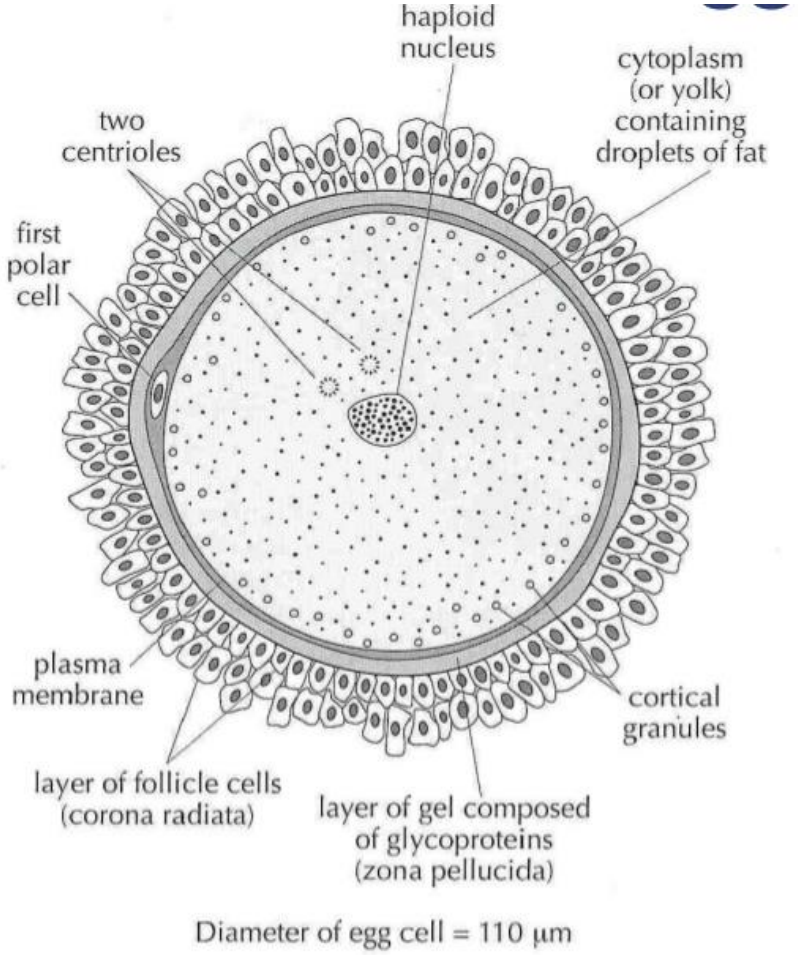
	Oogenesis	**Spermatogenesis**
Similarities	Fundamentally, both processes are to produce gametes. Therefore, the overview processes are identical. 1. Both start with germinal epithelial cells that are on the most outer part. 2. Both undergo mitosis. 3. Both undergo meiosis 1 and meiosis 2. 4. Both are differentiated.	
Differences As mentioned, women are more complicated (no offense ladies. I adore you.)	1. Their development of primary oocyte is already finished before birth. Thus they have their primary oocyte with 2n at prophase 1 ready to finish meiosis 1. 2. One haploid is produced per meiosis. The three polar bodies degenerate. 3. Meiosis 2 is not completed. It is only completed when egg is fertilized. 4. Stops menstruation at menopause. 5. 1 egg per 28 days. Stops at menopause. 6. Produced in ovaries. 7. Huge cytoplasm for food.	1. Men just do everything in a continuous time frame. Production starts during puberty. 2. Four sperms are produced per meiosis. 3. Meiosis 2 is completed. 4. Sperm production through the life. 5. Millions of sperms per ejaculation. 6. Produced in testes. 7. Reduced cytoplasm.

3. Explain how the egg prevents polyspermy.

- Polyspermy means many sperms! But we don't want that. Odd numbers of chromosomes can cause genetic mutations and defected children. Biology has solved it all!

In order to understand this, one needs to know the structure of ovum and spermatozoa.





Look at the structures. These all have distinct function.

For instance, sperms have mitochondria for respiration and microtubules to move (9+2 is because if the cross-sectional structure)

1. When sperm meets the egg, it goes with its acrosome first. The function of acrosome is to release enzymes that can digest the zona pellucida.

2. Membrane on sperm fuses with membrane on egg. Haploid nucleus is inserted. It is fertilized!

3. Cortical granules react to it and it releases digestive enzymes to digest binding proteins to prevent other sperms to bind. It is released by exocytosis and fuses with egg membrane. Zona pellucida hardens.

4. State that fertilization in animals can be internal or external.

- Aquatic animals such as frogs and fish fertilize externally. The female lays eggs and male spreads sperm over it. An obvious risk is that they are vulnerable to predators and environmental changes.

Terrestrial animals have internal fertilization. Internal may be more safe, but the mother carrying it risks health and very few are able to be born.

5. Explain what it is meant by "implantation".

- We know that fertilization happens in the oviduct. On its way there, the zygote divides by mitosis. Once it is more than two cells, it is called an embryo. For 7 days the embryo divides and forms a ball shape, called blastocyst with about 125 cells. At the 7^{th} day, it has used all of its nutrients (therefore we needed that big cytoplasm in ovum) and it needs more!

To get more, it is embedded on the endometrium where materials can exchange through blood. This is called implantation. Blastocyst settles down.

When the embryo develops bone tissues, it is then called a foetus.

6. Explain the function of HCG.

- In order to stop menstruation cycle to happen and break down the walls where the fertilized egg is, the fertilized egg releases a hormone called hCG (human chorionic gonadotropin).

