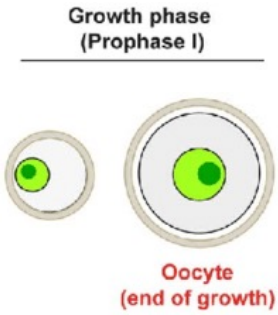
TO BE KEPT IN MIND

Structural and biochemical modifications discussed in this course module are associated with oocytes that, from a meiotic perspective, are arrestes in **Prophase I of Meiosis I**.

These modifications are crucial for achieving the appropriate level of growth, involving the storage of lipids, proteins, and everything necessary to support subsequent phases like maturation and fertilization. Only oocytes that have accumulated all these resources can be considered fully grown, and only these oocytes can sense the LH surge and respond to it correctly.



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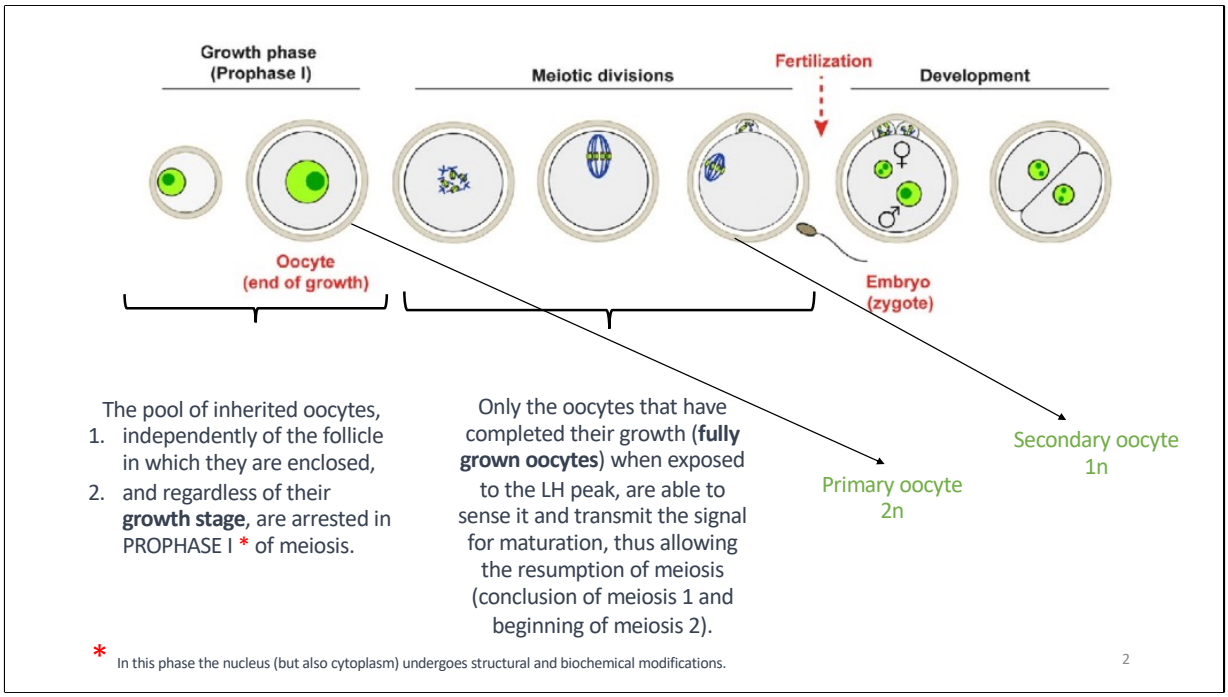
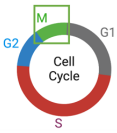
Watch this video for further insights:
https://www.google.com/search?sca_esv=945791448f04a98e&rlz=1C5CHFA_enIT909IT909&q=meiosis+i+and+ii+oocyte&tbm=vid&source=lnms&sa=X&ved=2ahUKEwj7y4OA0ZmEAxVlSfEDHWBaBXkQ0pQJegQICxAB&biw=1354&bih=728&dpr=2#fpstate=ive&vld=cid:d5a93e81,vid:_AP3A39p8Z4,st:0



The pool of inherited oocytes independently of the stage of growing reached by the follicle in which they are enclosed (please have a look to the slide 7 with classification of follicles), and regardless of their growth stage, are arrested in PROPHASE I * of meiosis.
Only the oocytes that have completed their growth (fully grown oocytes) when exposed to the LH peak, are able to sense it and transmit the signal for maturation, thus allowing the resumption of meiosis (conclusion of meiosis 1 and beginning of meiosis 2).

