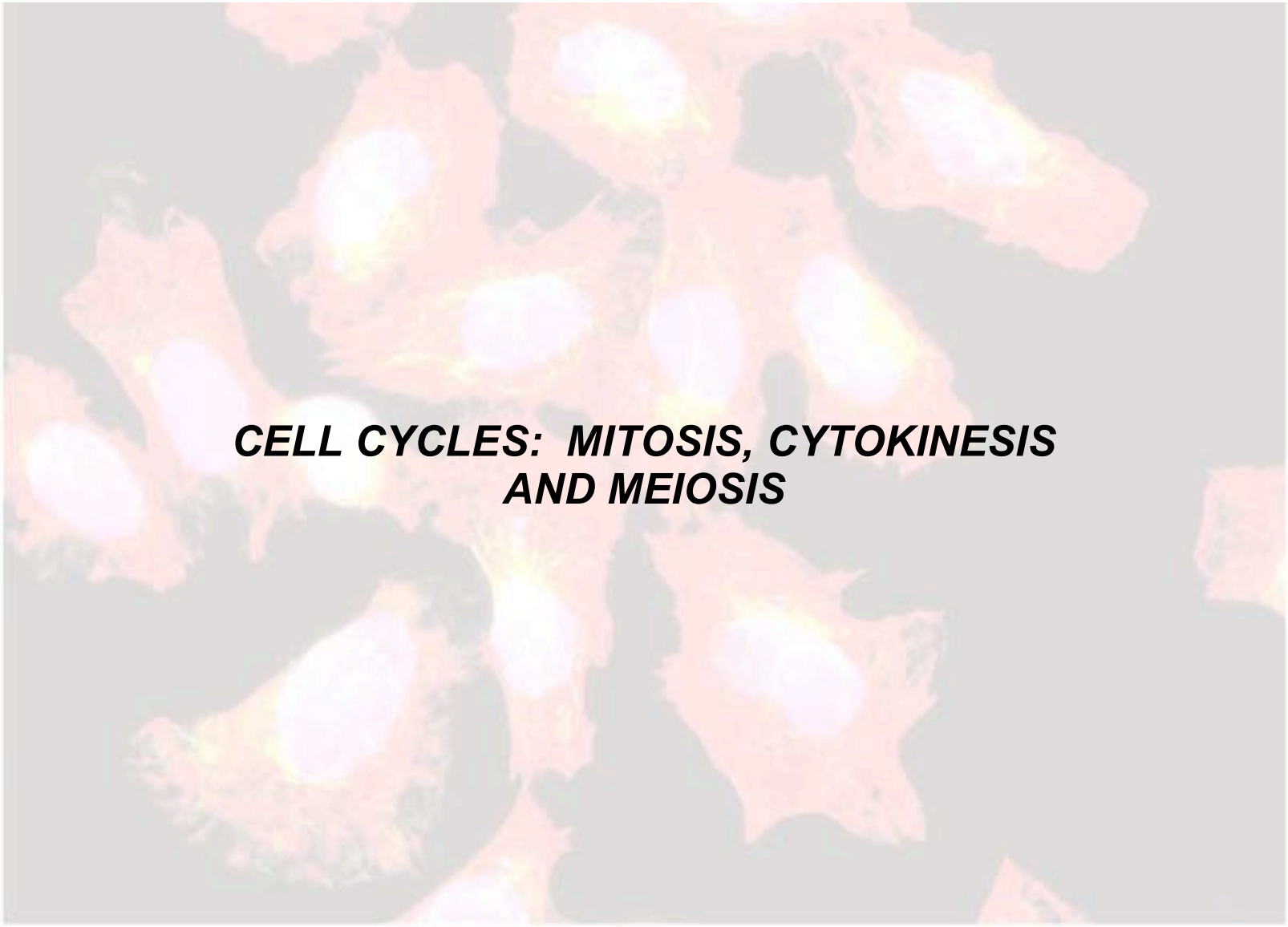
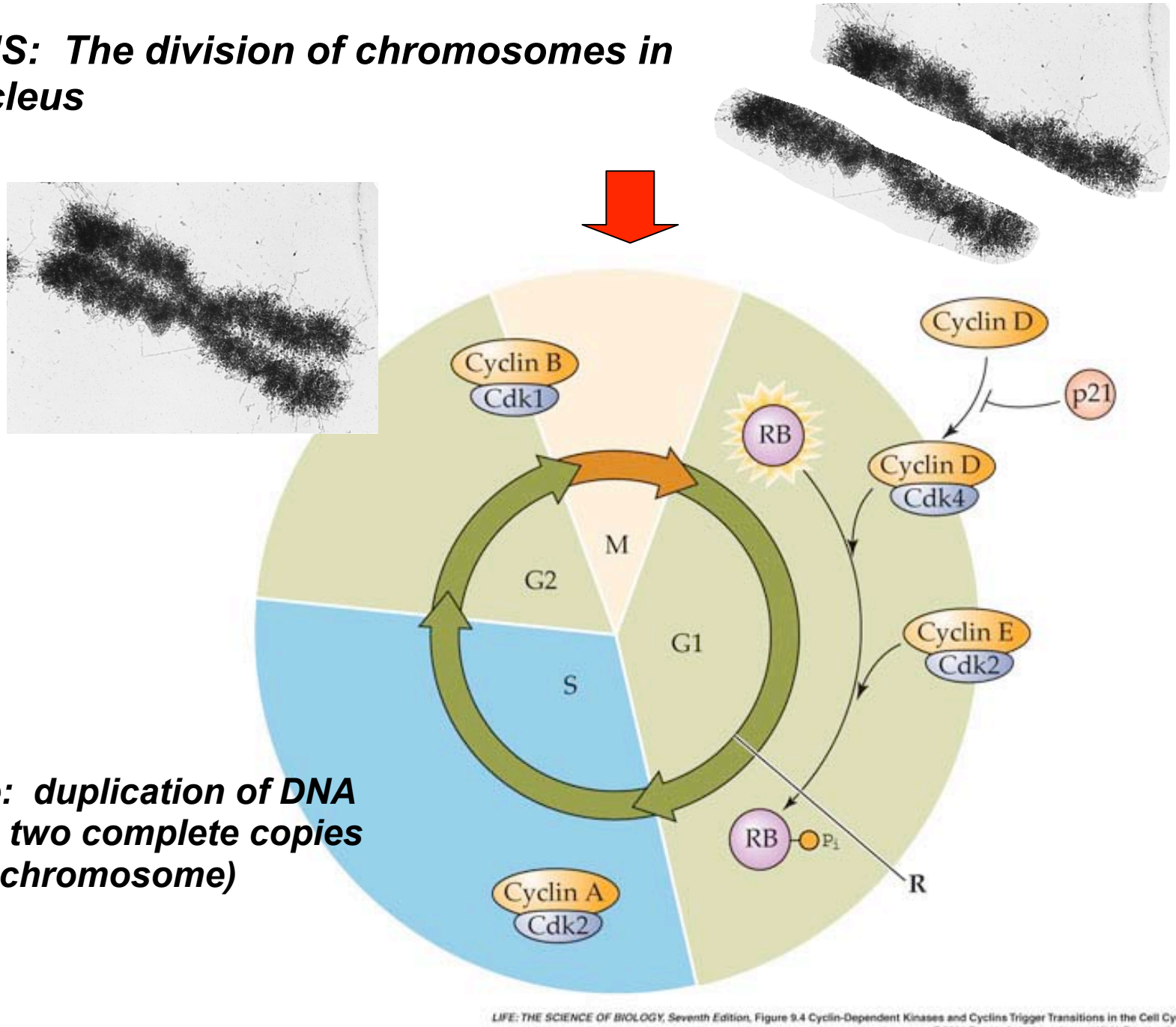


