ANAT2341: lectures overview

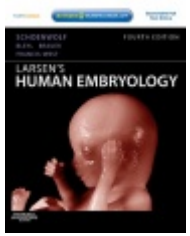
EMBRYOGENESIS

Fertilization
Cleavage and Blastocyst Formation
Gastrulation

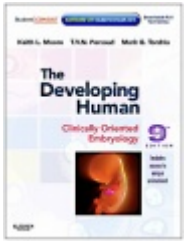
3 weeks

Organogenesis
(integumentary system, gonadogenesis)

37 weeks



Resources ANAT2341:
http://php.med.unsw.edu.au/embryology/
Larsen's Human Embryology
The Developing Human: Clinically Oriented Embryology



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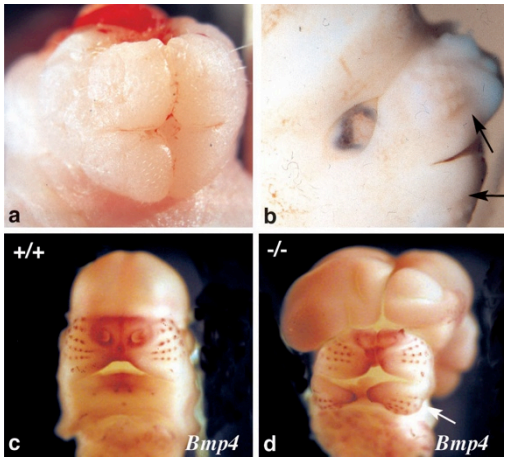
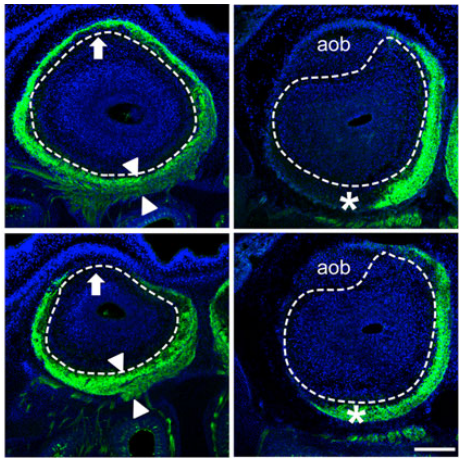
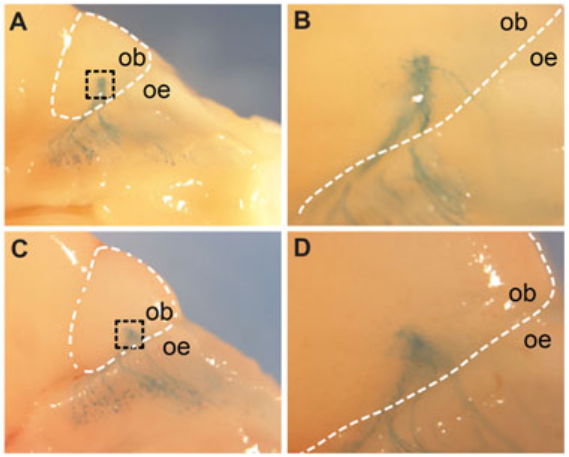
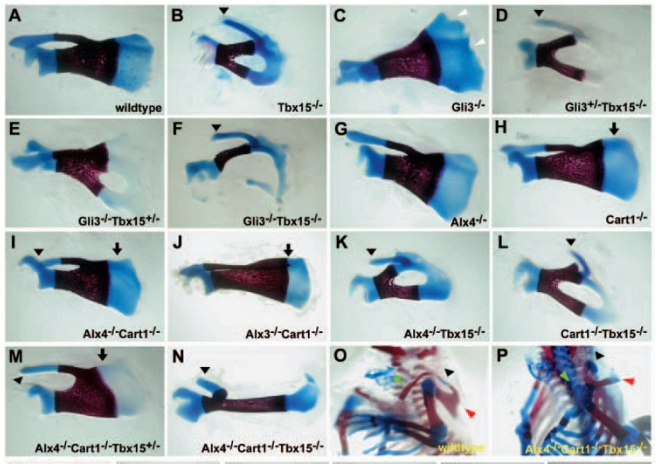
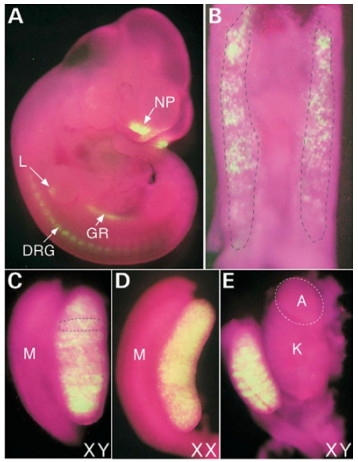
Images of my past

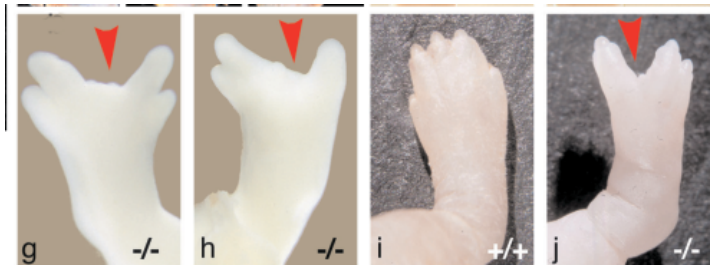


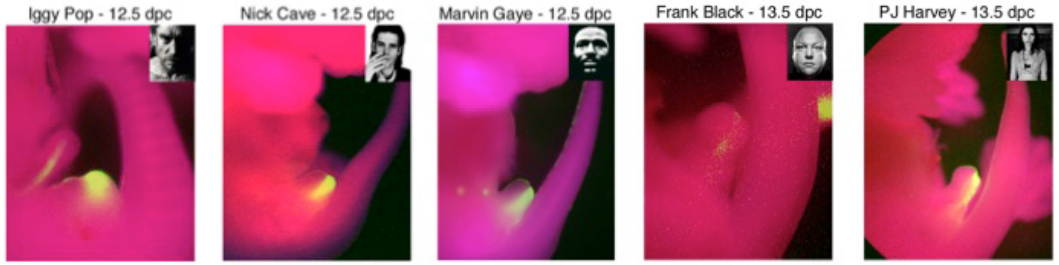










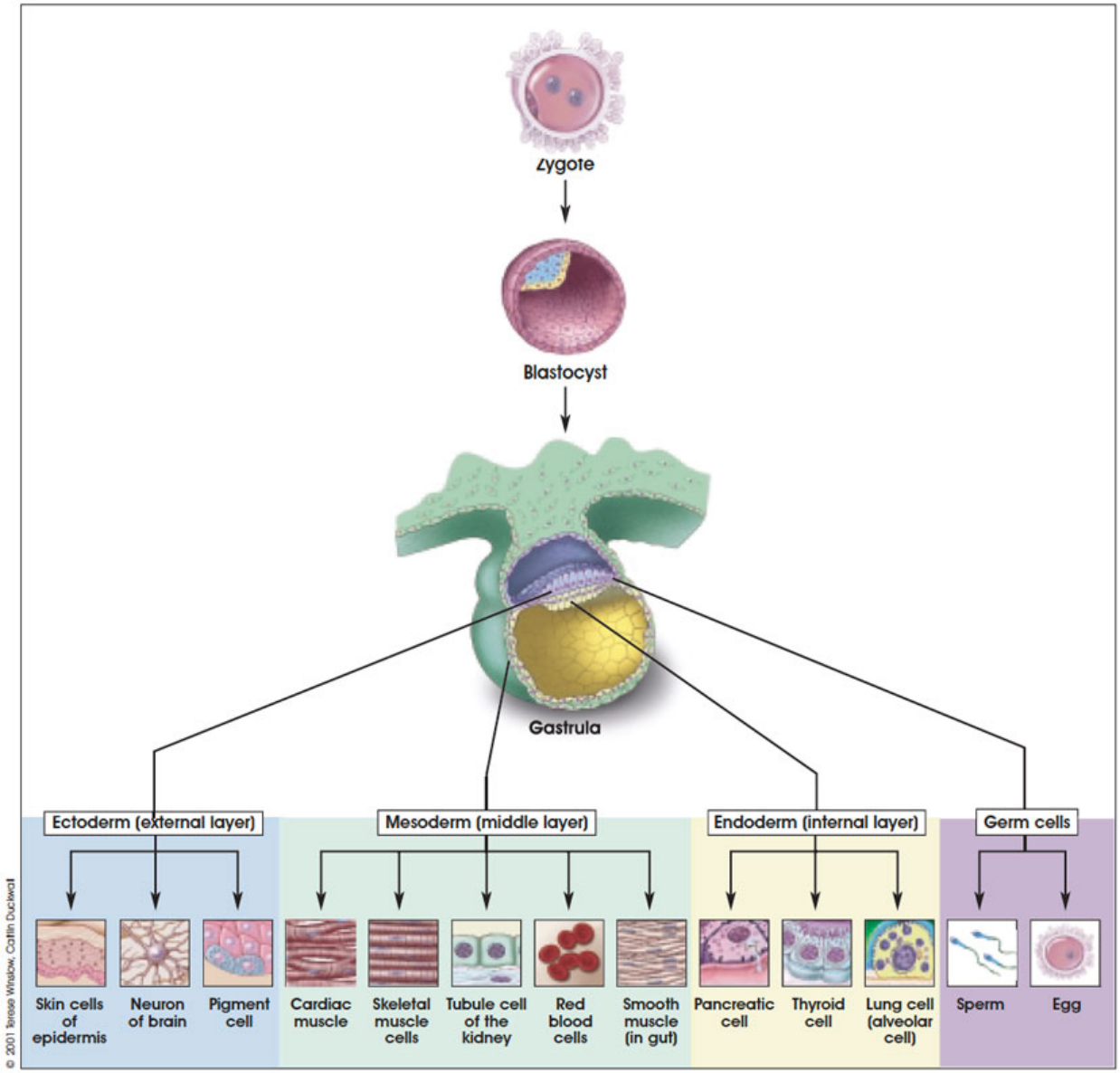


My Travels


GREENLAND (DENMARK)
ALASKA (USA)
CANADA
UNITED STATES OF AMERICA
MEXICO
RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
JAPAN
INDIA
THAILAND
INDONESIA
AUSTRALIA
NEW ZEALAND
ICELAND
SWEDEN
FINLAND
NORWAY
BELARUS
POLAND
UKRAINE
GERMANY
FRANCE
SPAIN
TURKEY
SYRIA
IRAQ
IRAN
ALGERIA
LIBYA
EGYPT
MALI
NIGER
CHAD
SUDAN
ERITREA
YEMEN
ETHIOPIA
SOMALIA
KENYA
UGANDA
TANZANIA
ANGOLA
ZAMBIA
NAMIBIA
SOUTH AFRICA
VENEZUELA
COLOMBIA
PERU
BRAZIL
BOLIVIA
ARGENTINA
1
2
3
4

