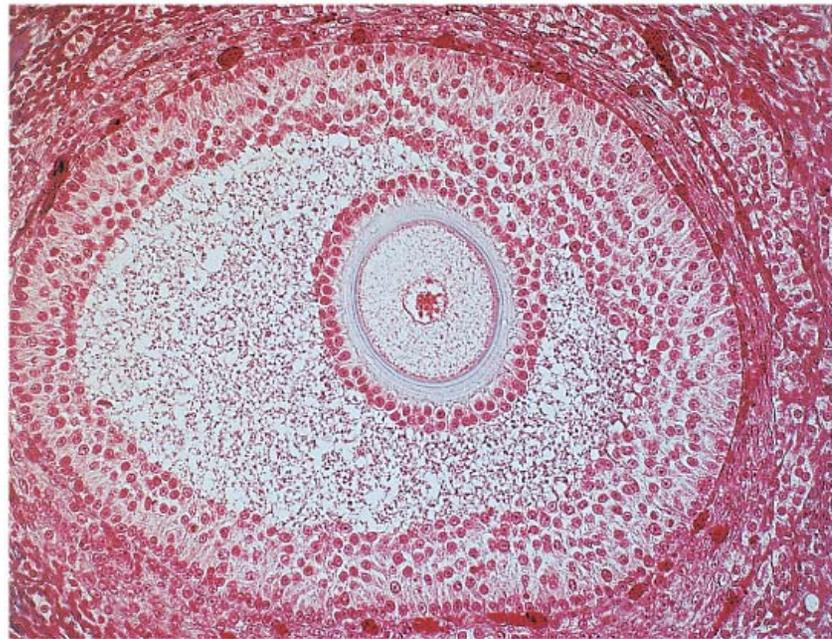


Chapter 28

Oogenesis



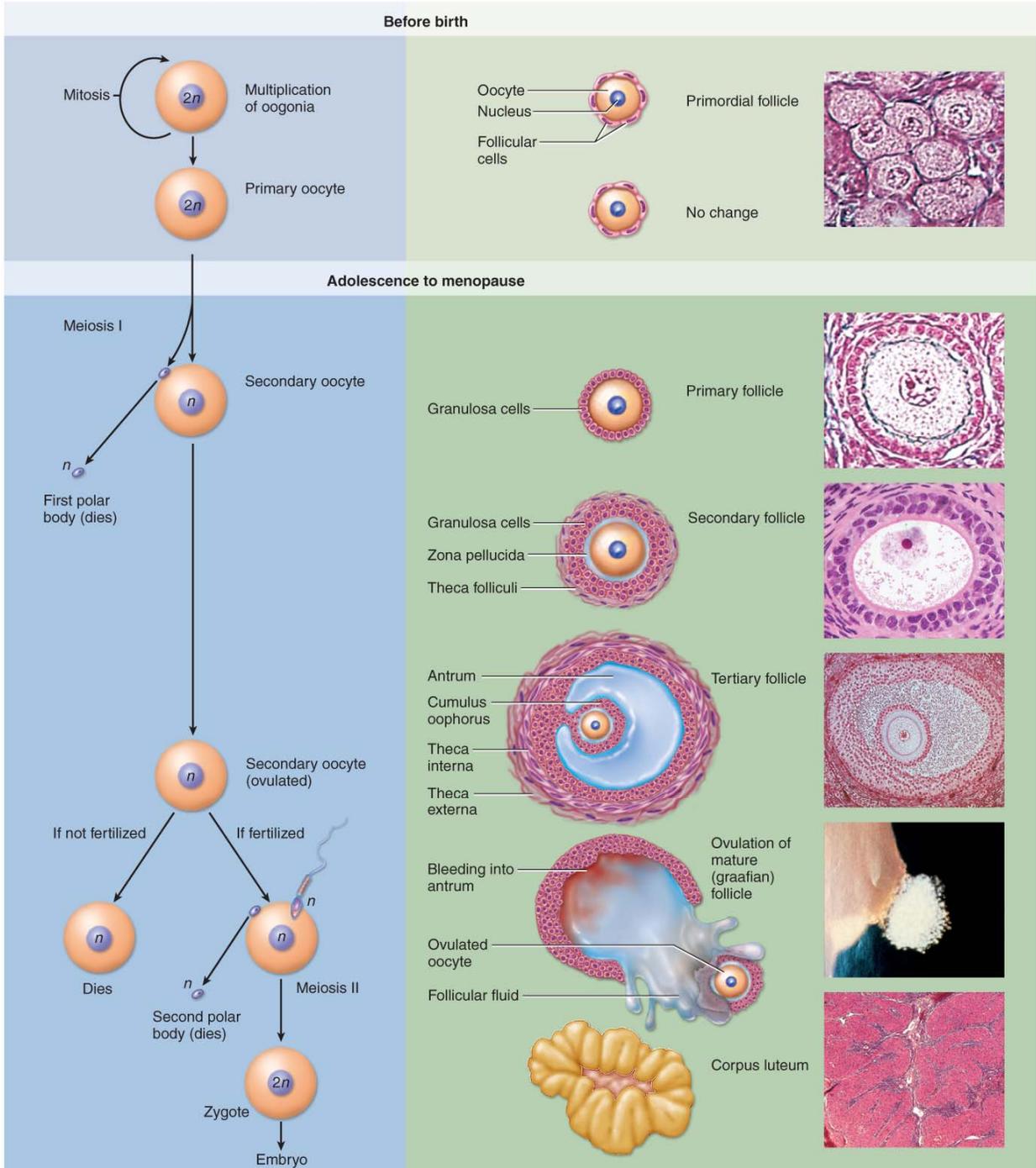
Oogenesis

- **oogenesis = egg production**
 - produces **haploid gametes** by means of **meiosis**
 - distinctly cyclic event that normally releases **one egg each month**
 - accompanied by cyclic changes in hormone secretion
 - cyclic changes in histological structure of the ovaries and uterus
 - uterine changes result in monthly menstrual flow
- **embryonic development of ovary**
 - female germ cells arise from **yolk sac**
 - colonize **gonadal ridges** the first 5 to 6 weeks of development
 - differentiate into **oogonia** and multiply until the fifth month
 - 5 to 6 million in number
 - transform into **primary oocytes** - early meiosis I by birth
 - Now around two million primary oocytes
 - By puberty number reduced to 400,000
 - Atresia = degeneration of oocytes
 - most degenerate (**atresia**) by the time the girl is born
 - **egg**, or **ovum** – any stage from the primary oocyte to the time of fertilization
 - **a lifetime supply** – probably will ovulate around 480 times

Oogenesis

- egg development **resumes in adolescence**
 - **FSH** stimulates monthly cohorts of oocytes to complete meiosis I
 - each oocyte divides into two haploid daughter cells of unequal size and different destinies
 - important to produce an egg with as much cytoplasm as possible
 - if fertilized, it must divide repeatedly and produce numerous daughter cells
 - **secondary oocyte** – large daughter cell that is the product of meiosis I
 - **first polar body** – smaller one that sometimes undergoes meiosis II, but ultimately disintegrates
 - merely a means of discarding the extra set of haploid chromosomes
 - **secondary oocyte** proceeds as far as metaphase II
 - **arrests until after ovulation**
 - if not fertilized, it dies and never finishes meiosis
 - if fertilized, it completes meiosis II and casts off a **second polar body**
 - chromosomes of the large remaining egg unite with those of the sperm