CELL CYCLES: MITOSIS, CYTOKINESIS AND MEIOSIS

MITOSIS: The division of chromosomes in the nucleus

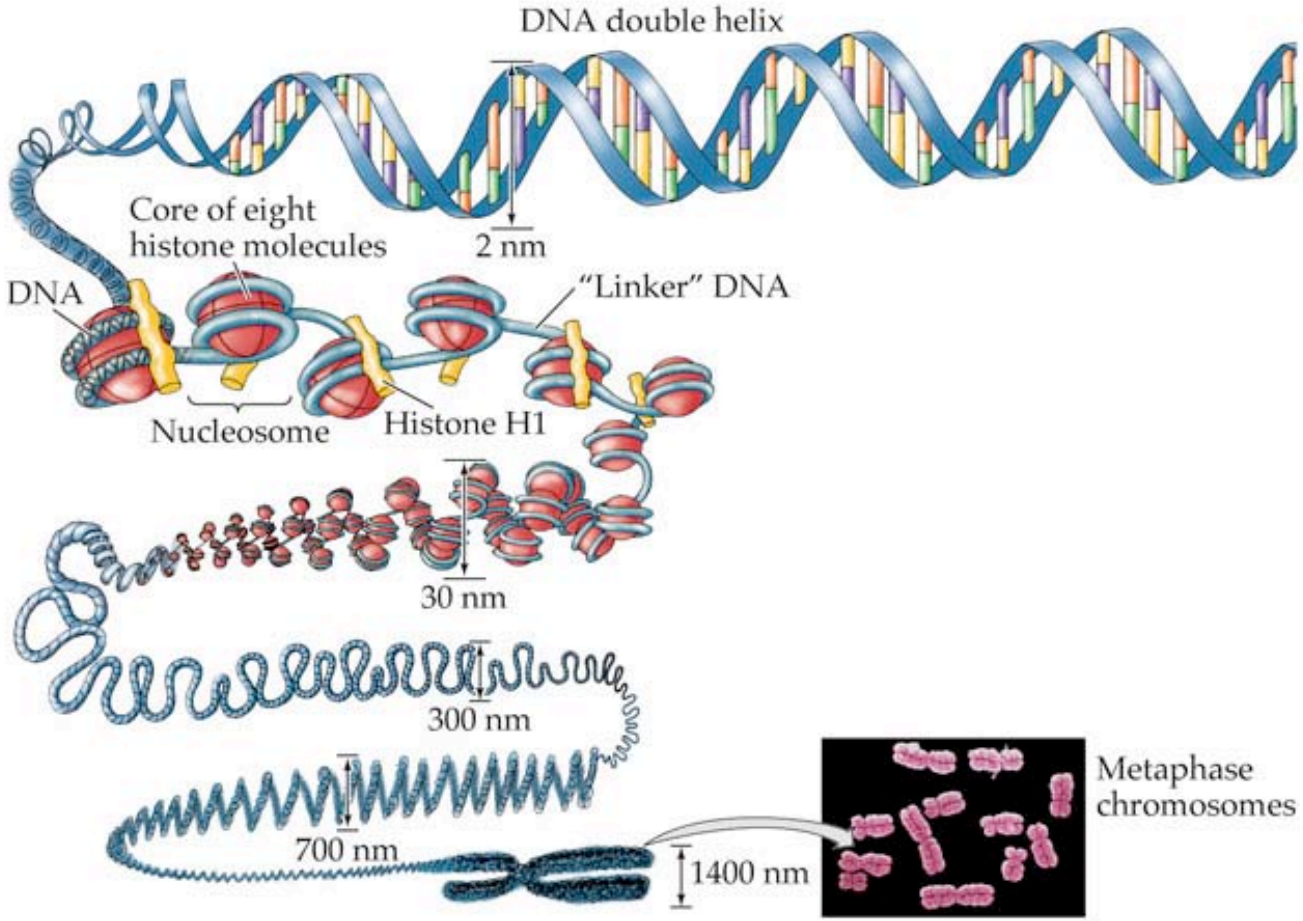


S phase: duplication of DNA (to form two complete copies of each chromosome)

LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.4 Cyclin-Dependent Kinases and Cyclins Trigger Transitions in the Cell Cycle

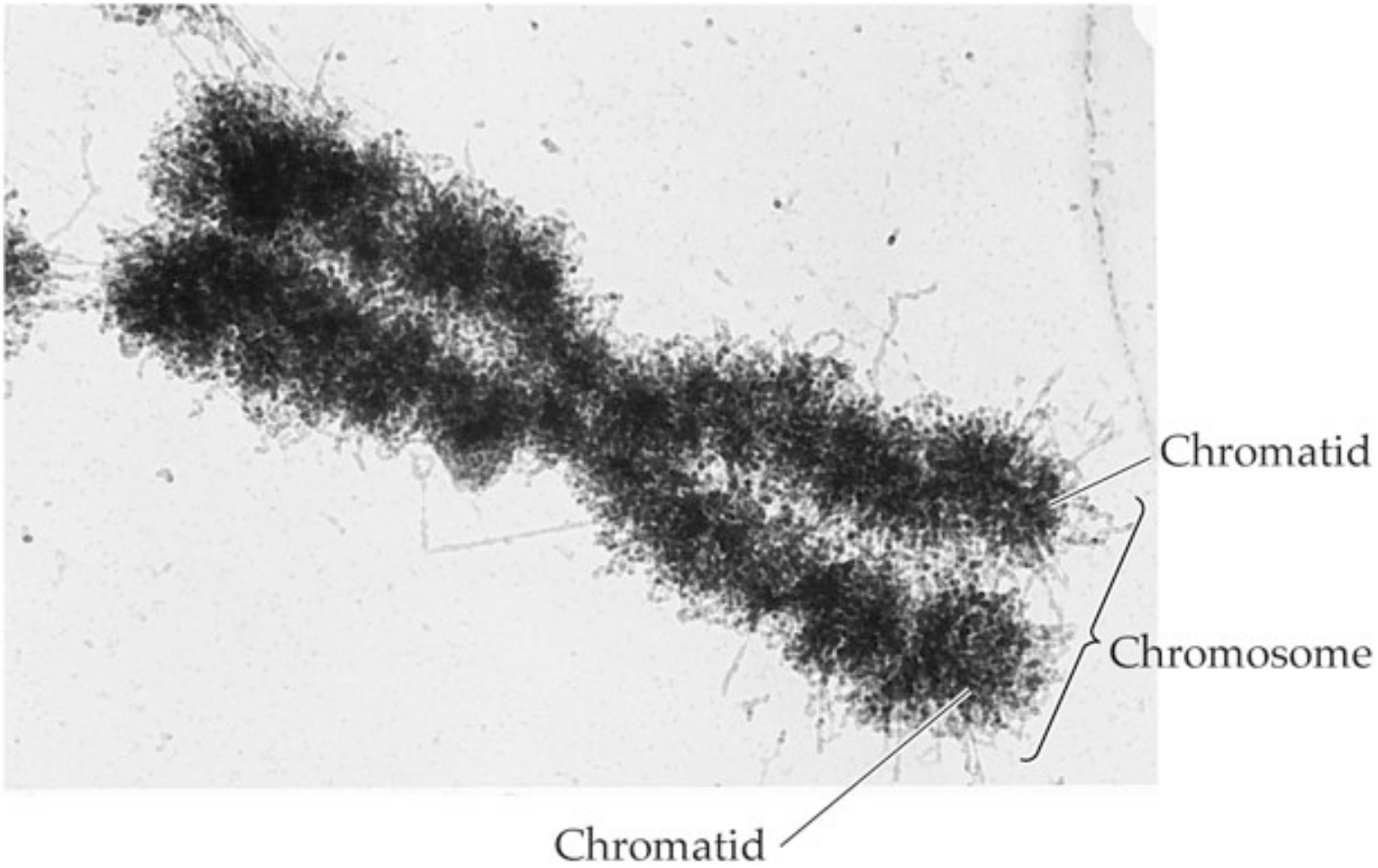
DNA (chromatin) is wound into a manageable length ("condensed") by multiple stages of coiling