Lectures overview

Early embryogenesis



3 weeks

37 weeks

Fertilization

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Fertilization lecture overview

Cell division, mitosis and meiosis

Gametogenesis: oogenesis and spermatogenesis

Fertilization

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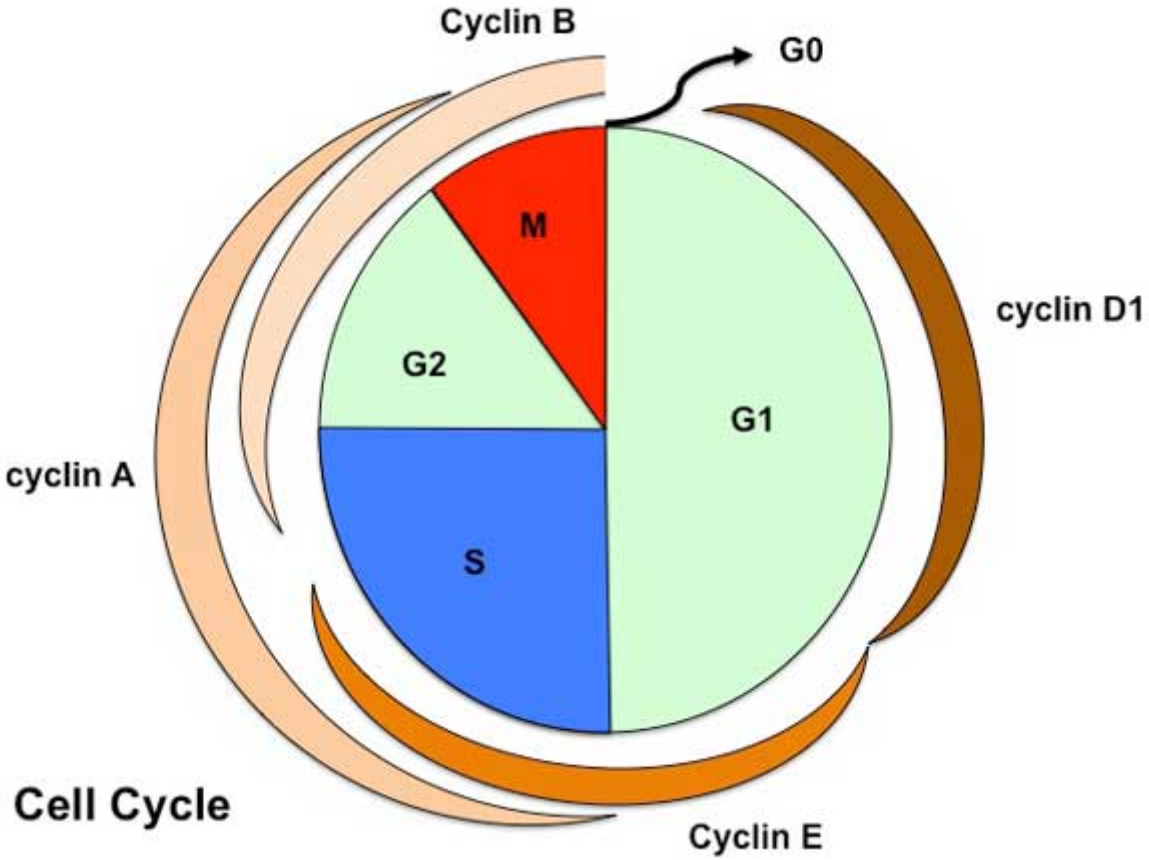
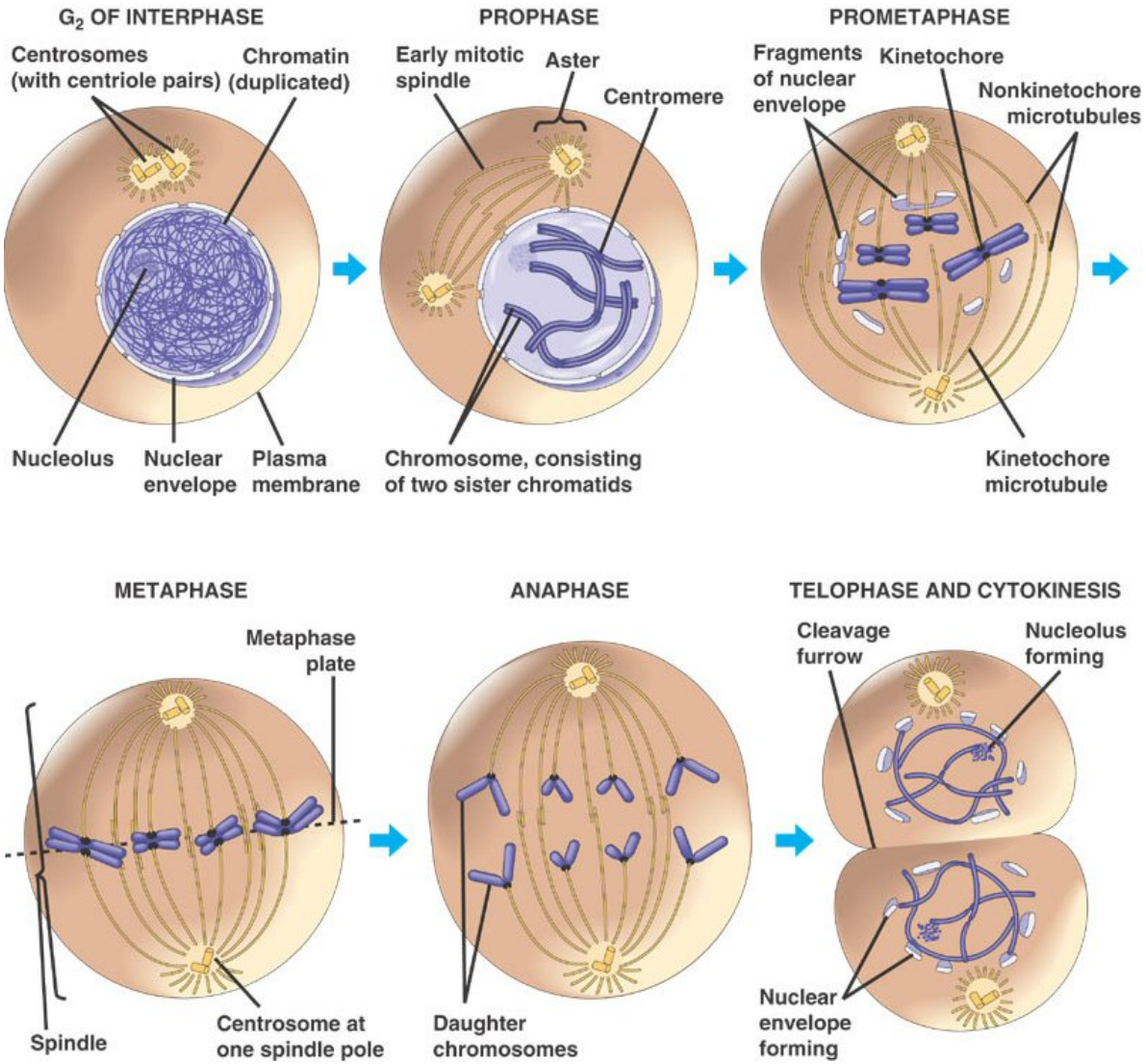
Cell Cycle

1 fertilized cell produces 10^{14} cells
Regeneration vs Quiescence
Interphase vs mitosis
Mitosis vs meiosis