Prophase I
Germinal Vescicle (GV)



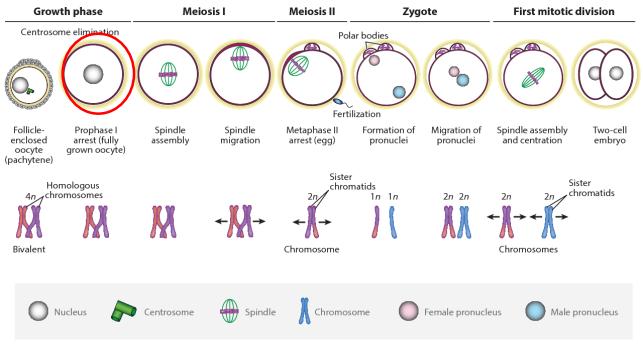
Leptotene
Zygotene
Pachytene
Diplotene
Diakinesis

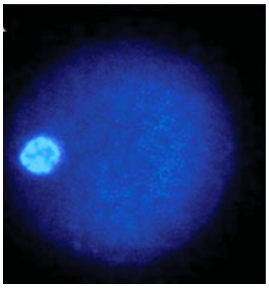
Chromatids start to condense

Homologous chromosomes find each other and pair up (through a process named synapsis). Two pairs together form a tetrade.

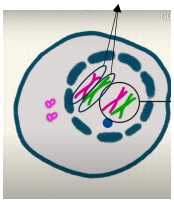
Chromatids from different pairs exchange genetic material (crossing over)

Formation of a chiasma (chromatids came very close) in the region of material exchange.





Homologous chromosomes



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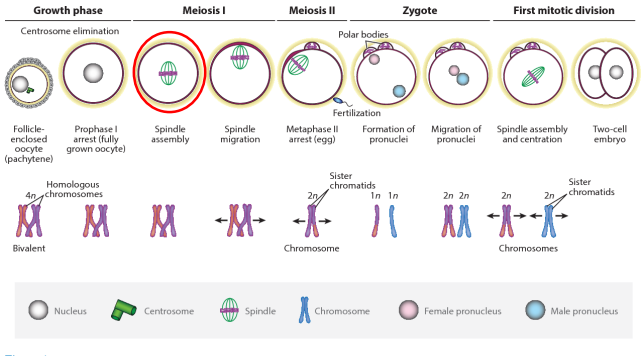
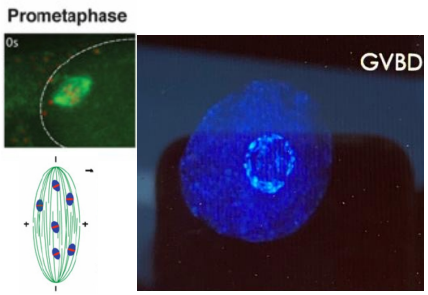
The GV stage is characterized by five sub-phases, each involving specific activities as outlined in the slide.

LH stimulus ⟶

Meiosis I resumption
Germinal Vescicle Breackdown (GVBD)

The nuclear envelope disassembles and a **spindle** machinery that is assembled from **microtubules** captures and aligns the liberated chromosomes at its centre.