- Two daughter DNAs: two chromatids
- Joined at centromere (kinetichore)



LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.6 DNA Packs into a Mitotic Chromosome

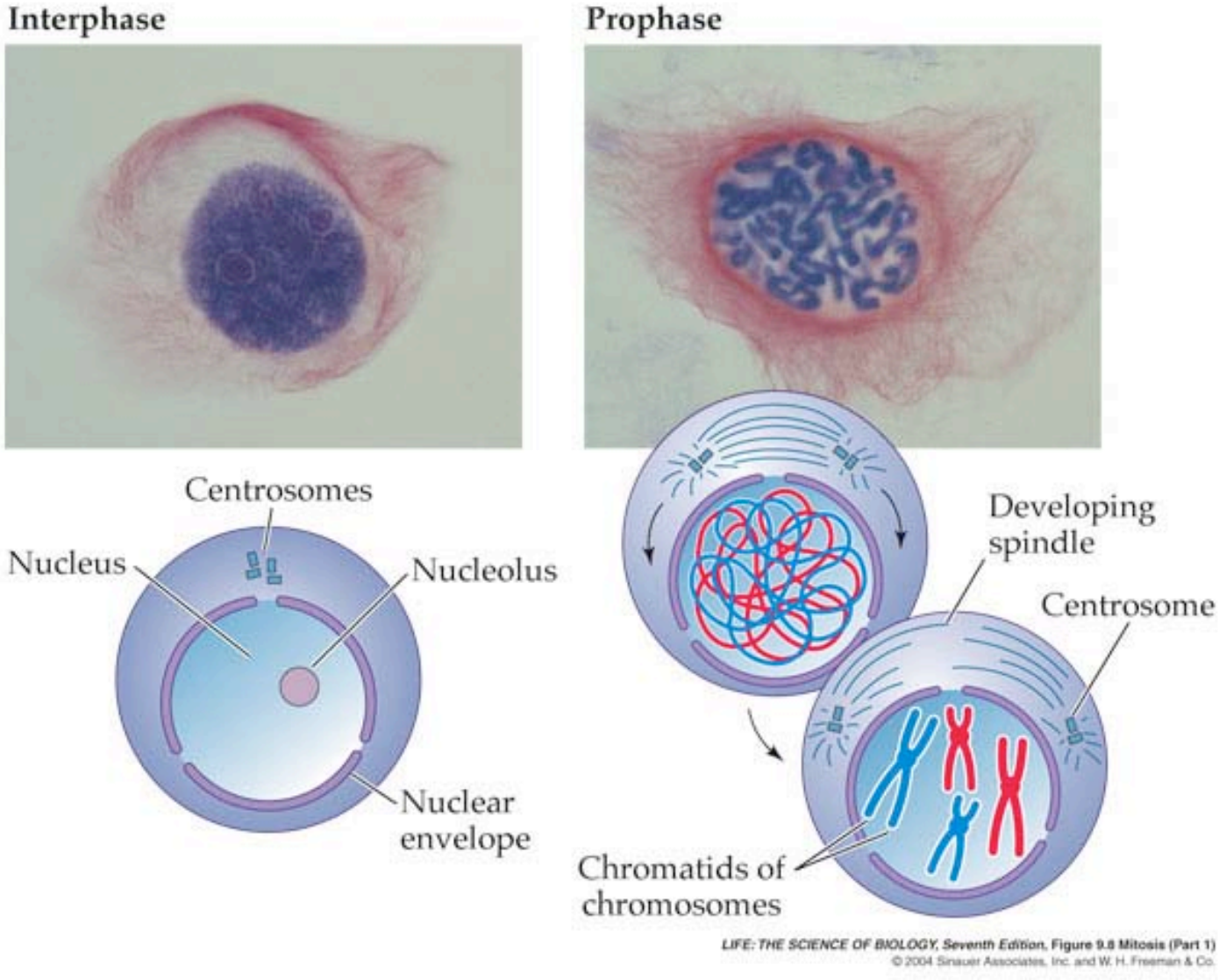
The "division of chromosomes" is really a separation of chromatids



LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.5 Chromosomes, Chromatids, and Chromatin

Prophase

- ♦ Chromatin condenses
- ♦ Centrosomes divide
- ♦ Asters (microtubules) form (in animal cells)