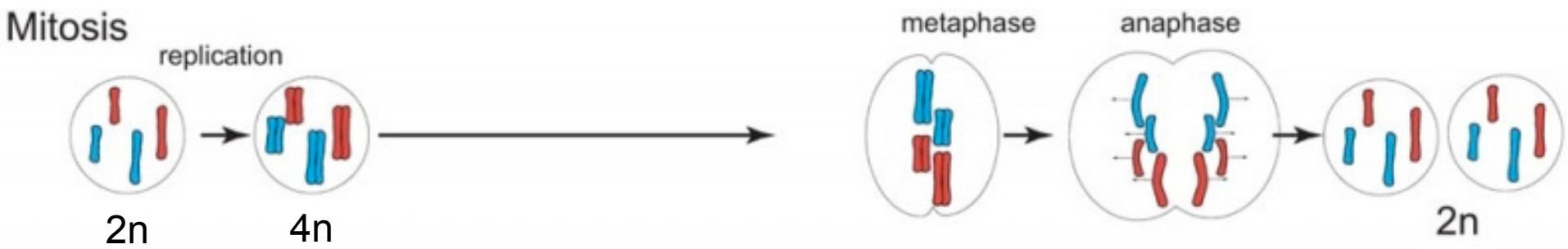
Mitosis



http://php.med.unsw.edu.au/embryology/images/d/dd/Mitosis_01.mp4

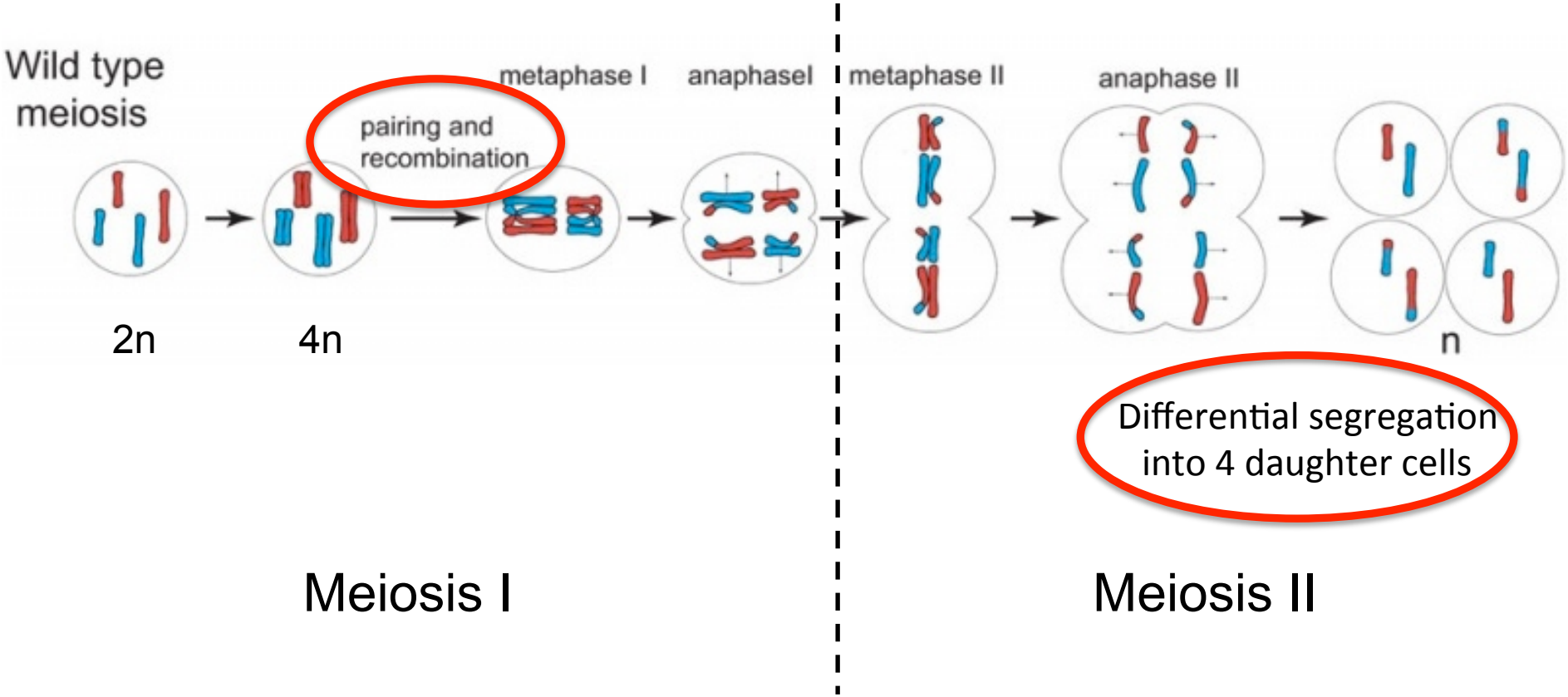
Mitosis

Occurs in all cells
Shuts down cellular function
Generation of two genetically identical daughter cells
2n -> 4n -> 2n

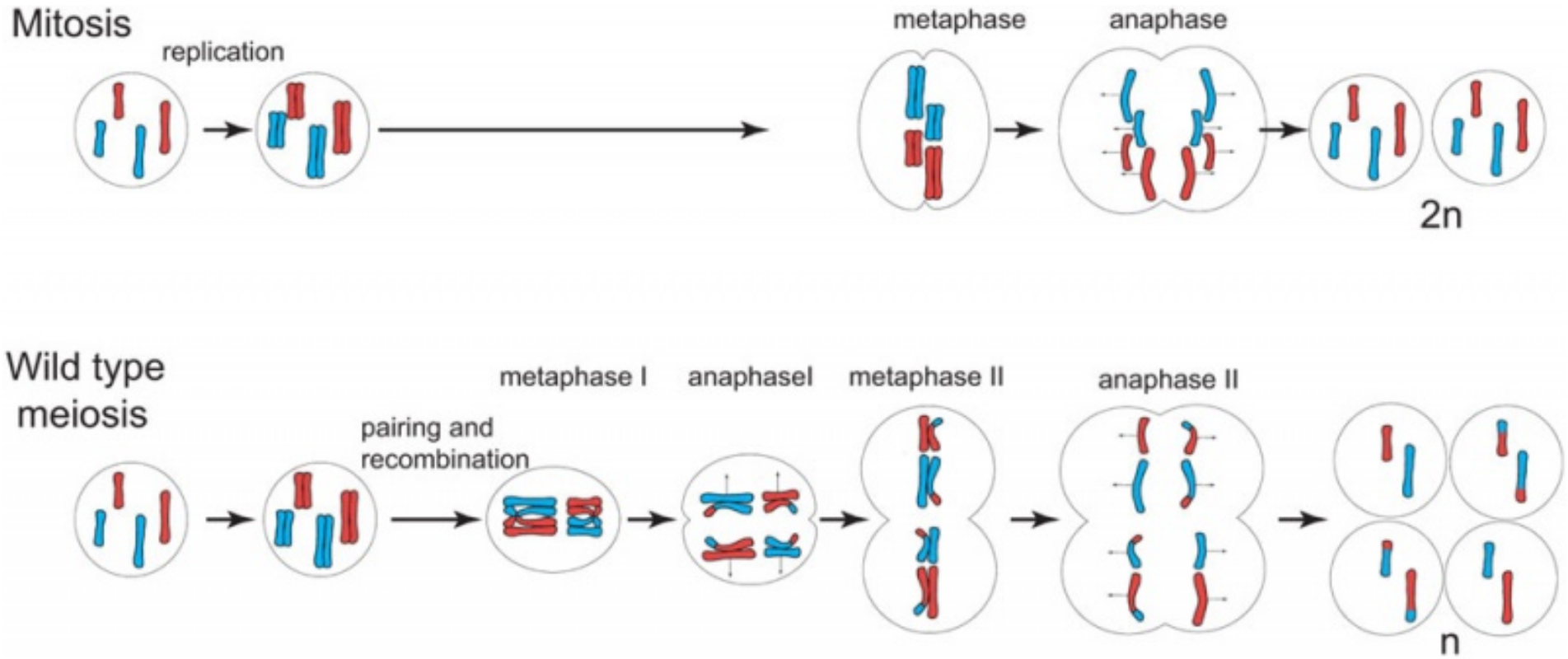


Meiosis

Occurs in only in gametes
Generation of genetically different daughter cells
2n -> 4n -> 2n -> n



