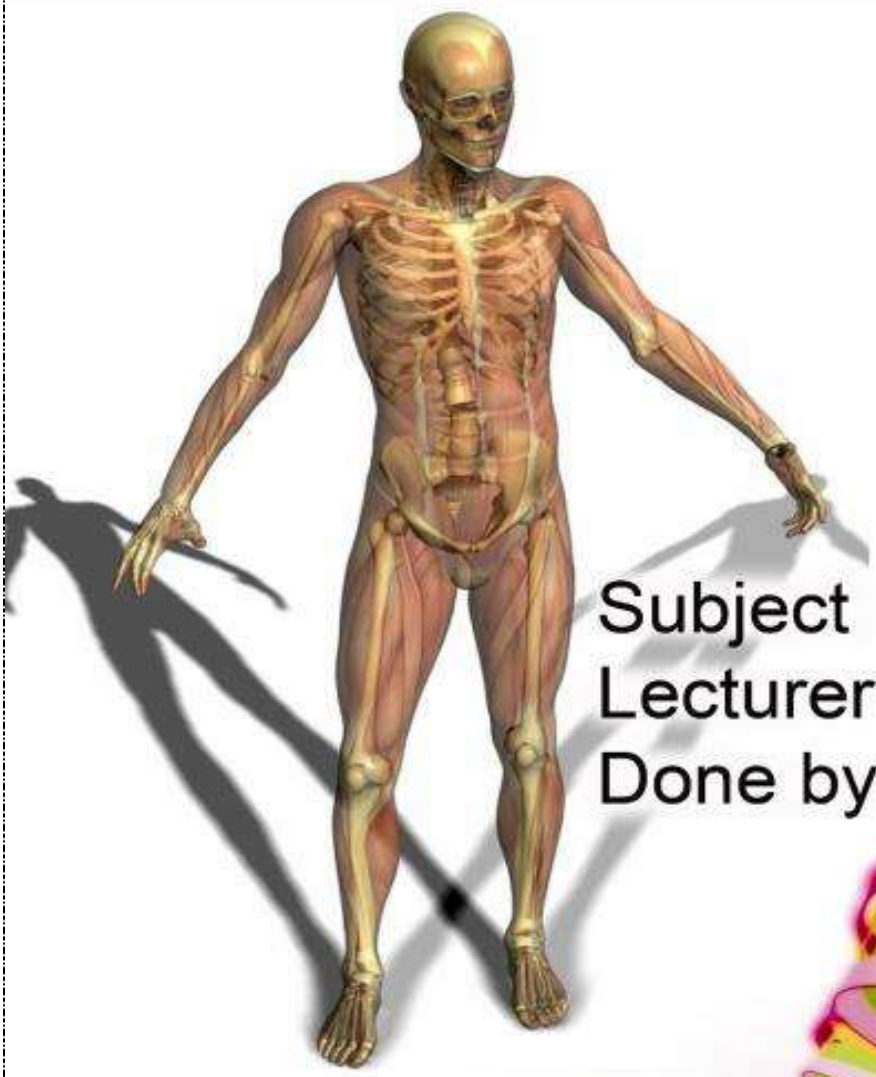
ANATOMY

Sheet



Subject : *Embryology*

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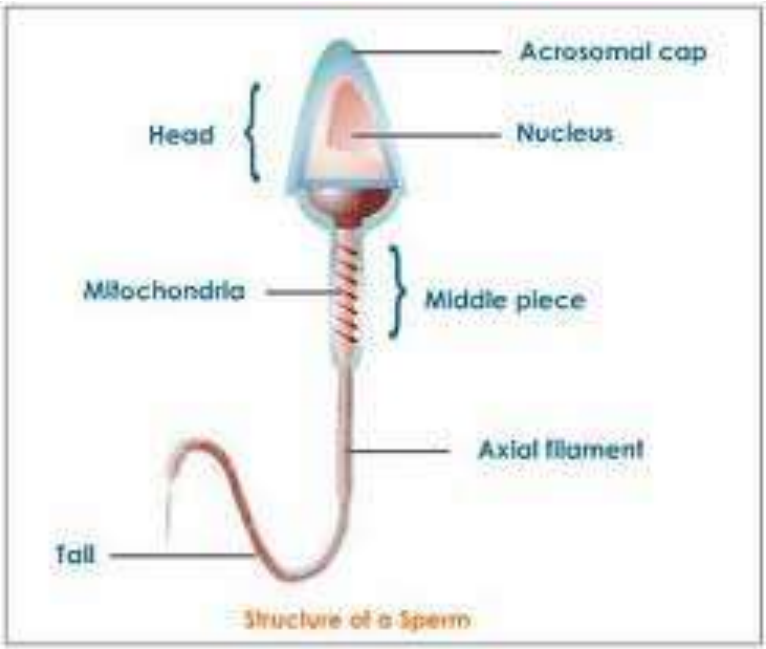
Embryology fifth lecture: spermatogenesis