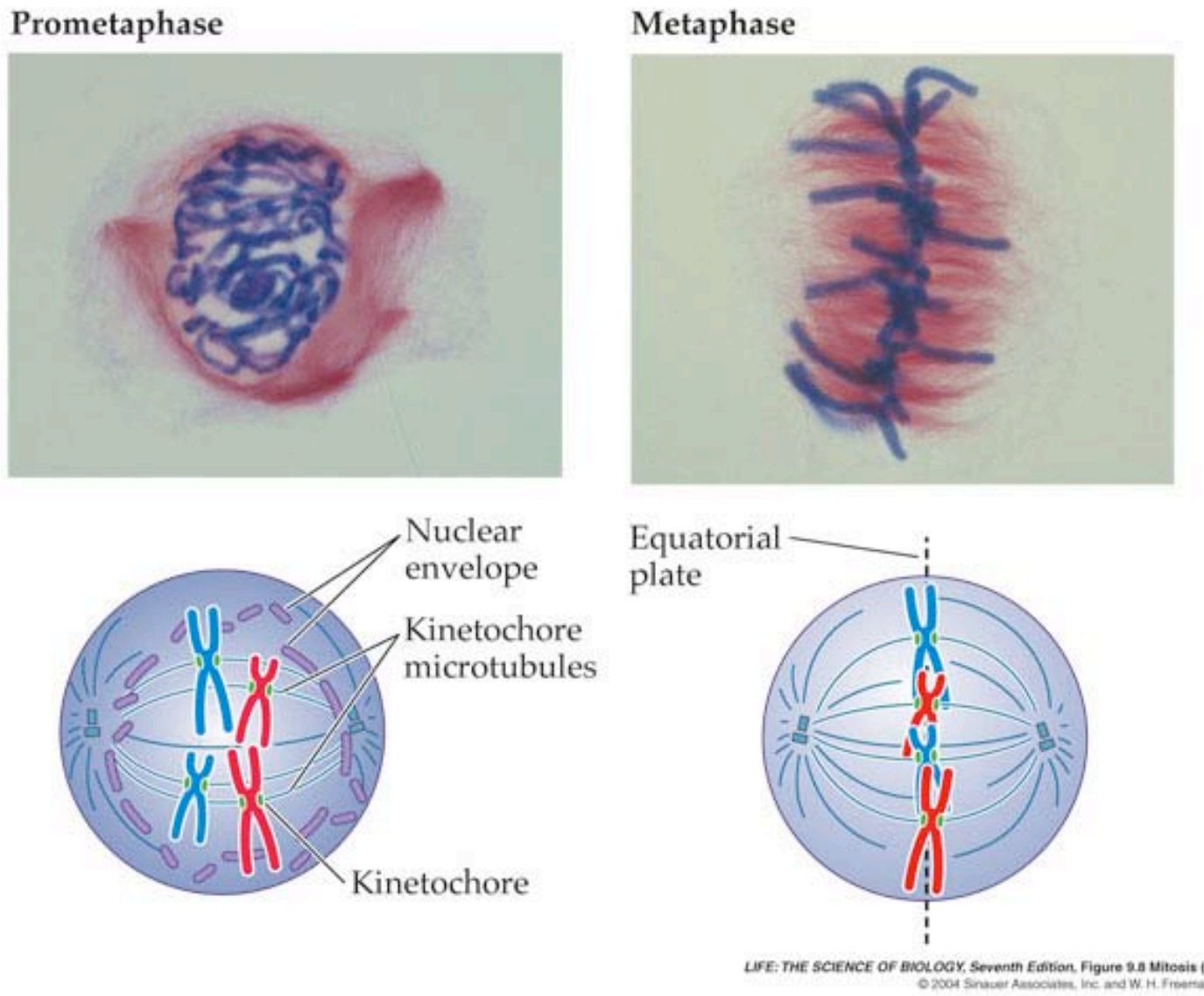
LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.8 Mitosis (Part 1)

Prometaphase

- ♦ Spindle forms
- ♦ Nuclear envelope disappears
- ♦ Nucleolus disappears

Metaphase

- ♦ Spindle fibers attach to kinetochores
- ♦ Chromosomes move to equitorial plane



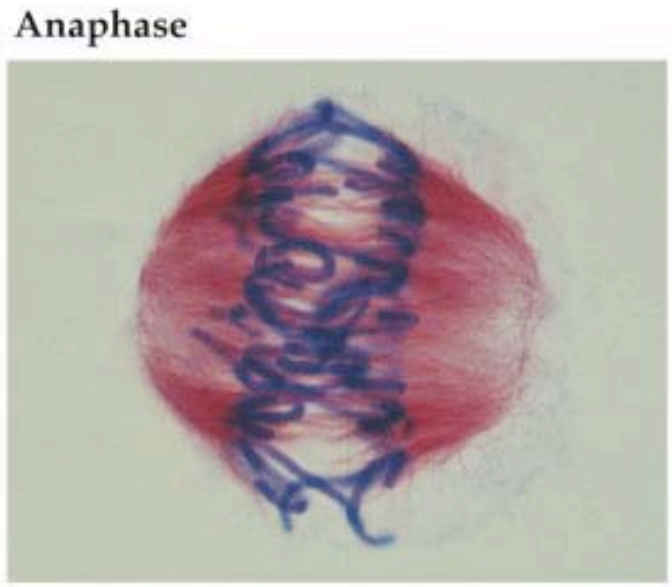
LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.8 Mitosis (Part 2)

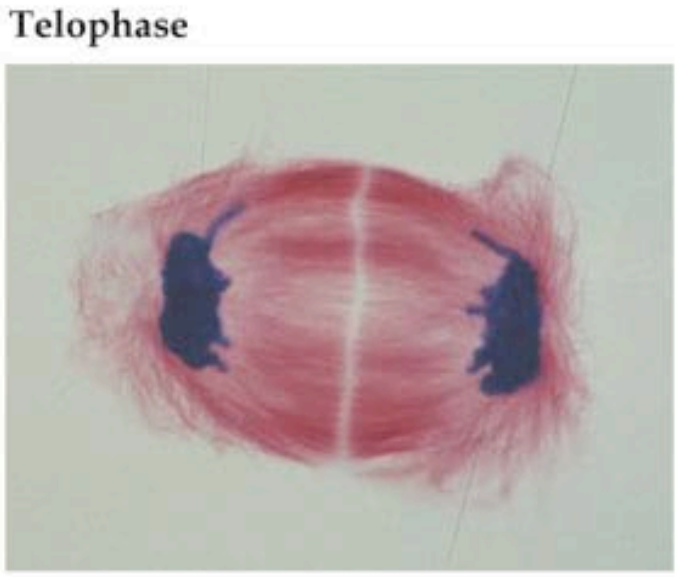
Anaphase

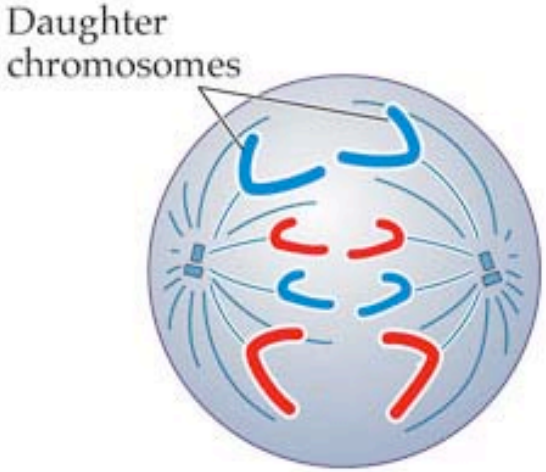
- ♦ Centromeres divide
- ♦ Chromosomes move to poles
- ♦ Cytokinesis begins

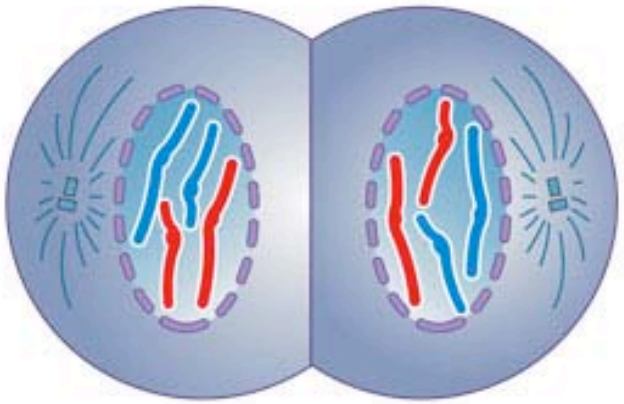
Telophase

- ♦ Chromosomes uncoil
- ♦ Nuclear membrane, nucleolus reform
- ♦ Spindle disappears