Mitosis *vs* meiosis



Gametogenesis

Reproductive system

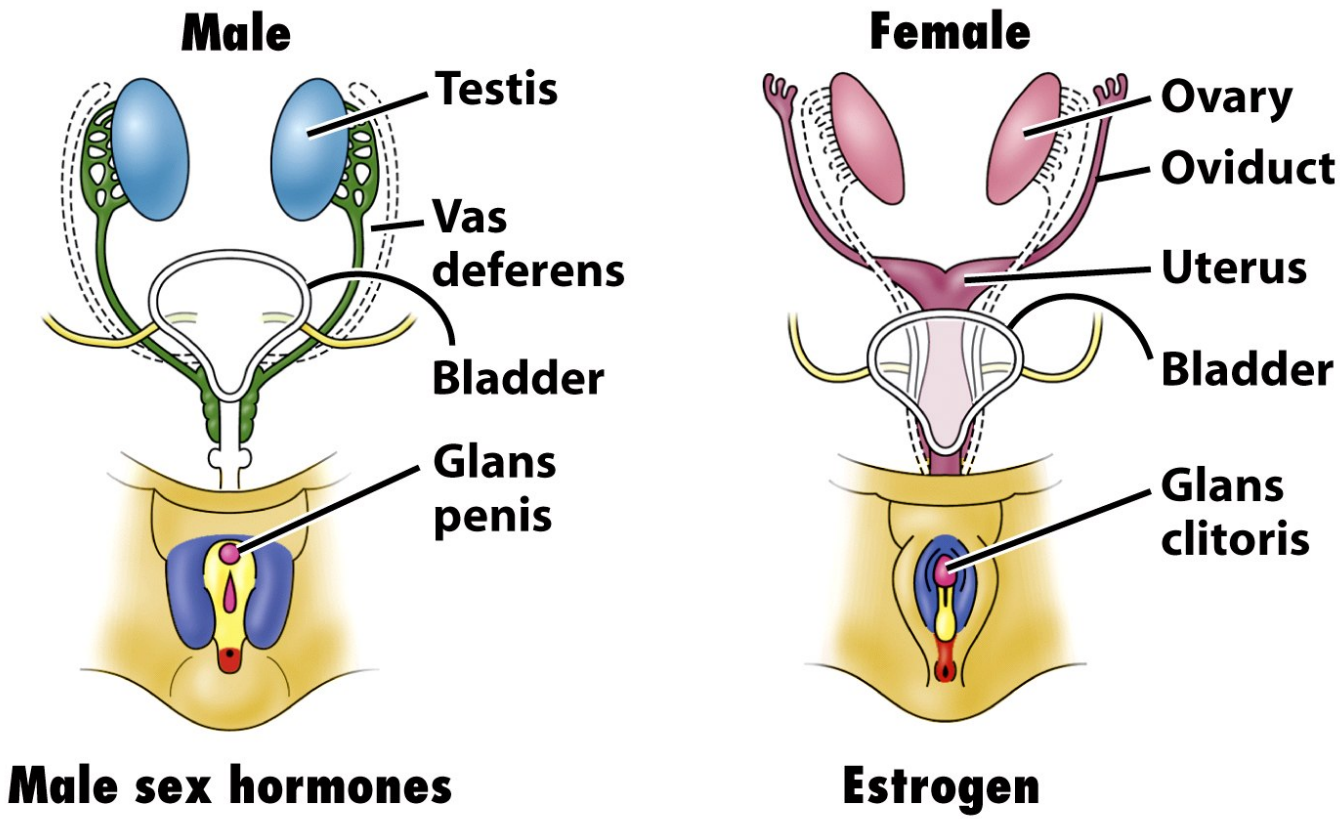
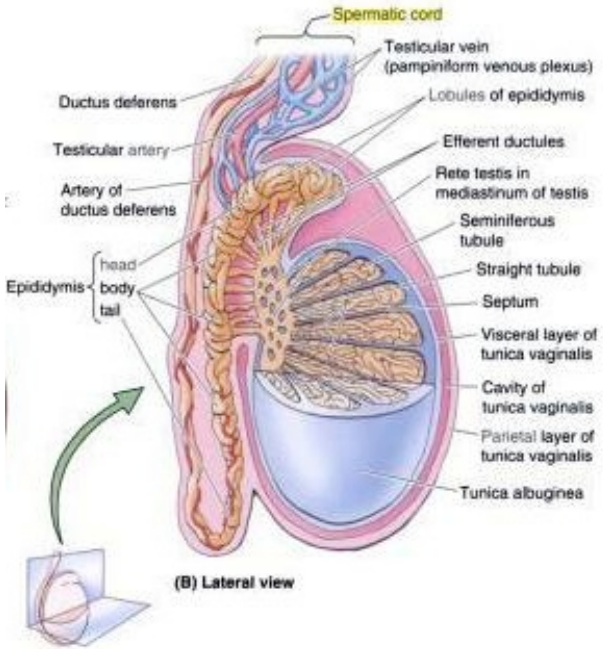
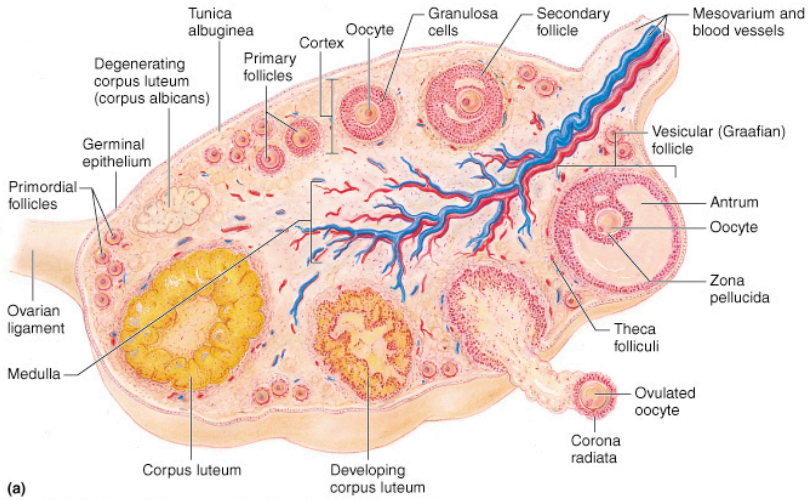