This tells the body to keep producing progesterone and oestrogen, which are important for maintaining endometrium. And this is done by preventing degeneration of corpus luteum because corpus luteum is what secretes progesterone and oestrogen.

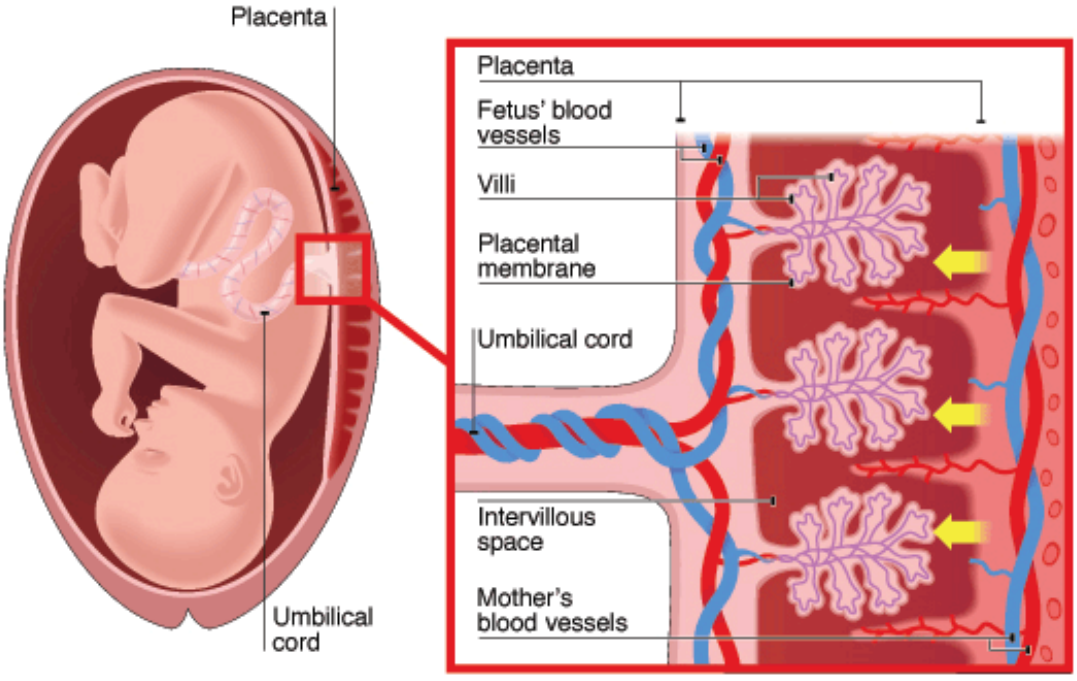
7. Explain the function of placenta and explain how placenta enables nutrition exchange.

- Placenta is a portal between mom and the child, and it is developed when the child become a foetus. There are three main reasons for a placenta.

1. To nurture the baby.

2. Diffusion is not sufficient due to surface to volume ratio therefore placenta is needed.

3. To remain in the body longer. It can feed more with the placenta.



Imagine you are the baby. You spend energy and produce waste and you want to get rid of it. Well, let's follow where your blood goes! Look at the image above and follow along.

Foetal blood → via umbilical arteries to umbilical cord → intervillous space → villi (high surface area to maximize exchange like usual) → exchange between mother and foetus indirectly via the semi-permeable placental barrier/chorion

Foetus blood	**Placental barrier/chorion (lots of mitochondria for active transport) and method of transport.**	**Maternal blood**
1. Carbon dioxide 2. Water 3. Urea	1. Diffusion 2. Osmosis 3. Diffusion? 4. Co-transporter 5. Endocytosis	1. Oxygen 2. Water 4. Glucose 5. Antibodies

8. Outline the hormones released by the placenta.
- There is no longer corpus luteum that can secrete oestrogen and progesterone. Thus placenta does that instead.

This transition in role is extremely important. If there is something wrong with transition, there will be lack of these two hormones, leading to menstruation cycle and bleeding off the endometrium.

9. Explain what parturition is and state the role of hormones in parturition.
- Parturition comes from the Latin word "parturition", which means childbirth.

When a mother is pregnant and a child develops, there is a constant release in progesterone and oestrogen as mentioned. This inhibits oxytocin, which inhibits contraction of myometrium, a muscle slightly inside cervix in the uterus.

When the pregnancy is finished, there is no release in progesterone and oestrogen. This leads to secretion of oxytocin. More oxytocin leads to more contractions. This positive feedback system helps to sort of squeeze out the baby much easier.

Amniotic sac bursts when it is time to give birth, hence why we say water is leaking (it is actually amniotic fluid). Anyways, when the baby comes out, placenta is cut and baby can take its first breath.

Applications and skills:

1. Explain the correlation between gestation time, mass and growth and development strategies.
- Gestation time is the time of how long it takes for the foetus to be developed.

Animals with long gestation periods have more mass and growth than animals with short gestation periods like mice.

Animals with short gestation periods are usually helpless and are called altricial species. Animals with long gestation periods usually have developed eyes and hair and ready to run away from predators and are called precocial species.

2. Be able to annotate diagrams of seminiferous tubule and ovary to show the stages of gametogenesis.
- Yes! This is shown above and also done in class. Just identify the processes and the rest will be easy.

3. Be able to annotation diagrams of mature sperm and egg to indicate functions.
- This is explained when prevention of polyspermy was explained.