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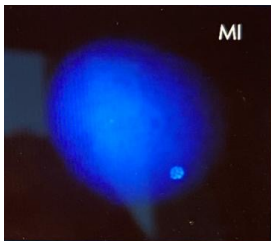
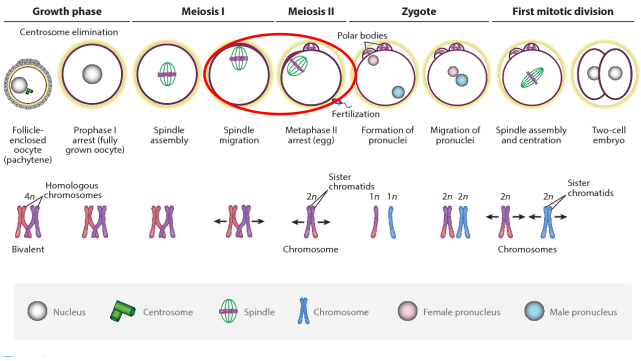
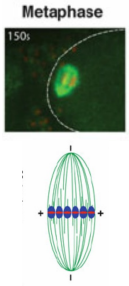
Meiotic resumption from the prophase of MI is morphologically characterized by the dissolution of the oocyte nuclear envelope, which is generally termed the "germinal vesicle breakdown" (GVBD).
A spindle machinery that is assembled from microtubules captures and aligns the liberated chromosomes at its centre.

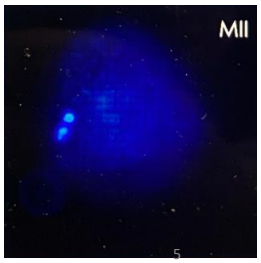
Ending to Metaphase II of Meiosis II
Waiting for fertilization

The spindle **asymmetrically** relocates to the oocyte surface where the **homologous chromosomes** are segregated at **anaphase I (MI).**
Half of them are eliminated into a very small cell termed polar body. The remaining chromosomes are captured and aligned by the second meiotic spindle. At this stage, the cell is called an egg and awaits fertilisation.