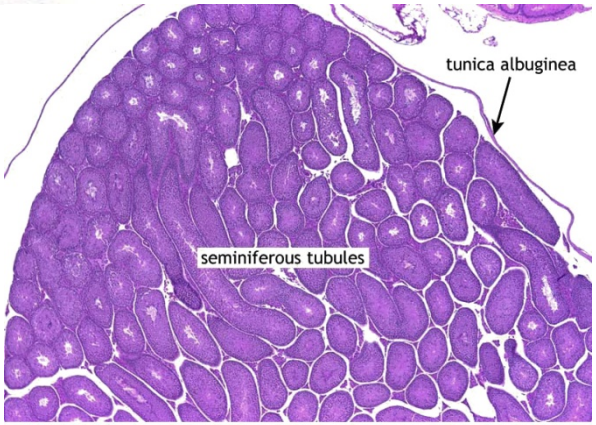
Figure 24-8 part 2 Discover Biology 3/e

Gametogenesis

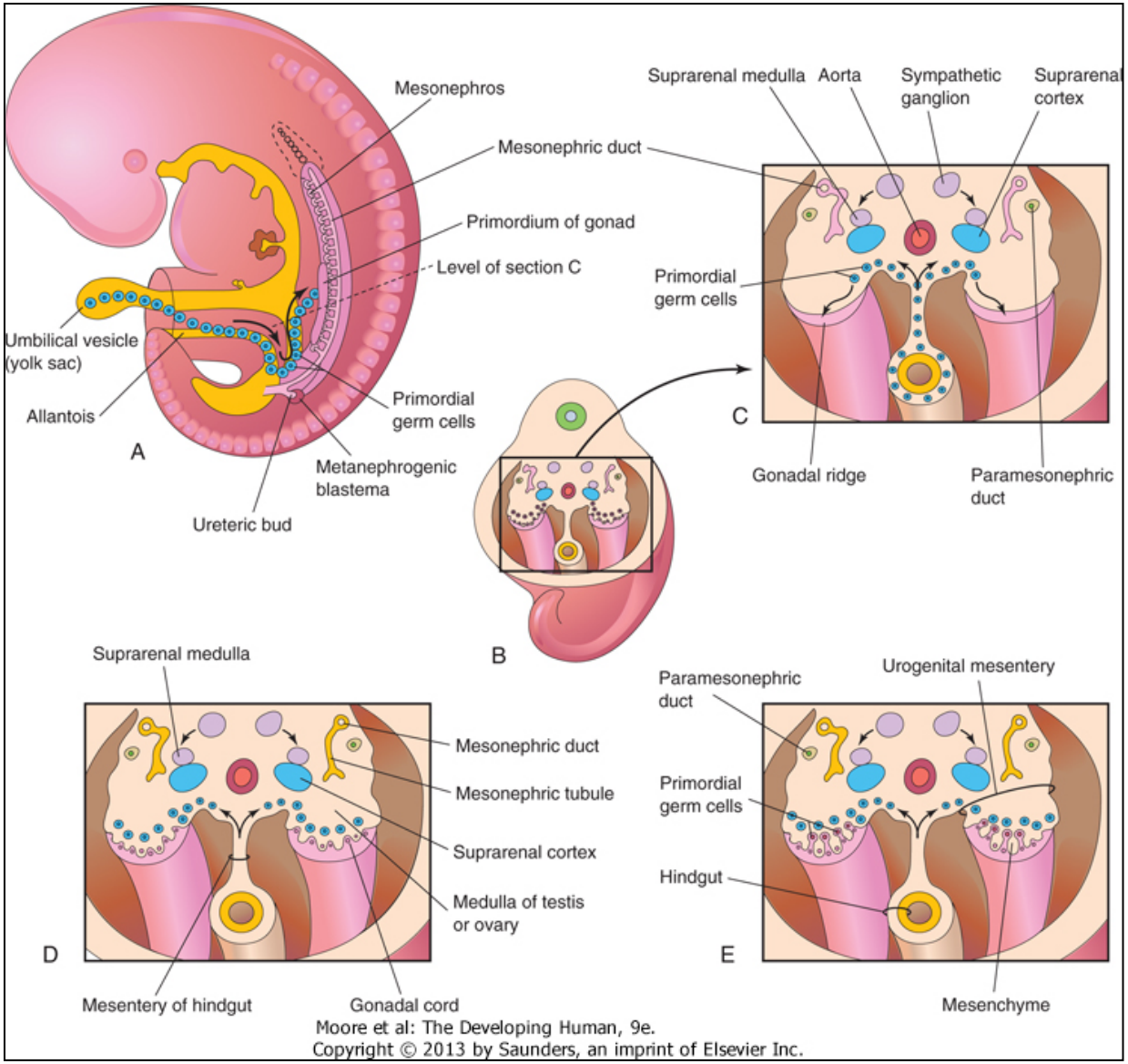
Reproductive system





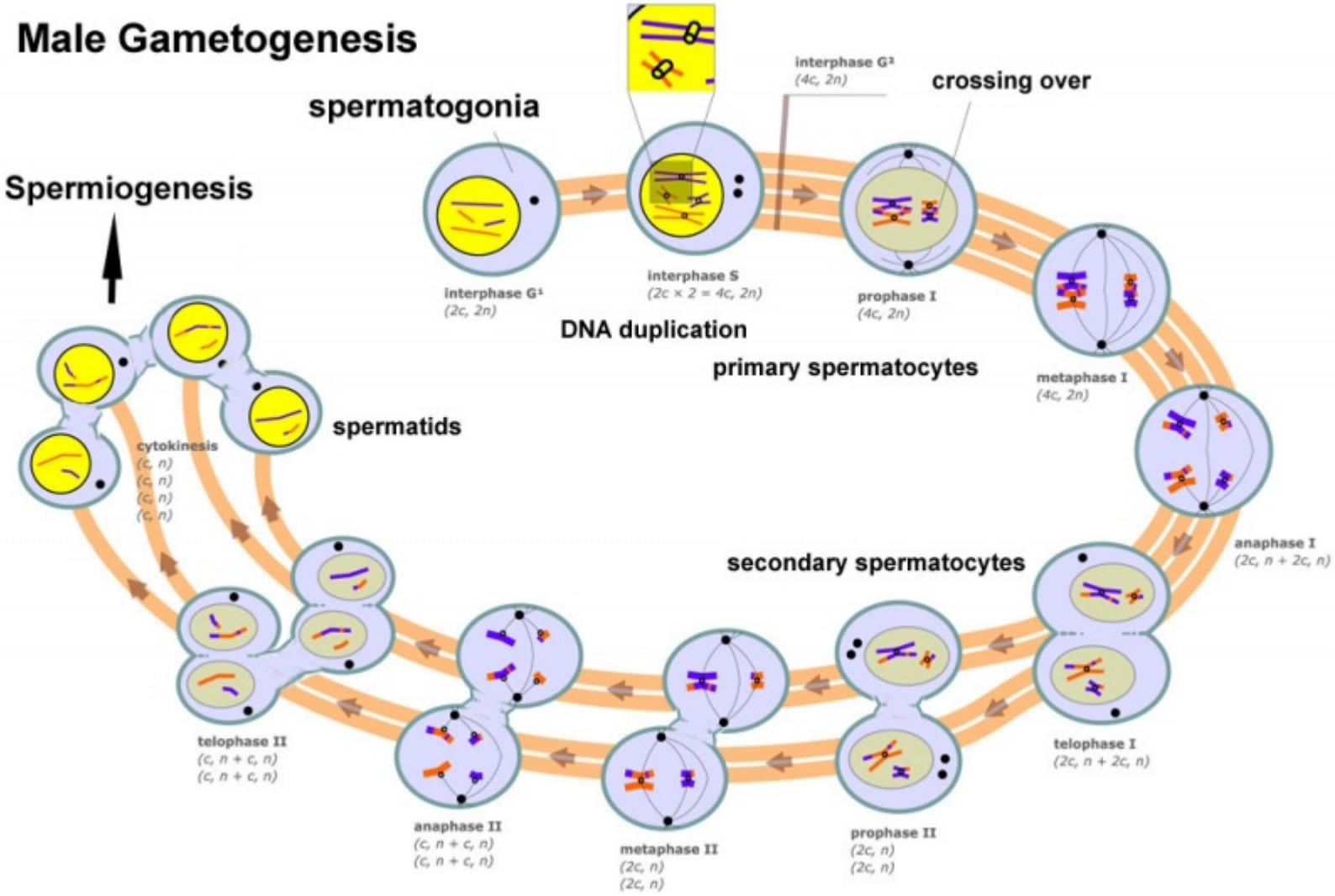


Gametogenesis

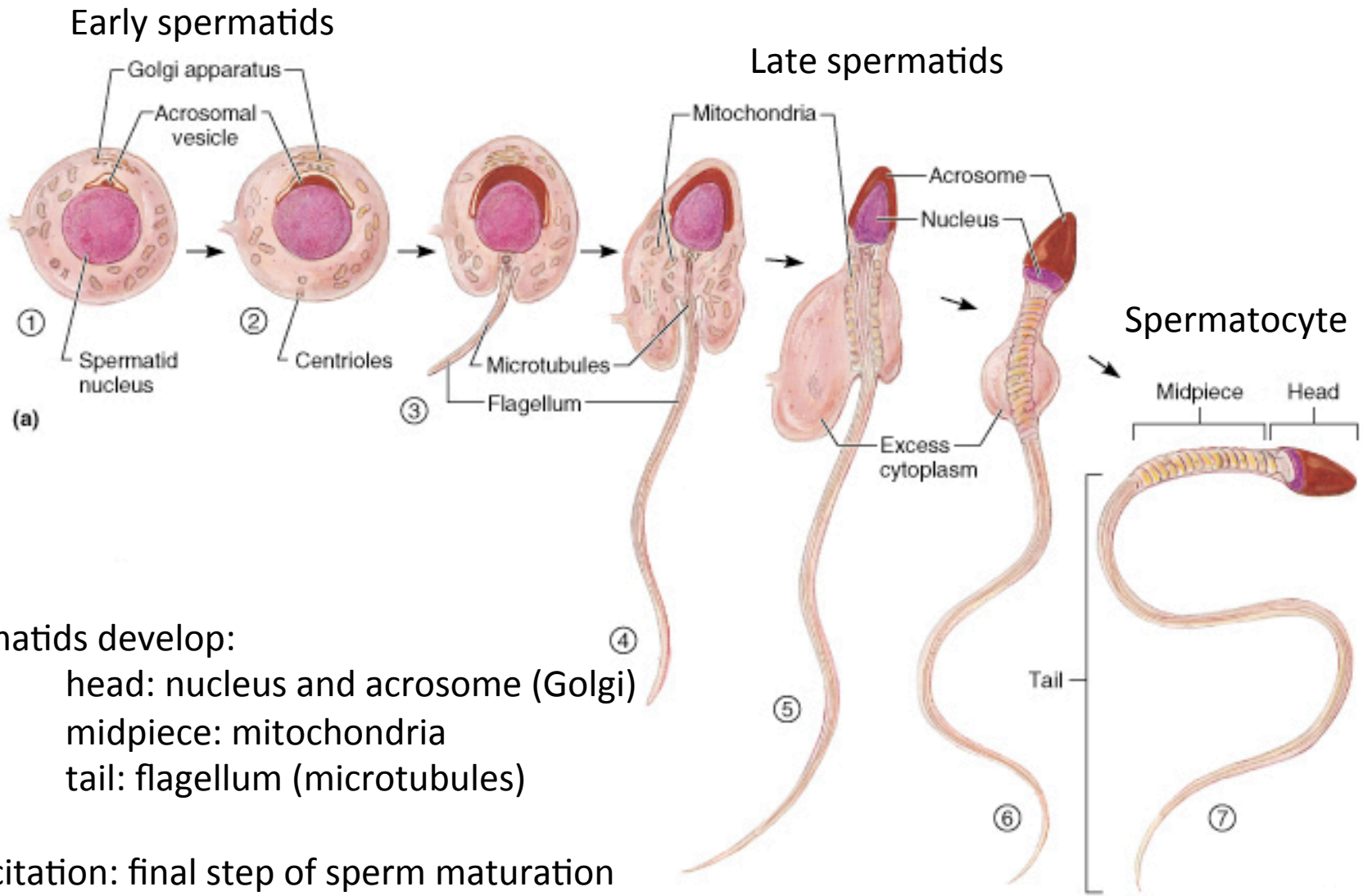


Moore et al: The Developing Human, 9e.

Spermatogenesis



Spermiogenesis



Spermatids develop:

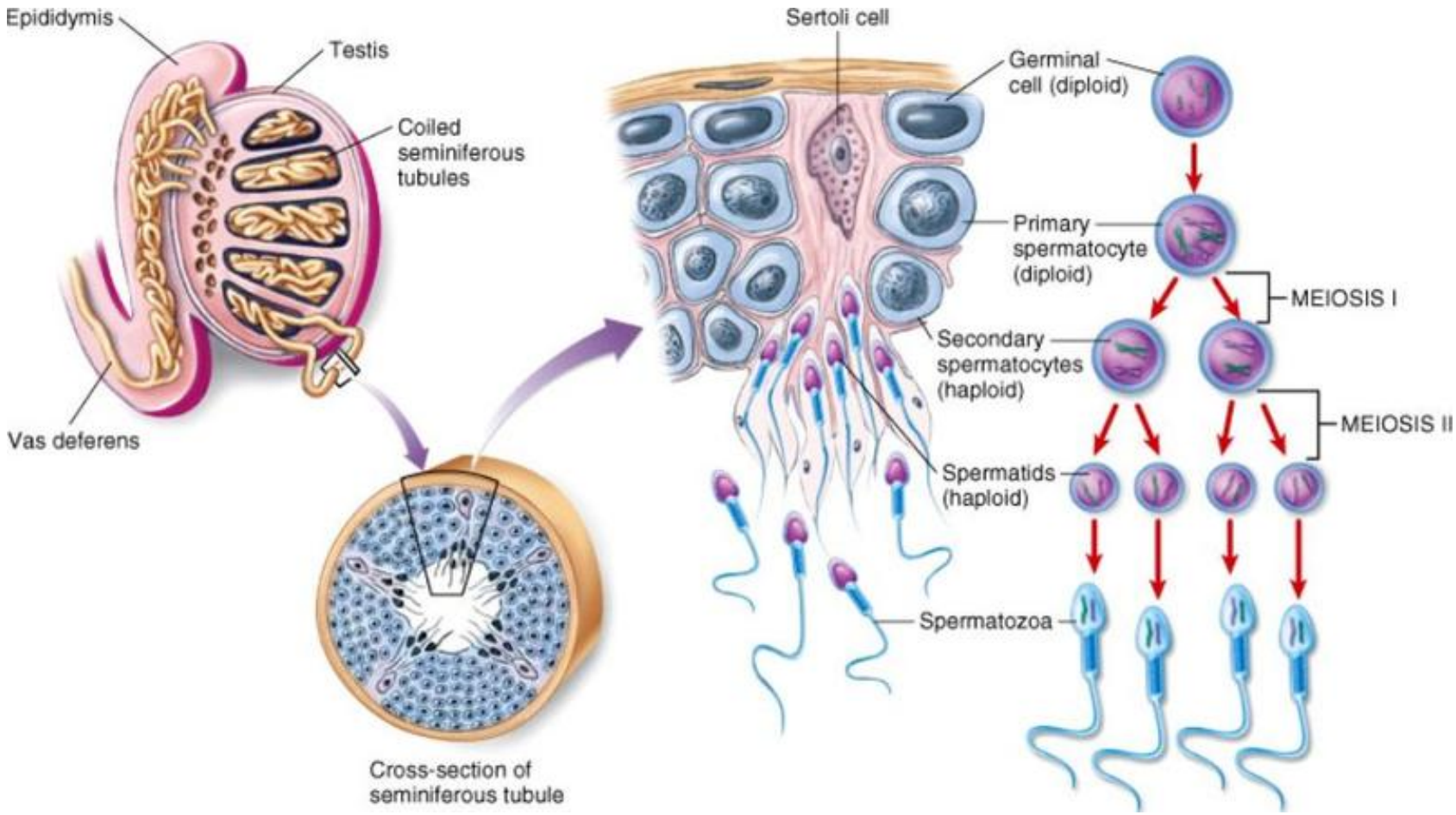
head: nucleus and acrosome (Golgi)

