"Oogenesis"

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1. Origin & Migration of Primordial Germ Cells (PGCs)

Flowchart:

Primordial Germ Cells (PGCs) → Originate in epiblast (2nd week) → Migrate via primitive streak → Reach yolk sac (4th week) → Migrate to developing gonads (5th week) → Differentiate into oogonia (in ovaries)

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2. Timeline of Oogenesis

Stage	Time	Key Events

Fetal life	Before birth	Oogonia form & begin meiosis
3rd month	Fetal	Follicular cells appear
5th month	Fetal	Peak oogonia (7 million), meiosis begins
Birth	Neonatal	0.6–0.8 million primary oocytes
Puberty	Adolescence	Follicular maturation begins
Reproductive life	Monthly cycles	Ovulation occurs

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3. Oogonia Proliferation & Meiosis Initiation

Key Events

- Oogonia undergo mitosis → Peak number: ~7 million (5th month)

- Then:
    - All oogonia enter meiosis I
    - Become primary oocytes

Characteristics of Meiosis in Females

Feature	Description
Completion	Incomplete (paused)
Arrest stage	Diplotene (Prophase I)
Cell formed	Primary oocyte

High-Yield Concept

- All primary oocytes are formed before birth
- No new oocytes are formed after birth

4. Primordial Follicle Formation

Process

- Primary oocyte → Surrounding flat epithelial cells → Formation of primordial follicle

Flowchart

- Oogonia → Primary oocyte (arrested in Prophase I)
- Flat follicular cells → Primordial follicle

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5. Follicular Atresia (Degeneration)

Timeline

- Occurs mainly: 5th–7th fetal month onward

Numbers

Stage	Number
Peak (5th month)	~7 million
At birth	600,000–800,000
At puberty	~40,000
Ovulated in lifetime	~500

High-Yield Concept

- Massive degeneration (atresia) occurs before and after birth

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6. Changes After Puberty (Hormonal Control)

- At puberty, under FSH influence:
    - 15–20 primordial follicles begin to mature per cycle
    - Usually only ONE ovulates
    - Others → Corpus atreticum (degenerate)

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7. Follicular Development Stages

A. Primary Follicle

Key Changes

- Zona pellucida forms
    - Secreted by:
        - Primary oocyte
        - Granulosa cells

- Theca folliculi forms
    - From surrounding ovarian connective tissue

Flowchart

Primordial follicle → Zona pellucida formation → Theca folliculi develops → Primary follicle

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B. Secondary (Antral) Follicle

Key Features

- Formation of antrum (fluid-filled cavity)
- Differentiation of theca:

Layer	Function

Theca interna	Produces androgens (androstenedione, testosterone)
Granulosa cells	Convert androgens → estrogens
Theca externa	Structural support

Hormonal Conversion

Theca interna (androgens) → Granulosa cells → Convert into estrogens (estrone, estradiol)

C. Graafian Follicle (Mature Follicle)

Features

- Large antrum
- Contains secondary oocyte

- Surrounded by:
    - Cumulus oophorus

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8. Meiotic Progression at Puberty

Flowchart

Primary oocyte (arrested in Prophase I) → LH surge → Completion of Meiosis I → Forms: Secondary oocyte (haploid) + First polar body → Secondary oocyte enters Meiosis II → Arrests at Metaphase II

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9. Ovulation

- Occurs from Graafian follicle
- Releases secondary oocyte

Key Concept

- The ovulated cell is:
  - Secondary oocyte (NOT ovum)
  - Arrested in Metaphase II

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10. Fate of Secondary Oocyte

If Fertilization Occurs

Secondary oocyte → Completes Meiosis II → Forms:

Ovum + Second polar body → Follicle becomes Corpus luteum graviditatis → Secretes progesterone

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If Fertilization Does NOT Occur

Secondary oocyte → Degenerates

Corpus luteum → Corpus albicans

↓ Progesterone → Endometrial shedding (menstruation)

II. Role of Syncytiotrophoblast (Pregnancy Support)

If Fertilization Occurs

Syncytiotrophoblast → Secretes hCG → Maintains corpus luteum → Corpus luteum → Corpus luteum graviditatis → Progesterone secretion continues→ Until ~4th month, then:
Placenta (syncytiotrophoblast) takes over progesterone production

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If No Fertilization

No hCG → Corpus luteum degenerates → Corpus albicans forms → ↓ Progesterone → Menstrual bleeding

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12. Integrated Overview

PGCs (epiblast) → Yolk sac → Gonads → Oogonia (mitosis) → Primary oocyte (Meiosis I begins, arrested) → Primordial follicle → Puberty (FSH) → Follicular development → Primary follicle → Secondary follicle (antrum) → Graafian follicle → LH surge → Meiosis I completes → Secondary oocyte (arrested in Metaphase II) → Ovulation →

i. If fertilized → Meiosis II completes → Corpus luteum maintained (hCG) → Progesterone secretion

ii. If not fertilized → Degeneration → Corpus albicans → Menstruation

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13. Exam Points

- Oogenesis starts before birth
- Primary oocyte arrested in Prophase I (Diplotene)
- Secondary oocyte arrested in Metaphase II
- Ovulated cell = secondary oocyte
- Only ~500 oocytes ovulated in lifetime
- hCG maintains corpus luteum
- Placenta takes over progesterone after ~4th month

-> The End <-