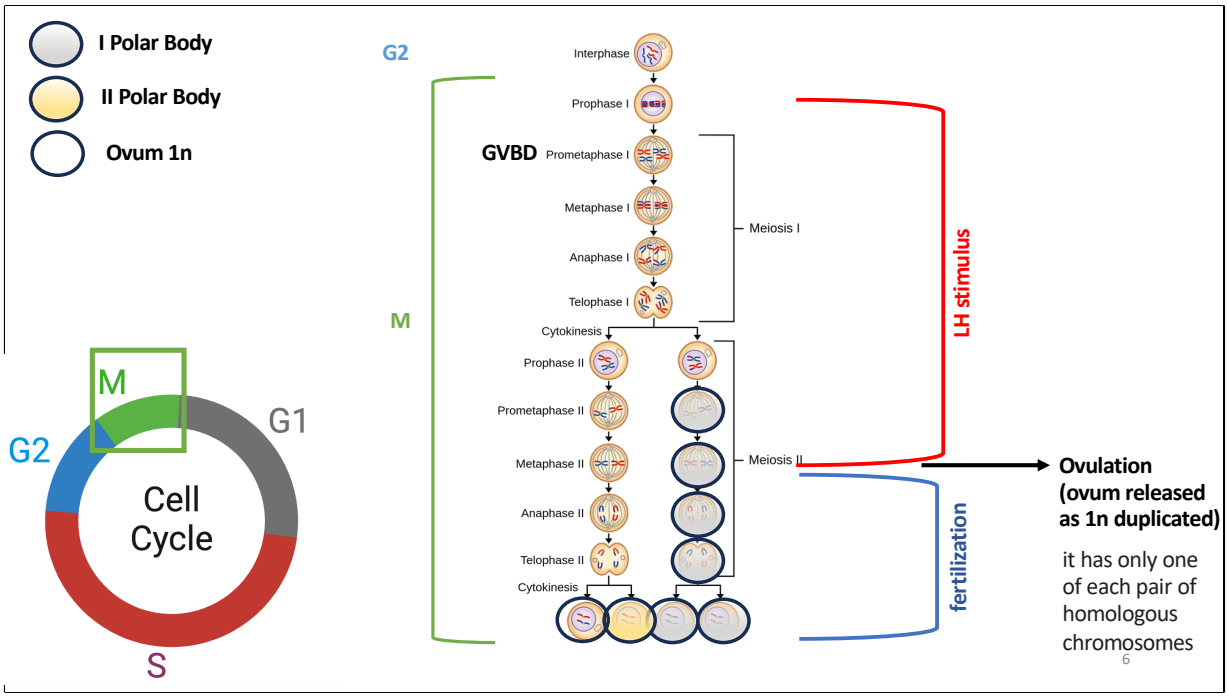




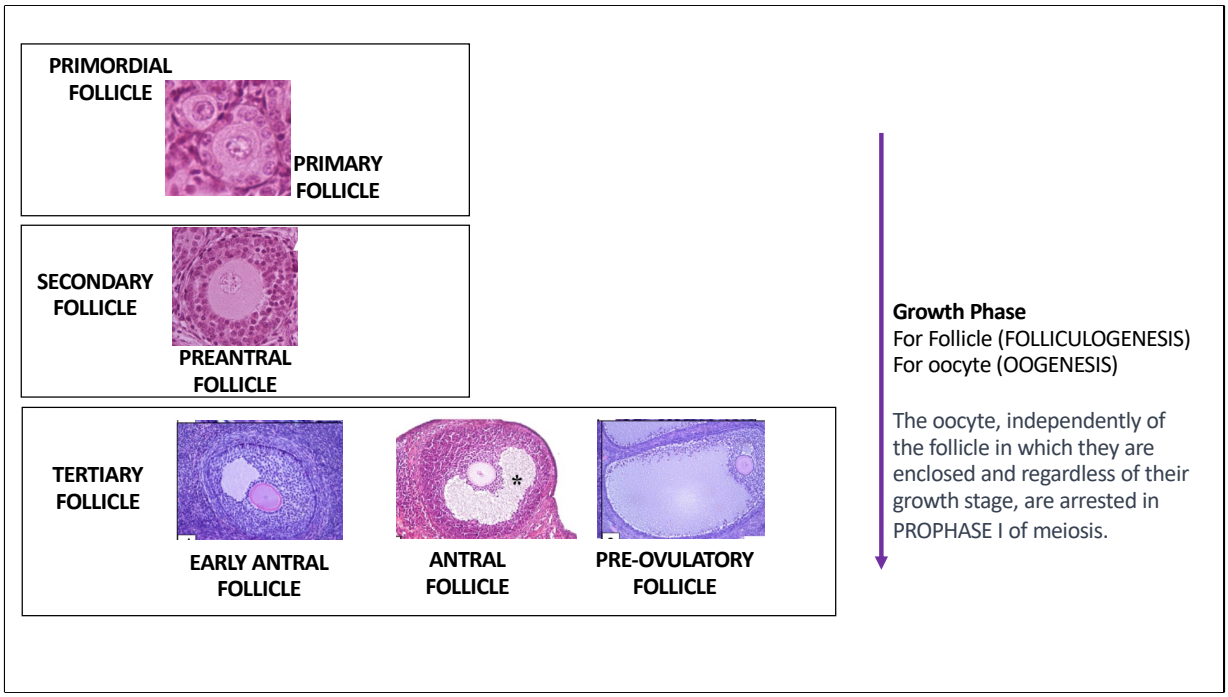




Following GVBD and completion of MI, the oocyte enters meiosis II without an obvious S-phase (for this reason this meiosis is considered as «reductional») and arrests at metaphase phase II (MII) until fertilization.
The spindle asymmetrically relocates to the oocyte surface where the homologous chromosomes are segregated at anaphase I. Half of them are eliminated into a very small cell termed polar body. The remaining chromosomes are captured and aligned by the second meiotic spindle. At this stage, the cell is called an egg and awaits fertilisation.



Overview on the Meiosis I and II into the oocyte



The oocyte cannot be thought as isolated from its microenvironment provided by the follicle. These images are derived from hematoxylin and eosin staining and allow visualization of the structural differences in the follicle during its growth (folliculogenesis).