midpiece: mitochondria

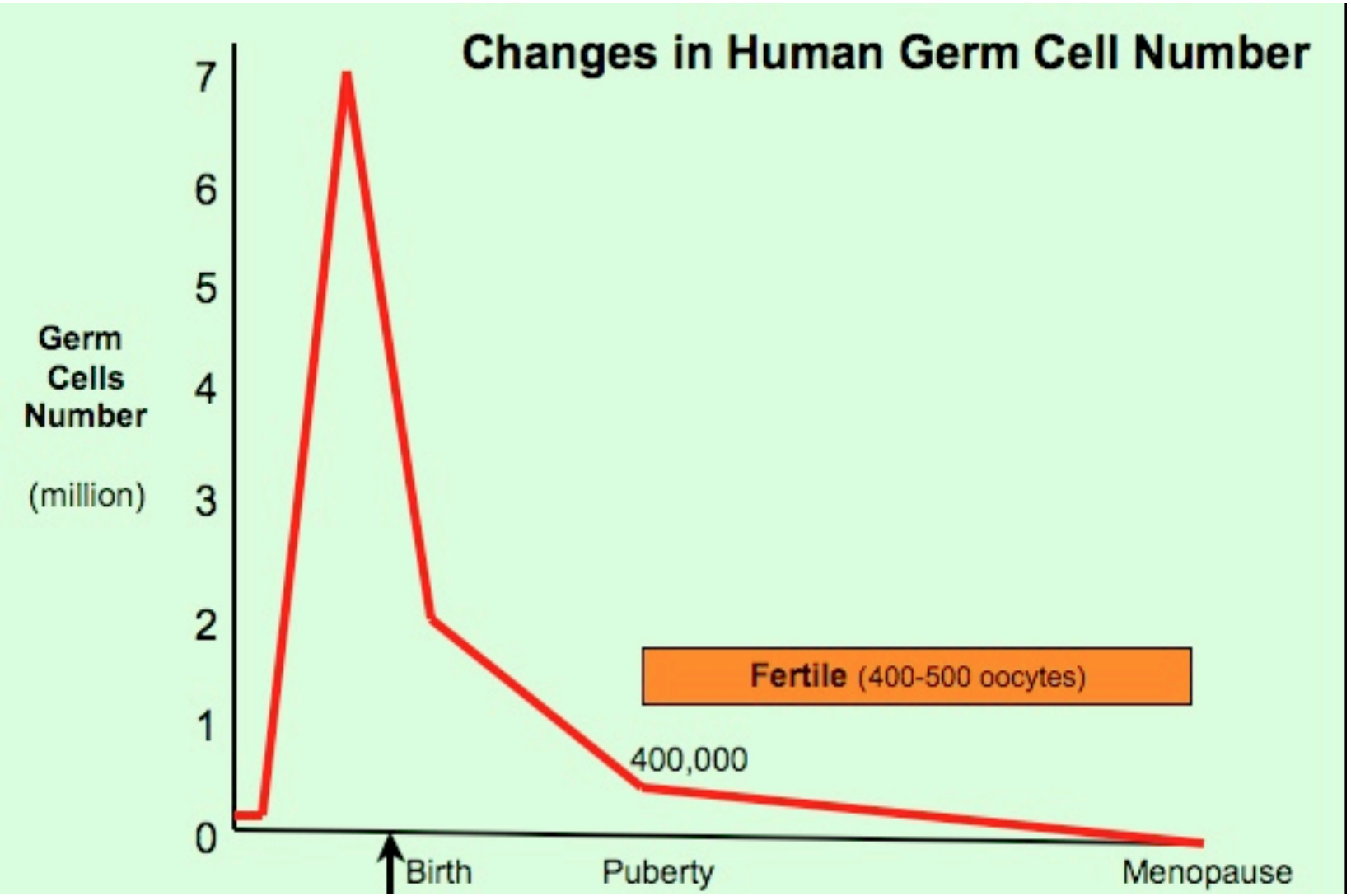
tail: flagellum (microtubules)

Capacitation: final step of sperm maturation

Spermatogenesis/spermiogenesis

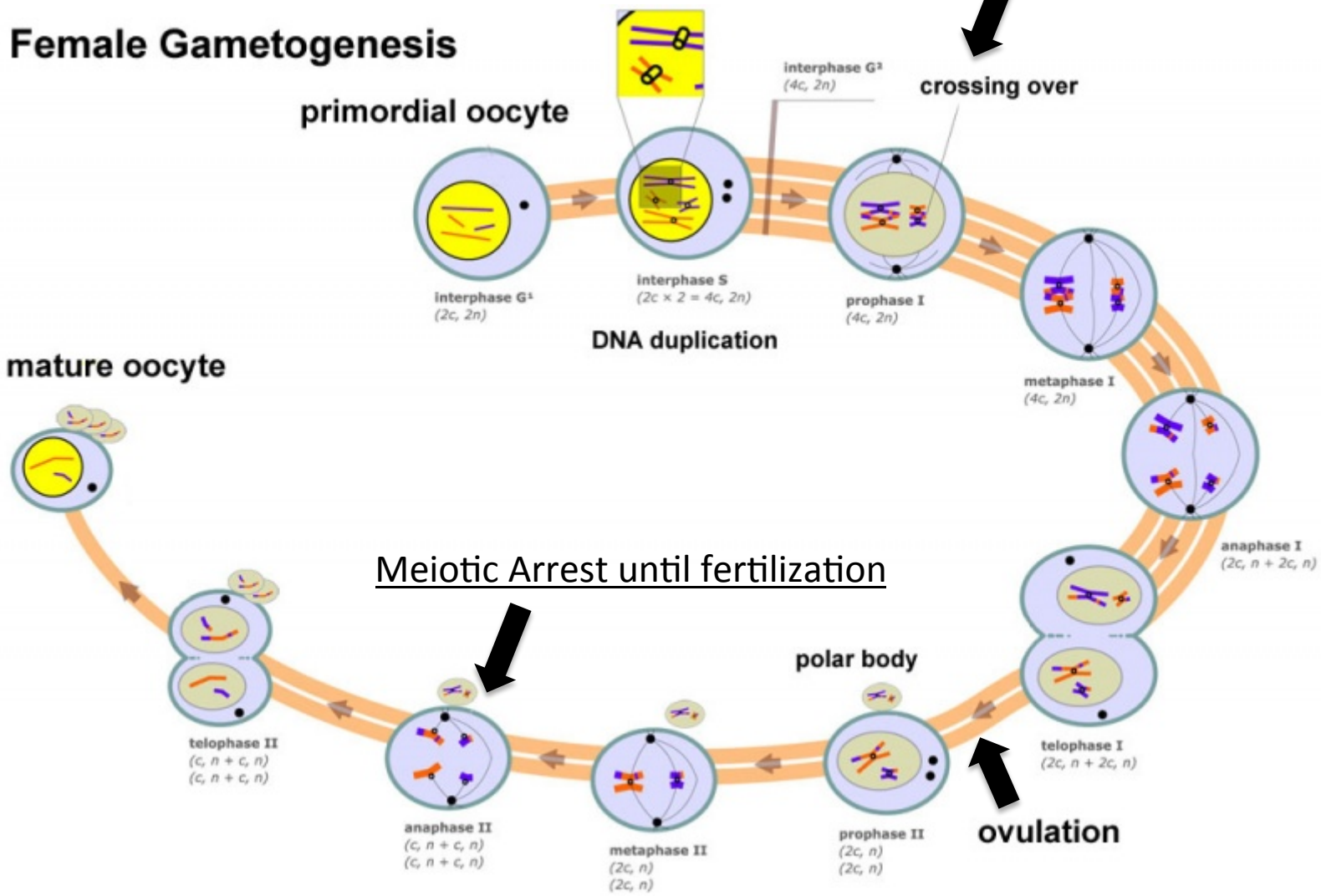


Oogenesis


Changes in Human Germ Cell Number
Germ Cells Number
(million)
7
6
5
4
3
2
1
0
Fertile (400-500 oocytes)
400,000
Birth
Puberty
Menopause