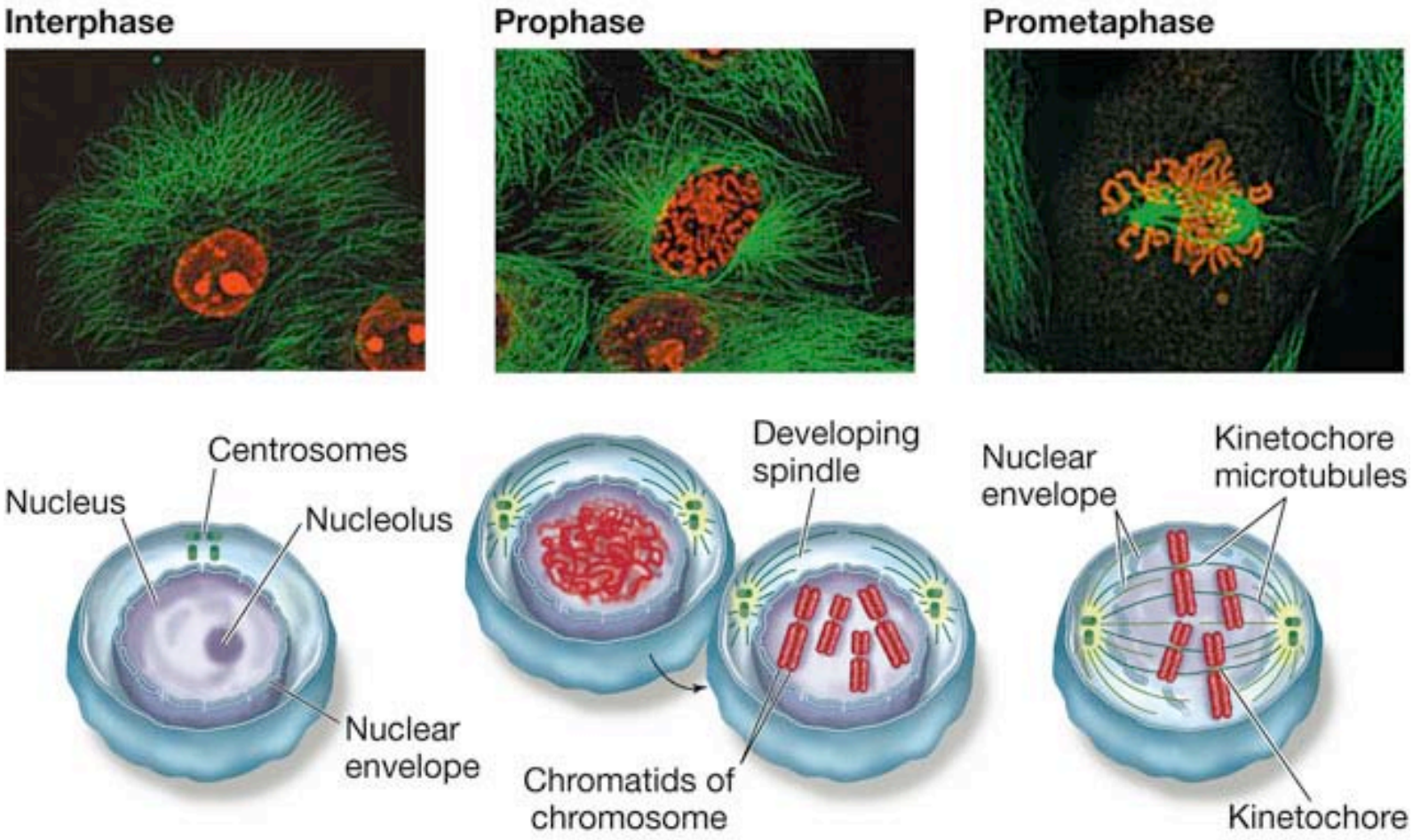




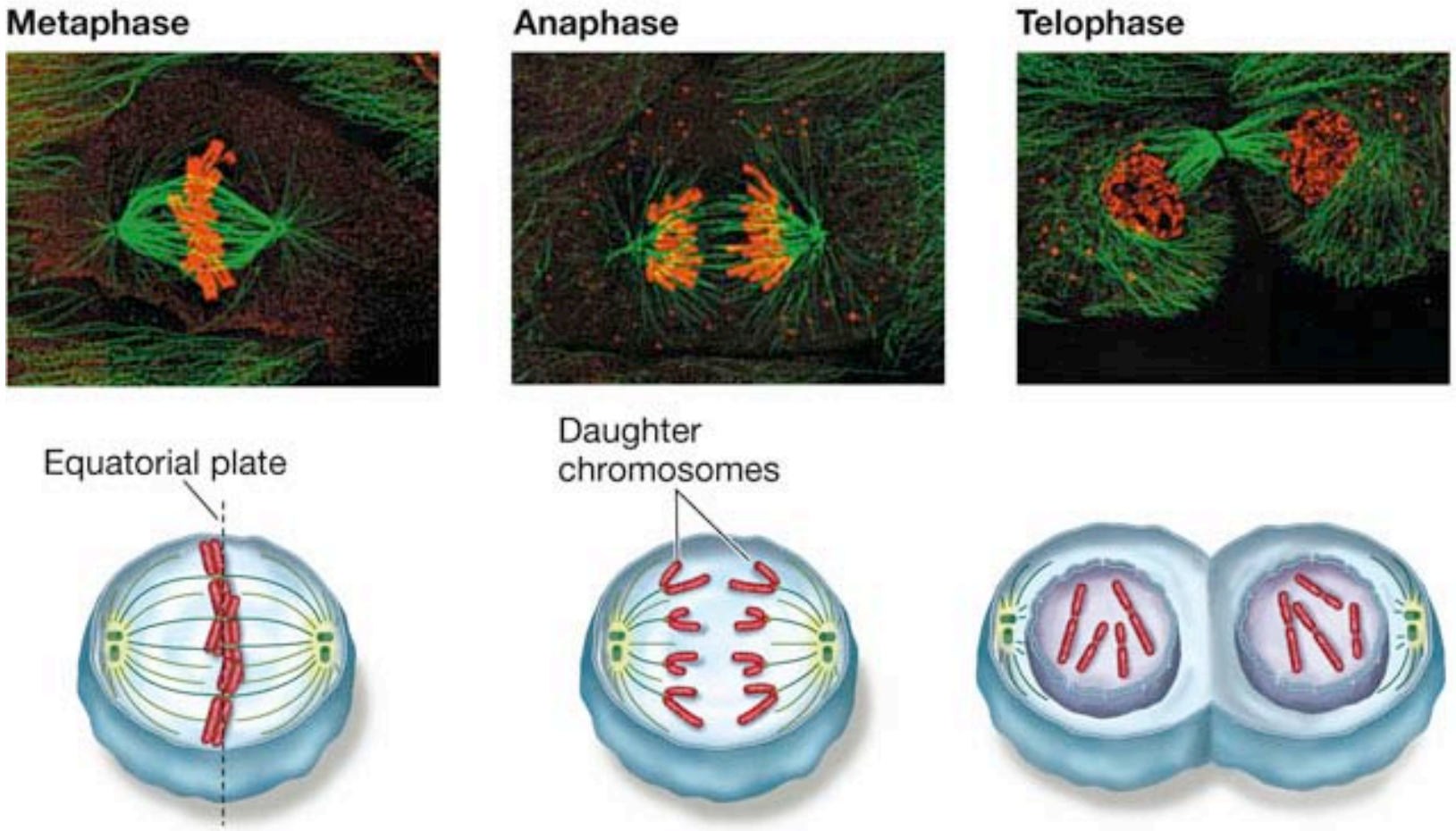


LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.8 Mitosis (Part 3)