To begin with, check please this preview:

A Comparison of spermatogenesis and oogenesis		
	Differences	
	Spermatogenesis	Oogenesis
Similarities: ▪ Both processes begin with mitosis ▪ Both processes have meiosis	▪ Involves millions of cells daily ▪ Process begins at puberty ▪ Fertility is life long but reduces ▪ Meiosis produces 4 cells from one	▪ One cell produced per cycle ▪ Process begins in foetal development ▪ Fertility is limited until menopause ▪ One cell per meiotic division

Spermatogenesis is the process of transformation of spermatogonia into mature sperm that begins at puberty and continues until old age.

Let's go first to the sperm cell, it consists of a head, a midpiece (or middle piece,) and a tail. The head contains the nucleus with 23 chromosomes, and the Acrosome which contains enzymes (like corona radiata) used to assist penetration of the sperm during fertilization. The midpiece has many mitochondria acting as energy apparatus to the sperm. The tail enables the sperm to navigate its way into the uterine tube; the fertilization site.
note: the tail is long in order to provide motility of sperm to reach the fertilization site.



At birth:

Taking a cross section in a new born boy's testis, we find primitive sex cords rather than seminiferous tubules. They contain **Primordial Germ Cells (PGCs)** surrounded by **Sertoli cells** (supporting mother cells). At birth and during childhood PGCs stay inactive until puberty.

Just before puberty:

These cords obtain lumen and develop into the seminiferous tubules just before puberty. The seminiferous tubules (the term means seed carrying tubules) show two types of cells in their epithelia:

1) Spermatogenic cells: (خلايا مولدة للحيوانات المنوية)
   They are at different stages of maturation, differentiate eventually to sperm cells.

2) Sertoli cells: they support and protect germ cells, nourish the developing sperm cells through the stages of spermatogenesis, assist in the release of mature sperms, assist in nutrition, and act as phagocytes consuming the residual bodies.

In addition, PGCs give **spermatogonial stem cells** just before puberty. Each PGC divides mitotically into two diploid cells, one normal PGC and another stem cell (This self-renewal maintains spermatogenesis.)

At puberty:

The pituitary gland stimulates **Leydig cells** via LH to secrete testosterone, high concentration of which triggers the stem cells to enter spermatogenesis. Also binding of testosterone to sertoli cells promotes spermatogenesis.
This is the reason why males doesn't have a menopause.

- ✓ Leydig cells, also known as peritubular cells, are found adjacent to the seminiferous tubules in the testis.

So stem cells starts dividing at regular intervals in mitosis producing **Type A spermatogonia,** this indicates the initiation of spermatogenesis. It

means whenever this happens and type A spermatogonia are found, that male is no longer known as a child.