Oogenesis

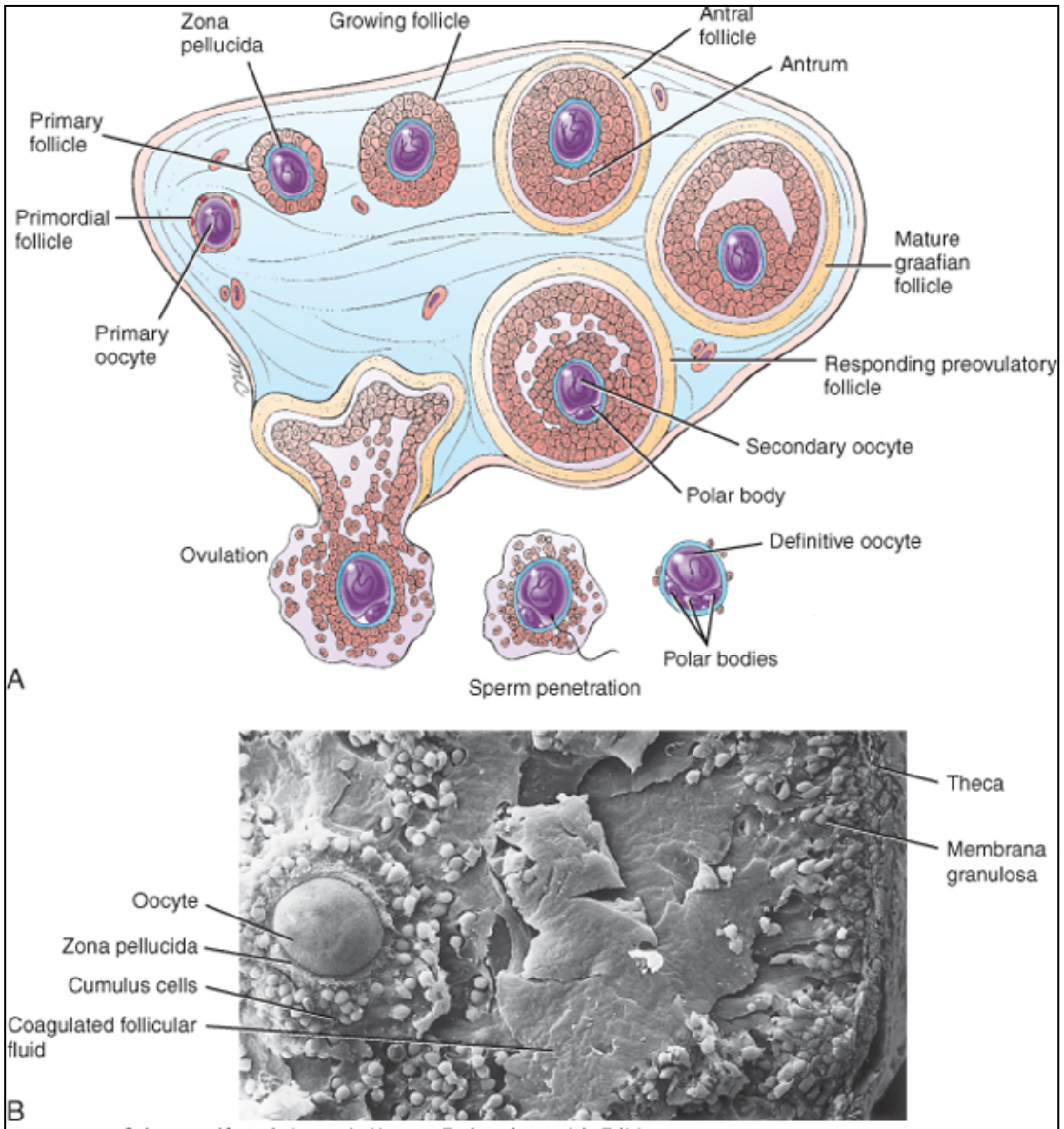
Meiotic Arrest @ week 12



Meiotic Arrest until fertilization

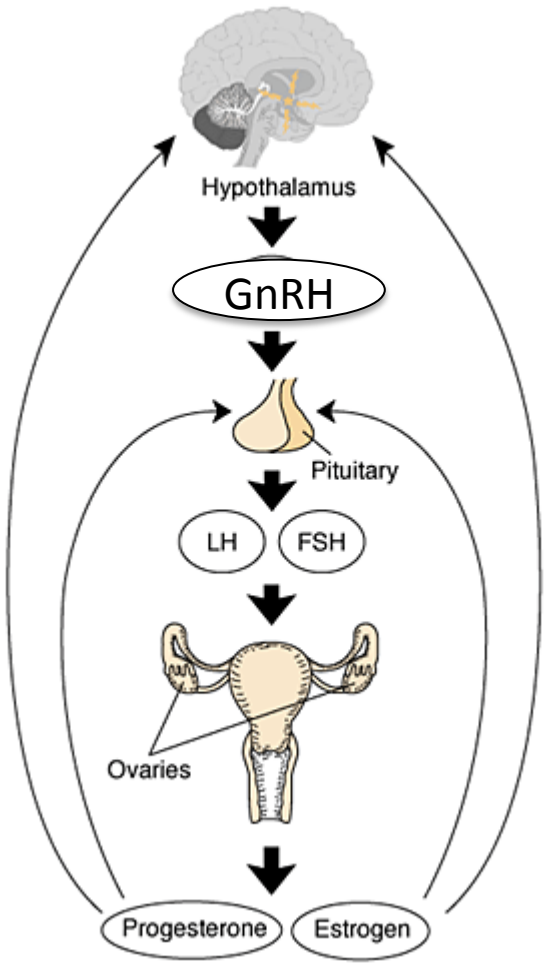
Primary oocyte generates 1 mature oocyte and 2 (or 3) polar bodies