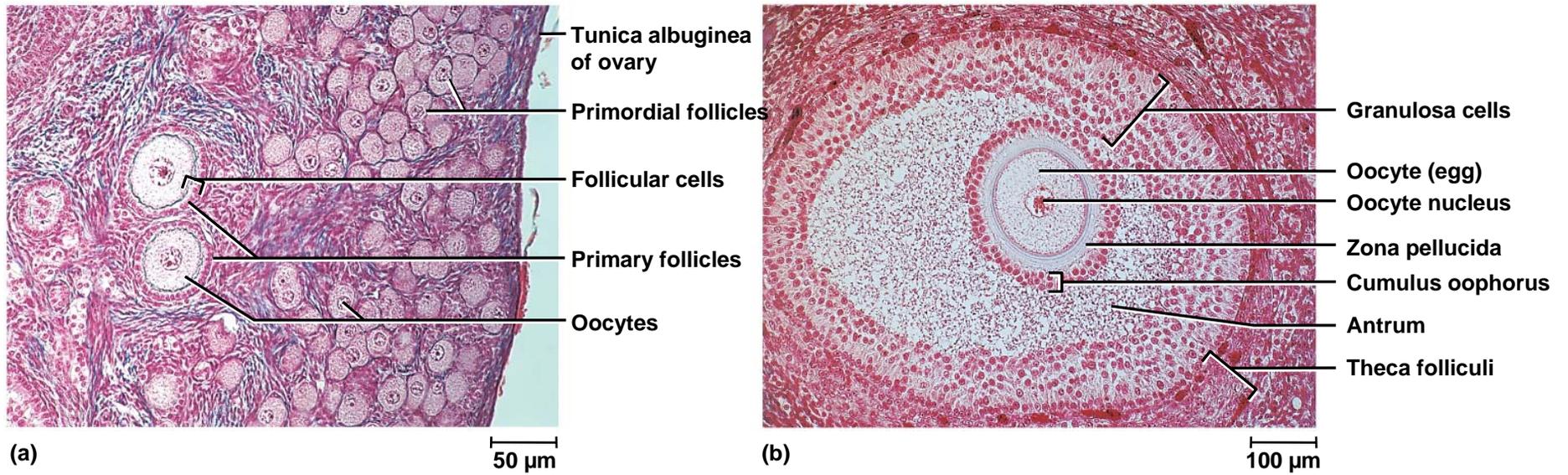
Oogenesis and Follicle Development



(Primordial & Primary follicle): © Ed Reschke; (Secondary follicle): © The McGraw-Hill Companies, Inc./Photo by Dr. Alvin Telser; (Tertiary follicle): Manfred Kage/Peter Arnold, Inc.; (Ovulation): Dr. Landrum Shettles; (Corpus luteum): © The McGraw-Hill Companies, Inc./Photo by Dr. Alvin Telser

Ovarian Follicles

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a: © Ed Reschke; b: Manfred Kage/Peter Arnold, Inc

Folliculogenesis

- The development of the follicles around the egg (concurrent with oogenesis)
 - **primordial follicles**
 - consists of a **primary oocyte in early meiosis**
 - surrounded by a single layer of squamous **follicular cells**
 - follicular cells connected to the oocyte by fine cytoplasmic processes for passage of nutrients and chemical signals
 - concentrated in the **cortex of the ovary**
 - most wait 13 to 50 years before they develop further
 - adult ovary has 90% to 95% primordial follicles
 - **primary follicles**
 - have larger oocytes and follicular cells that still form a single layer
 - **secondary follicles**
 - still larger oocytes and follicular cells now stratified (**granulosa cells**)
 - **zona pellucida** – layer of glycoprotein gel secreted by granulosa cells around the oocyte
 - **theca folliculi** – connective tissue around the granulosa cells condenses to form a fibrous husk