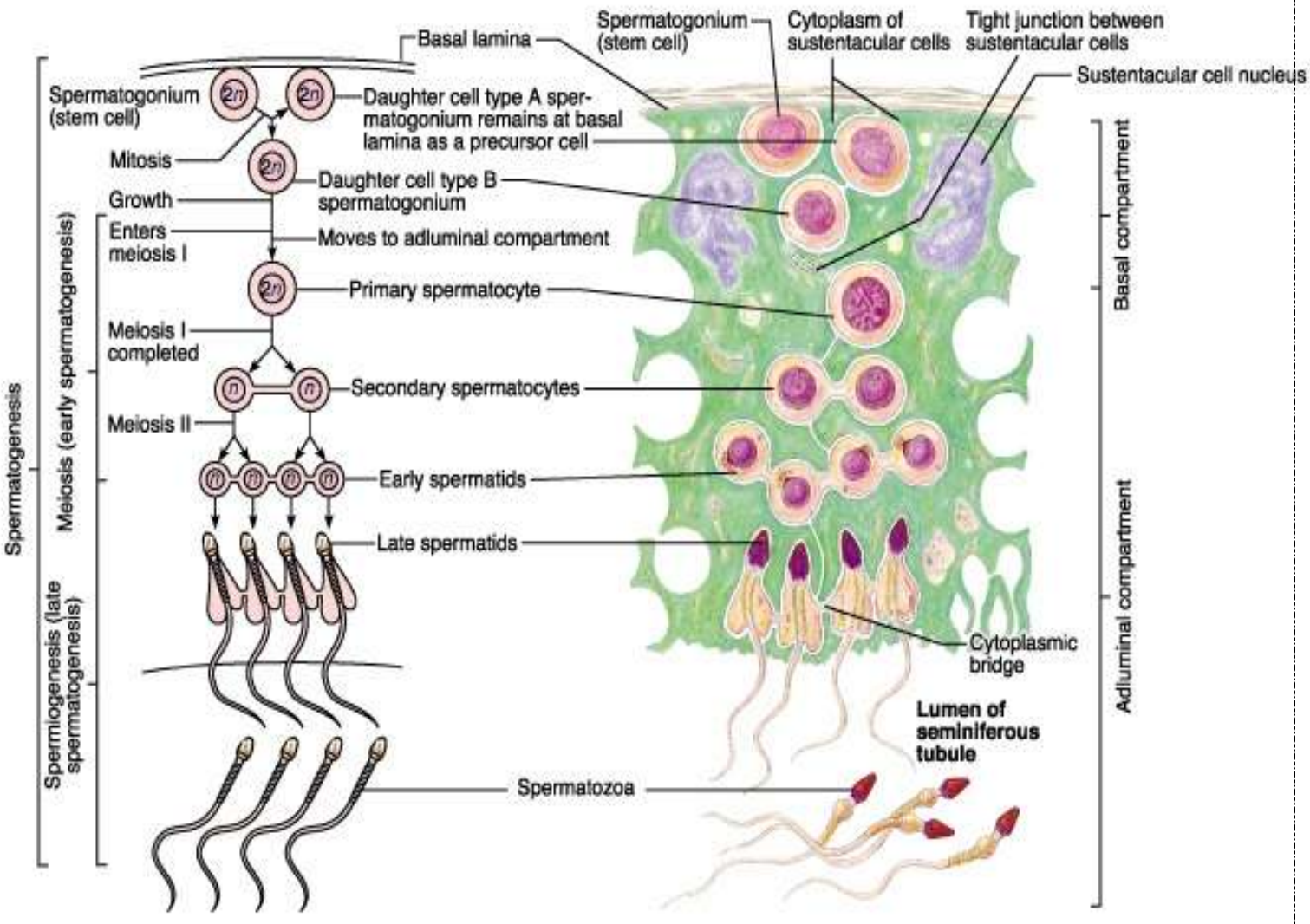
Then, type A spermatogonia undergo multiple mitosis and finally end with **type B spermatogonia** which, in turn, divide by mitosis as well to give diploid **primary spermatocytes.**

Every primary spermatocyte now gives two diploid **secondary spermatocytes** in meiosis I, and within meiotic II division of these latest, four haploid **early spermatids** are formed.
Note: committed cells that will continue the cycle : **type B spermatogonia**

- ✓ Hormonal control: We saw how LH and testosterone affect spermatogenesis. FSH plays a major role here too, when it binds to sertoli cells it stimulates testicular fluid production.

One important subdivision of spermatogenesis is **spermiogenesis,** which is the change in shape and alteration of early spermatids into **late spermatids** (mature sperms.) During spermiogenesis, a spermatid develops a tail, a neck, and a mid-piece and forms the acrosome. The nucleus becomes condensed forming the head. The unnecessary excess cytoplasm and organelles, known as **residual bodies**, are phagocytosed by surrounding Sertoli cells in the testes. The resulting sperms are now mature and are released from the protective Sertoli cells into the lumen of the seminiferous tubule.

This map summarizes the whole subject:

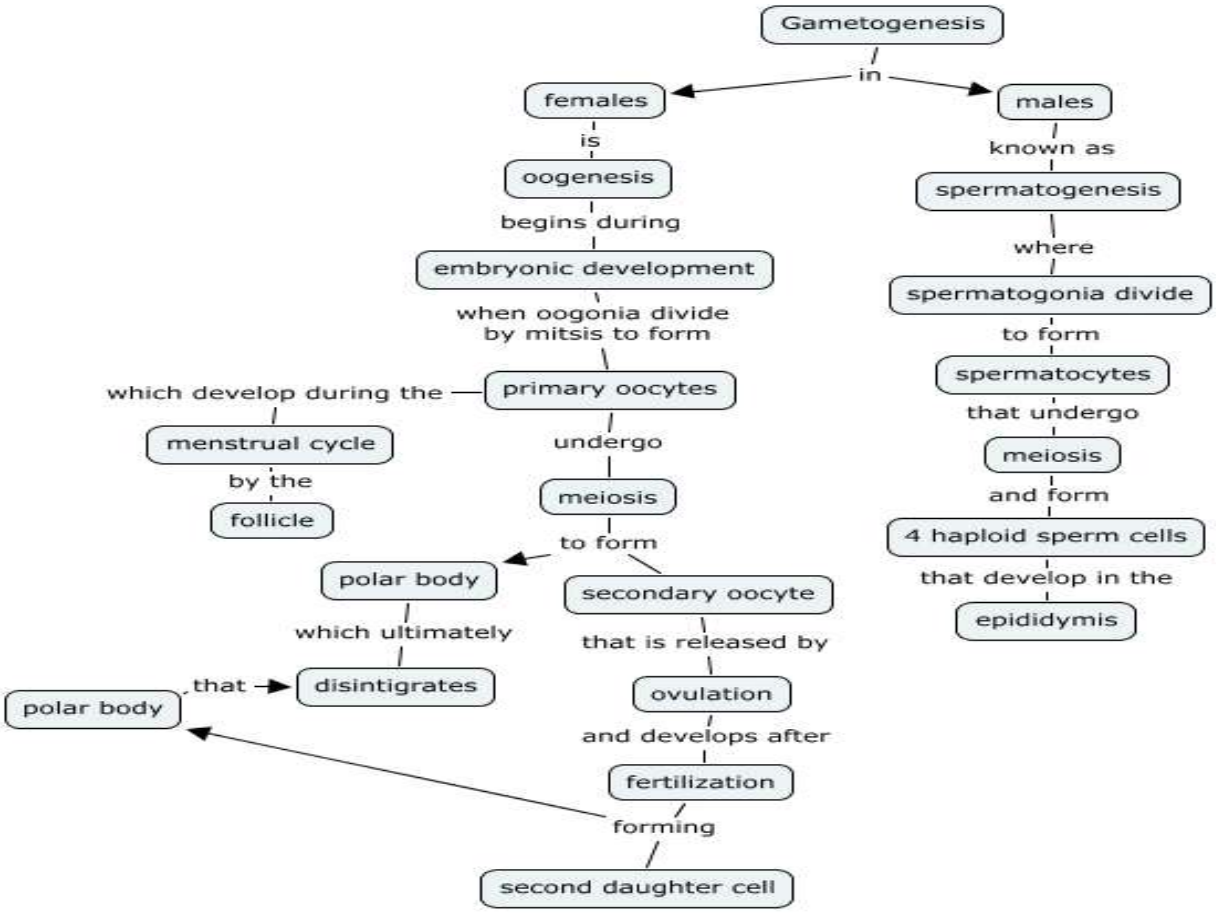


Brief notes:

- ✓ If type B spermatogonia are not produced spermatogenesis doesn't continue, therefore these cells are called "the committed cells."
- ✓ During the divisions from type A spermatogonium to spermatid, the cells move farther and farther away from the basement membrane of the seminiferous tubule and closer to the lumen.
- ✓ During the divisions, cytokinesis is not complete. Each cell communicates with the others through cytoplasmic bridges producing clones of interconnected cells.

- ✓ Clinically, absence of acrosome or lack of its enzymes causes incapability of the sperm. In this case compensating enzymes are given.
- ✓ A sperm would go to the ureter or other wrong destination if the tail is defected.
- ✓ Chromosomes of the produced sperms are never identical; because of crossing over.
- ✓ In ladies every period produces one ovum, whereas in men at each time about three hundred million sperms are tossed. Only the strongest one makes it to the end..

Let's recall what we have known about oogenesis and spermatogenesis, hope by this you visualise all gametogenesis :



All the best ☺

" كن مختلفا .. فالعالم لم يعد بحاجة إلى مزيد من النسخ "

Correction team notes

here are some mistakes we found in anatomy's sheets and some mistakes in the past papers that were given to you and sorry for that

Sheet # 14

P.7 >> the number of the oocytes at birth >> 2 million not 9

Sheet # 16

p.1 >>

Condyles of femur are for articulations with tibia only

sheet #17 p.7 >>

Origin of the hamstring part of adductor magnus is Ischial Tuberosity not ischial ramus

Past papers >>

Q21 p.3 :

Option B is wrong also not only c (oogonia reaches the maximum # by the 5th month not the 7th)

Q18 p.6

Adductor polices is supplied by the ulnar nerve (true)

Q22.p6

Winged scapula results from injury of long thoracic nerve and thoracodorsal nerve (thoracodorsal nerve innervates the Dorsi muscle which also prevents the winging of scapula … we haven't taken this with dr Mahir)

Q38 : p7 >> answer is false

>>> embryology lectures are as the following :

Sheet # 6 >>> 1st embryology

Sheet # 9 >>> 2nd embryology

Sheet # 14 >>> 3rd embryology

Sheet # 18 >>> 4th embryology

and this one is the 5th ^_^