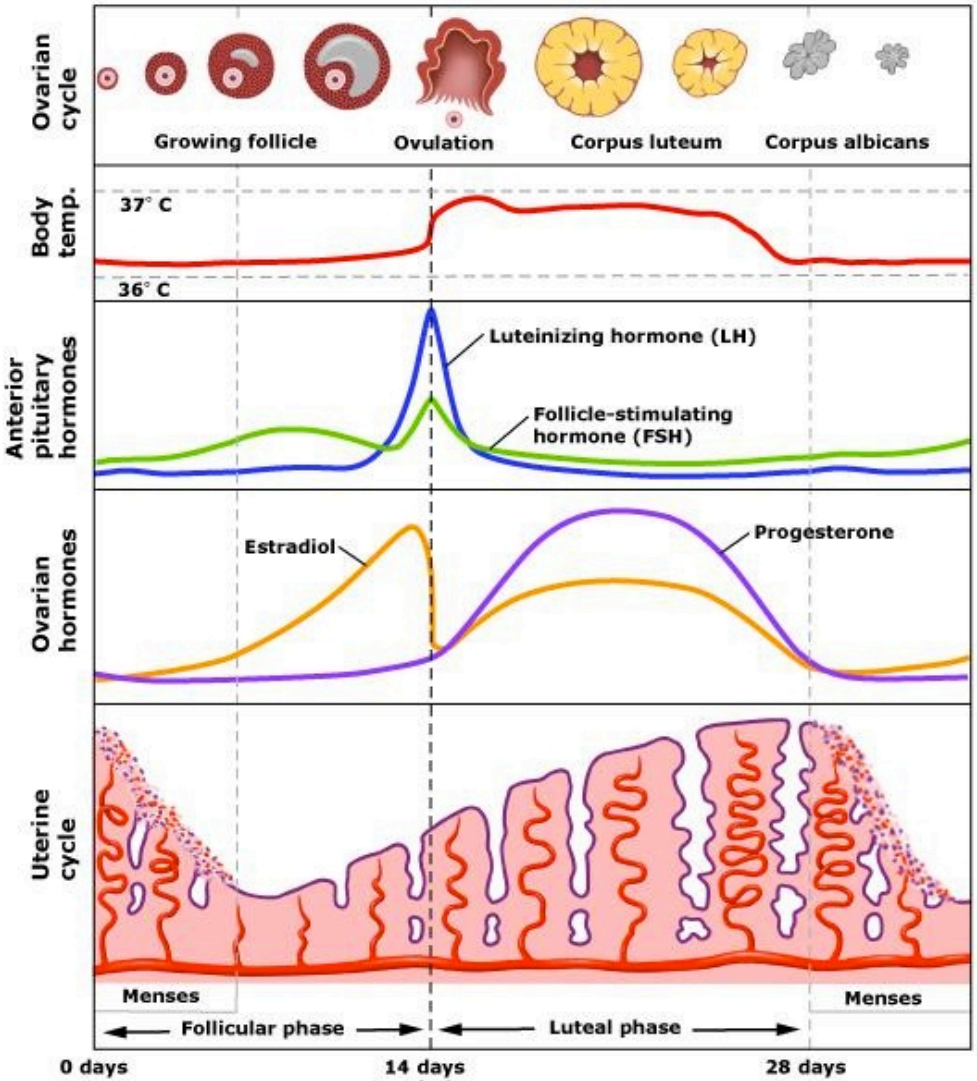
Oogenesis



Oogenesis

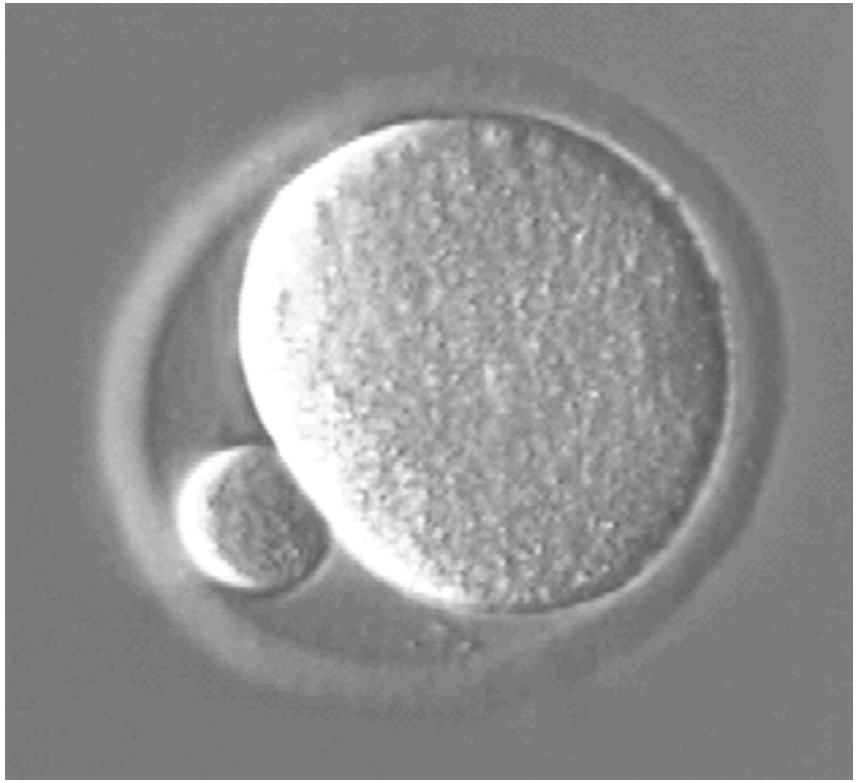
Menstrual cycle





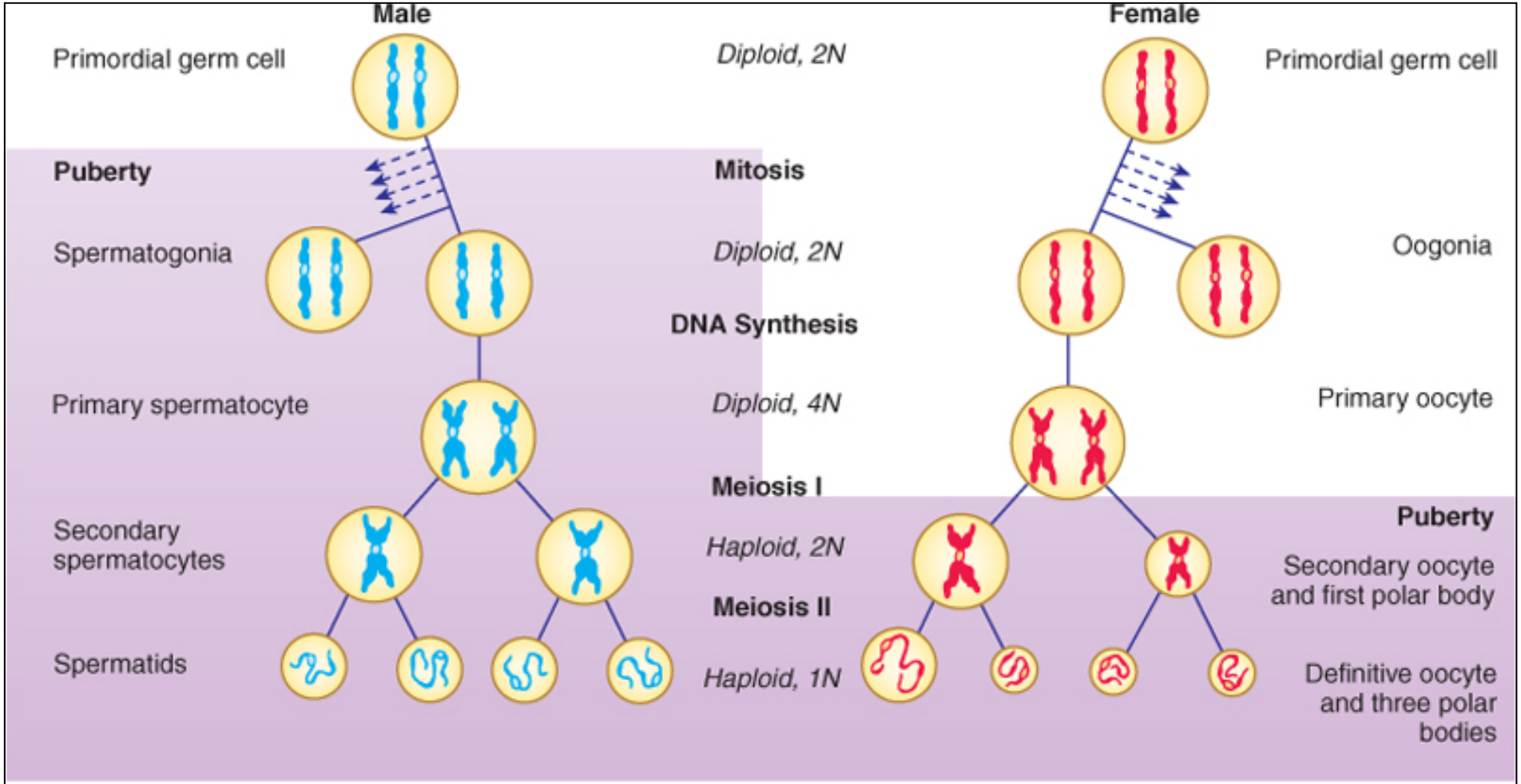
Oogenesis

Zona Pellucida



Produced by granulosa cells and oocyte
ZP1, ZP2, ZP3 glycoproteins:
Fertilization process/sperm binding/acrosome reaction

Gametogenesis



Mitotic arrest until puberty
Continuous mitosis followed by meiosis from puberty
1 primary spermatocyte: 4 spermatids (cytoplasmic bridges)
Spermiogenesis in testes

Prophase I arrest prenatally
Metaphase II arrest until fertilization
1 primary oocyte: 1 oocyte, 3 polar bodies
Oogenesis in ovary and oviduct

Gametogenesis

<u>Female:</u>
Oogenesis
Ovaries/oviduct
Meiotic arrest at prophase I until puberty
Meiotic arrest at metaphase II until fertilization
1 oocyte per month

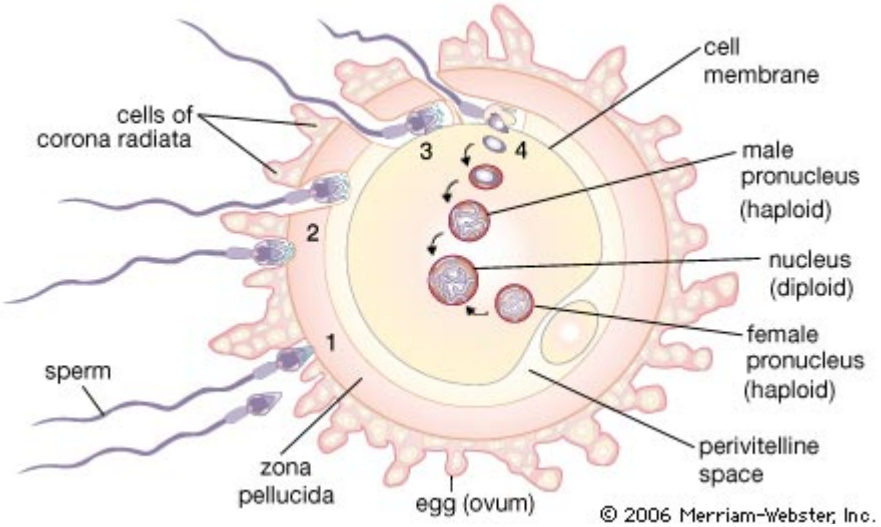
<u>Male:</u>
Spermatogenesis
Testes
Mitotic arrest until puberty
Maturation of many spermatocytes throughout life

Fertilization

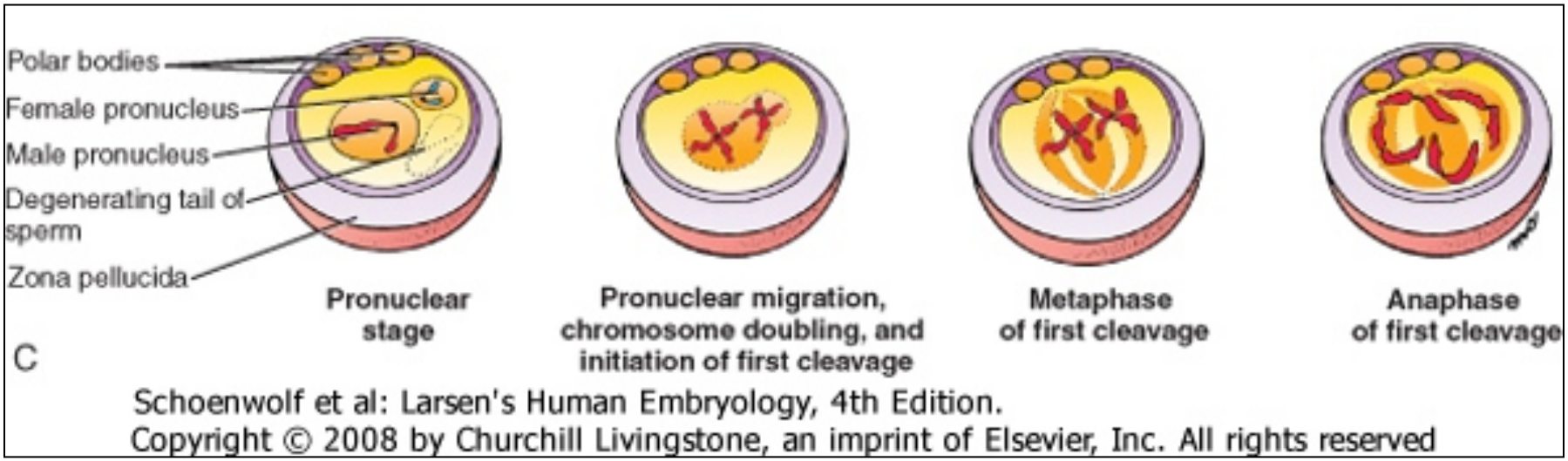
Ejaculation
Capacitation of sperm in female genital tract
Oocyte secretes chemotactic factors

Fertilization takes place in first 1/3 of oviduct
Zona Pellucida induces acrosome reaction
Membrane Fusion:
Cortical granule release: prevention of polyspermy
Oocyte resumes meiosis

Fusion of male and female pronuclei
Mitosis



Fertilization



http://php.med.unsw.edu.au/embryology/images/5/5f/Fertilization_003.mp4

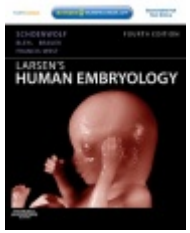
http://php.med.unsw.edu.au/embryology/images/9/95/Pronuclear_fusion_001.mp4

Fertilization lecture overview

Cell division, mitosis and meiosis

Gametogenesis: oogenesis and spermatogenesis

Fertilization



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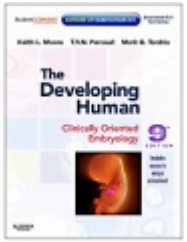

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