Same process in pictures from the 8th edition:



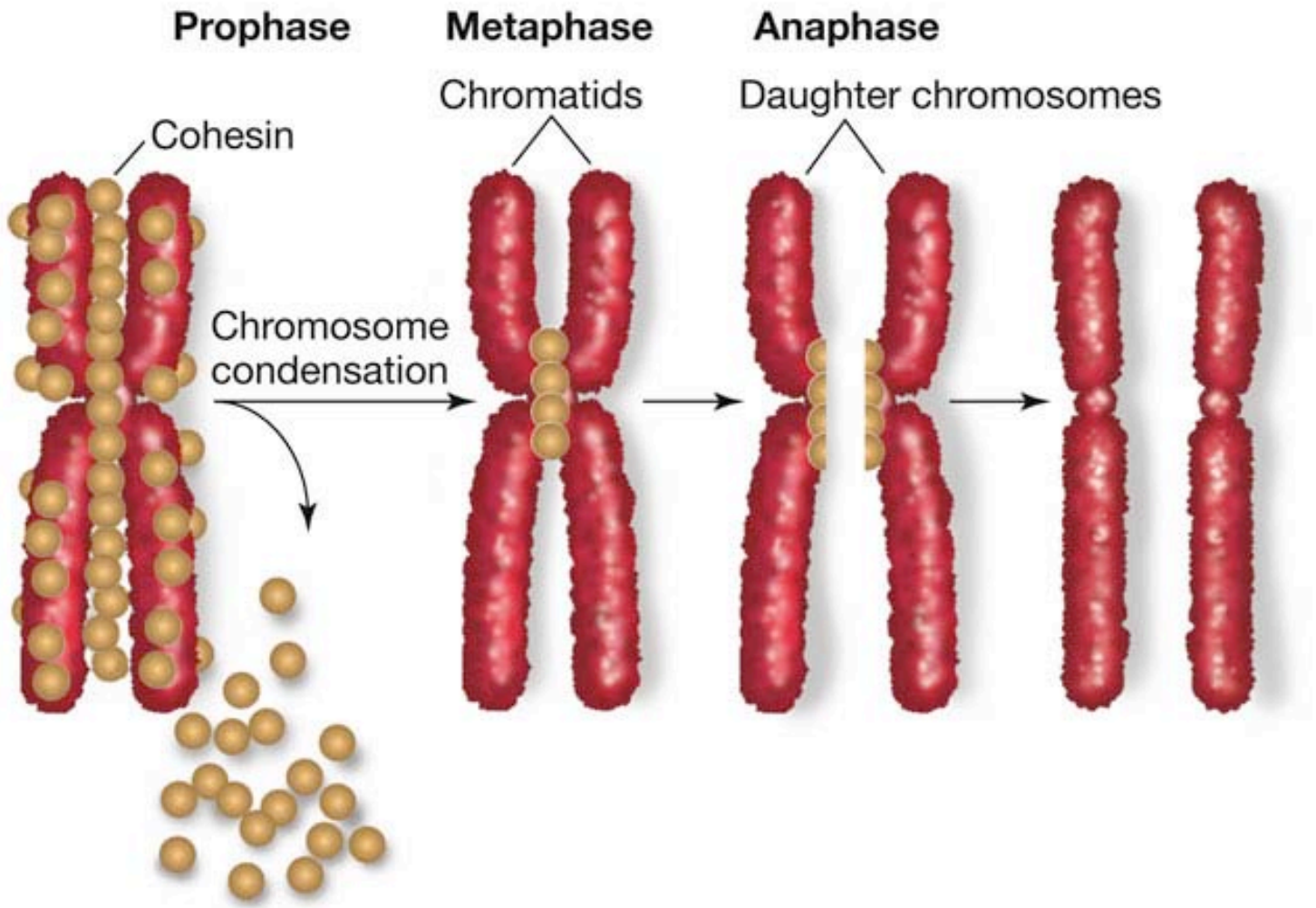
***LIFE 8e*, Figure 9.10 (Part 1)**



***LIFE 8e*, Figure 9.10 (Part 2)**

Proteins are involved in the separation of chromatids

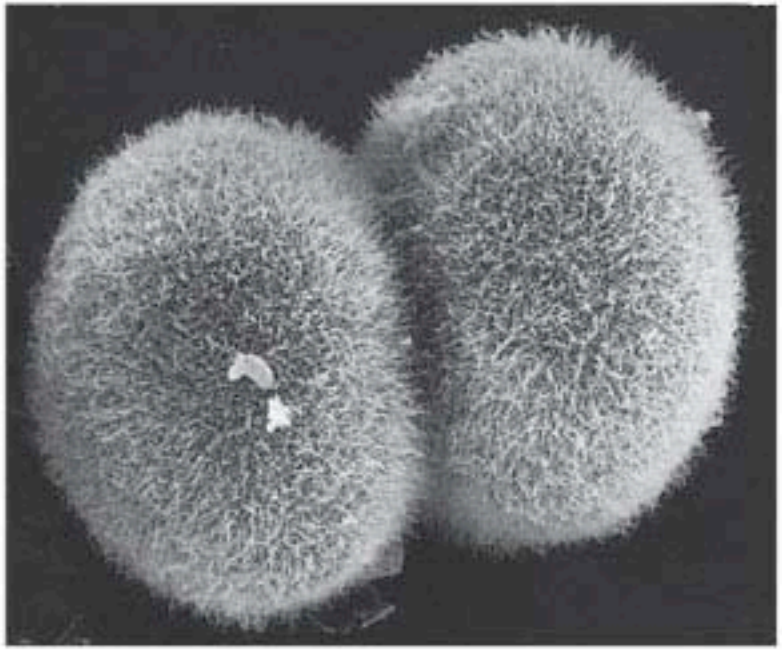
- Cohesin; Securin; Separase



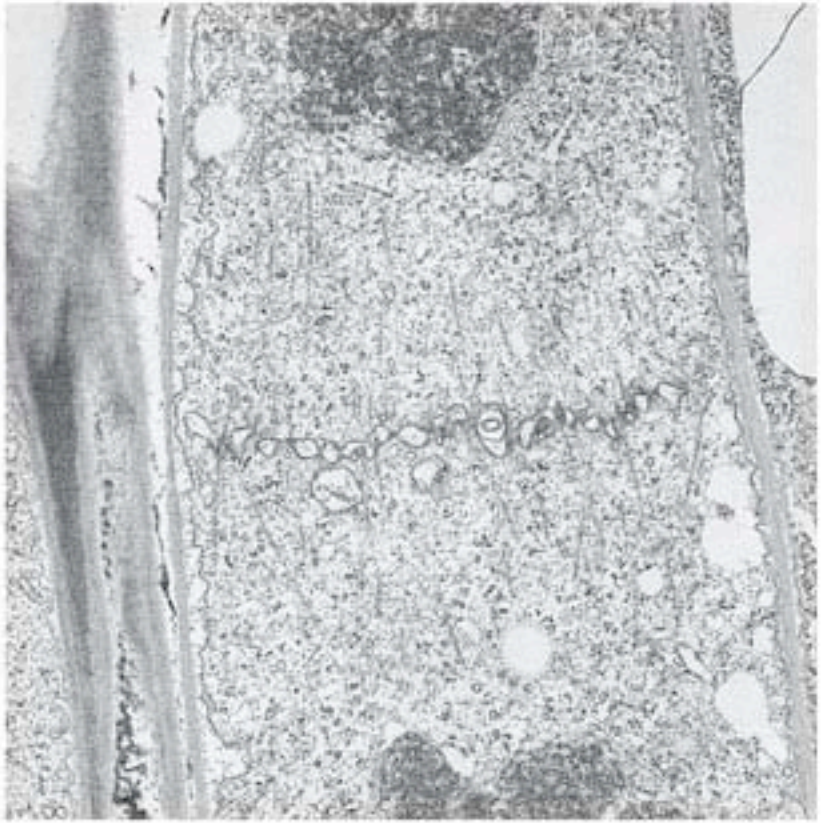
LIFE 8e, Figure 9.11

Cytokinesis: *The division of the cytoplasm*

(a)



(b)



Animal cells:

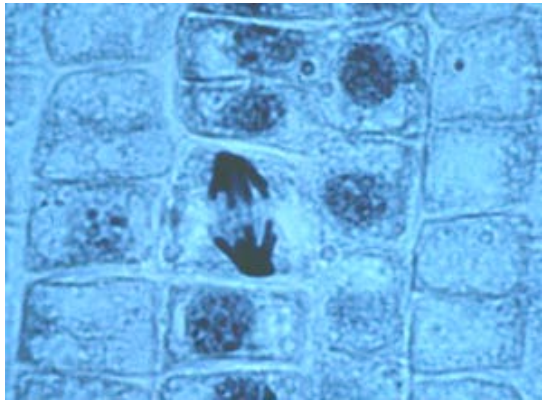
- Cleavage furrow
- Actin-myosin

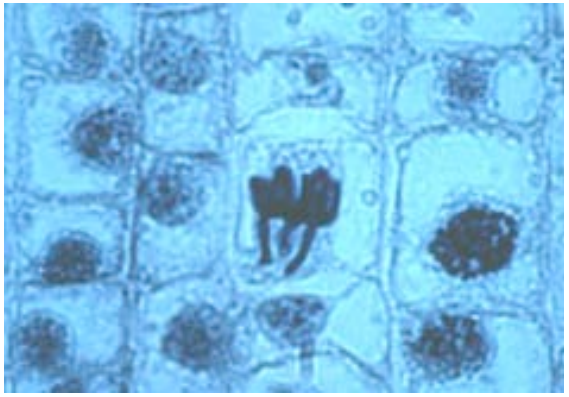
Plant cells:

- Cell plate
- Kinesin-microtubules

These cells, from a bean root tip, are dividing by mitosis. Can you identify the phases of mitosis?