Folliculogenesis

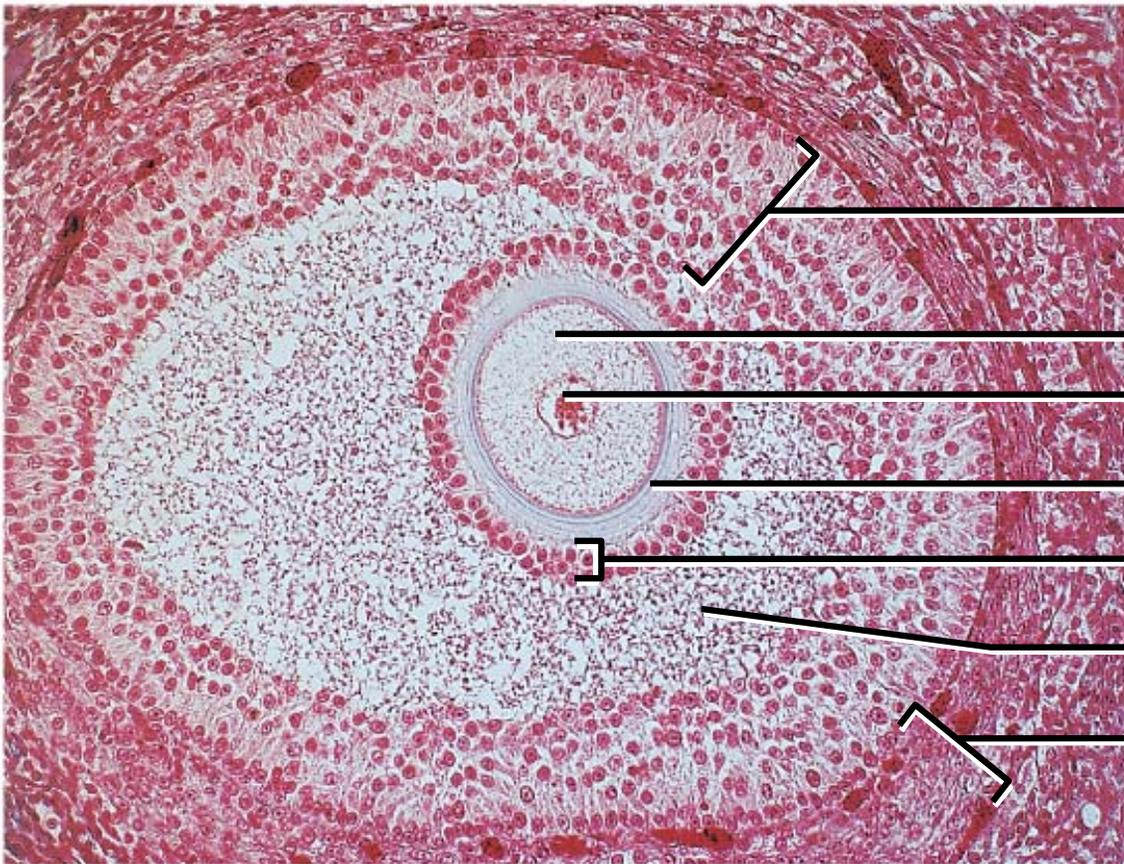
– tertiary follicles

- granulosa cells begin secreting follicular fluid
- accumulate in little pools in the follicular wall - this defines the tertiary follicles
- as they enlarge, the pools merge forming a single fluid-filled cavity, the **antrum**
- **antral follicles** – tertiary and mature follicles
- **preantral follicles** – earlier stages of the follicles
- **cumulus oophorus** – a mound of granulosa cells on one side of the antrum that covers the oocyte and secures it to the follicular wall
- **corona radiata** – innermost layer of cells in the cumulus surrounding the zona pellucida and the oocyte
- protective barrier around the egg with a similar function as the blood-testis barrier
- **theca folliculi** continues to differentiate forming two layers
 - **theca externa** – outer fibrous capsule rich in blood vessels
 - **theca interna** – inner cellular, hormone secreting layer producing androgens (androstenedione and testosterone), and granulosa cells converts them to **estradiol**

– mature (graafian) follicles

- normally only one follicle from each month's cohort becomes a mature follicle destined to ovulate
- remainder degenerate

Histology of Ovarian Follicles



Granulosa cells

Oocyte (egg)

Oocyte nucleus

Zona pellucida

Cumulus oophorus

Antrum

Theca folliculi

100 μ m