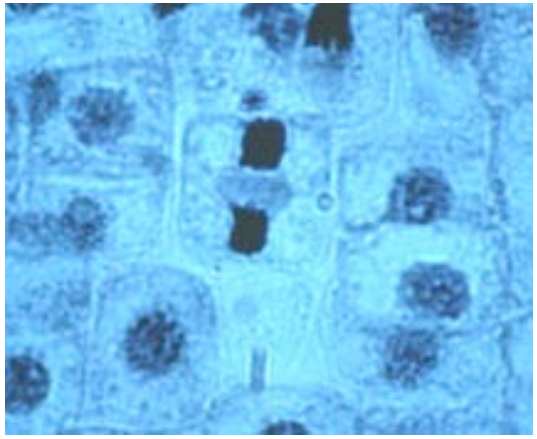
A

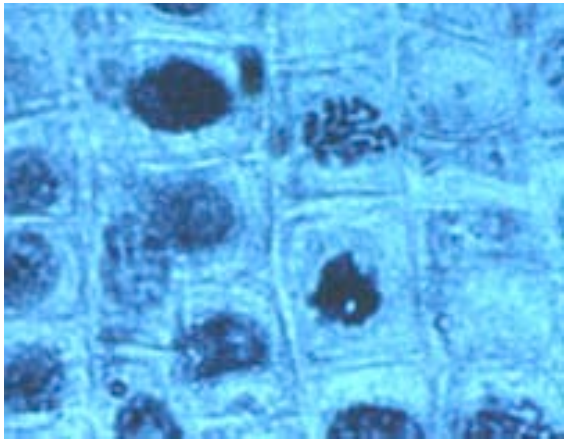




B

C

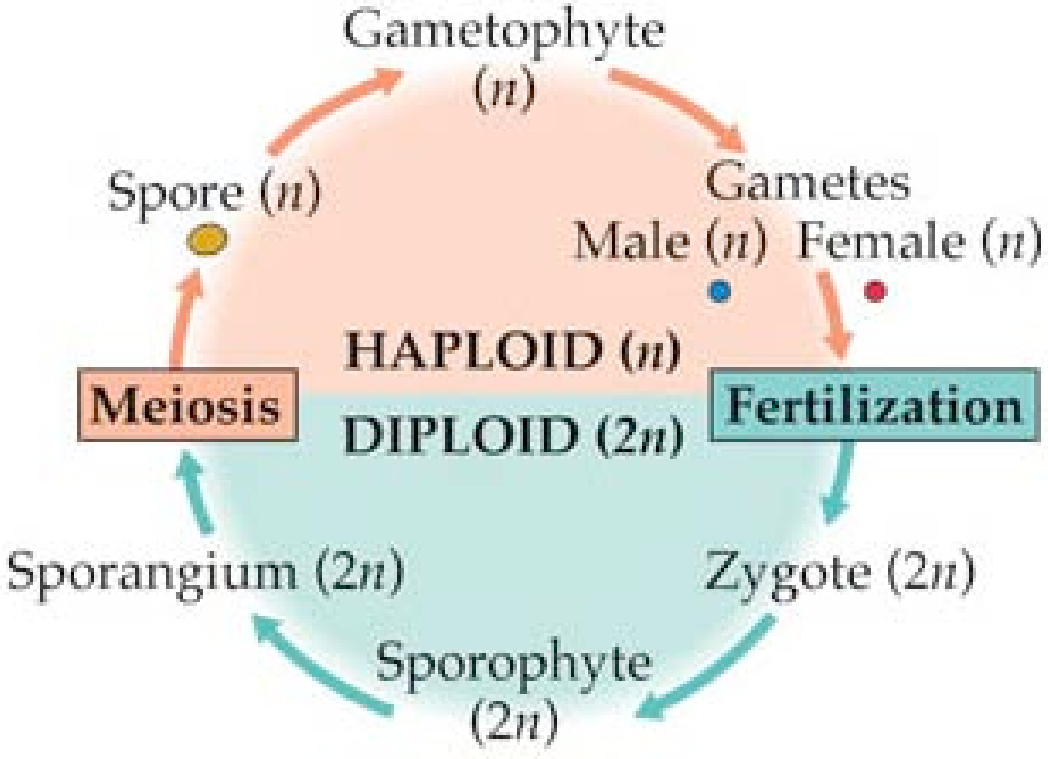




D

MEIOSIS

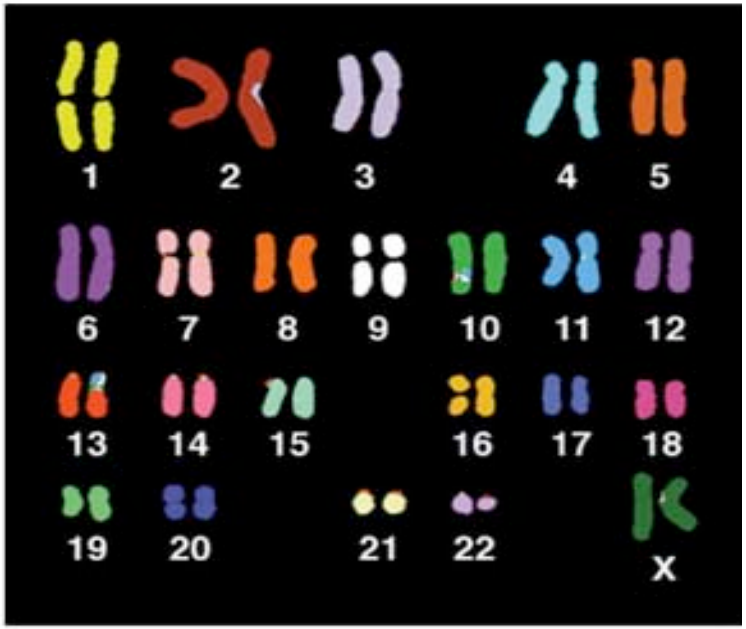
A sexual life cycle involves an alternation of diploid (2n) and haploid (1n) generations. Meiosis is the process of deriving haploid cells from diploid cells.



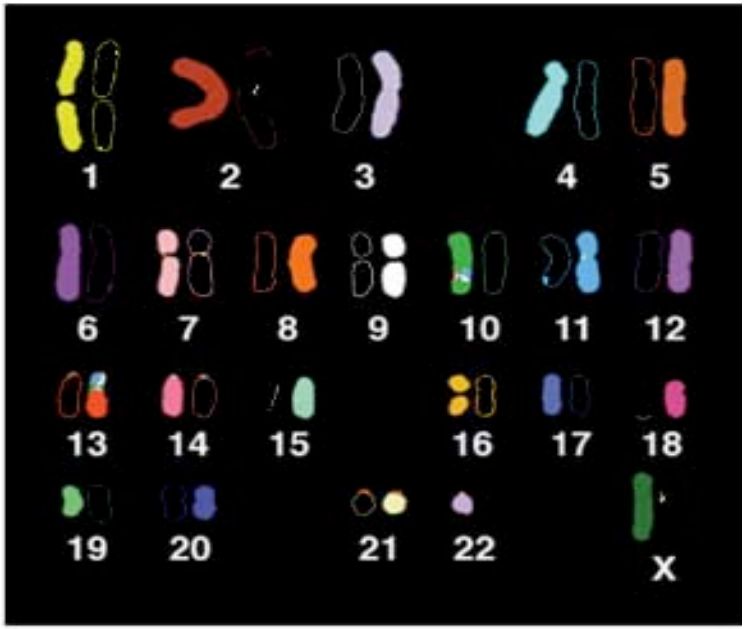
Alternation of generations

Meiosis is a process for reducing chromosome number from 2n to 1n

- Diploid nucleus
  - Two chromosomes of each type
  - One from each gamete in fertilization
  - "Homologous chromosomes"
- Meiosis separates homologous chromosomes
  - Result: one of each type of chromosome



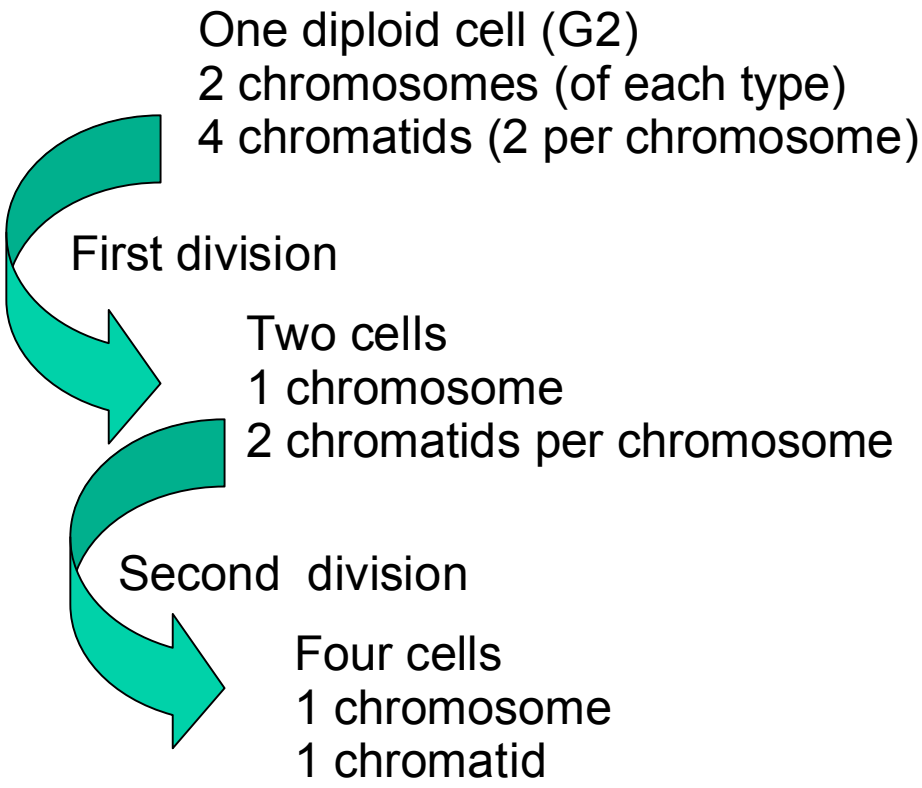
Diploid karyotype



Haploid karyotype

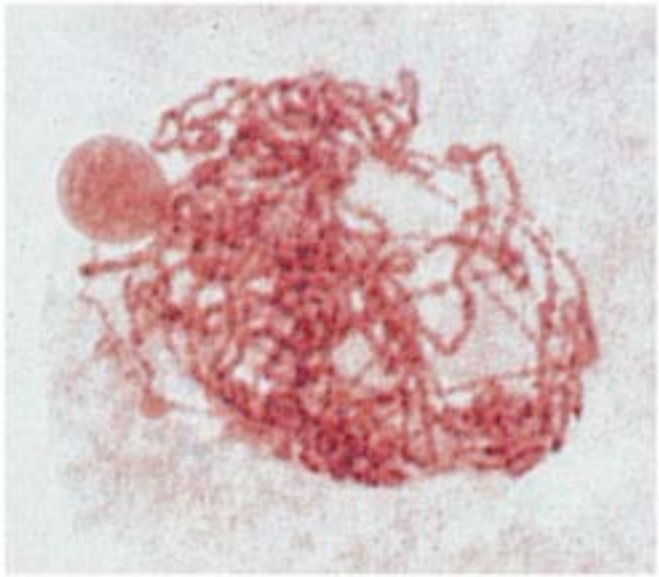
Meiosis strategy:

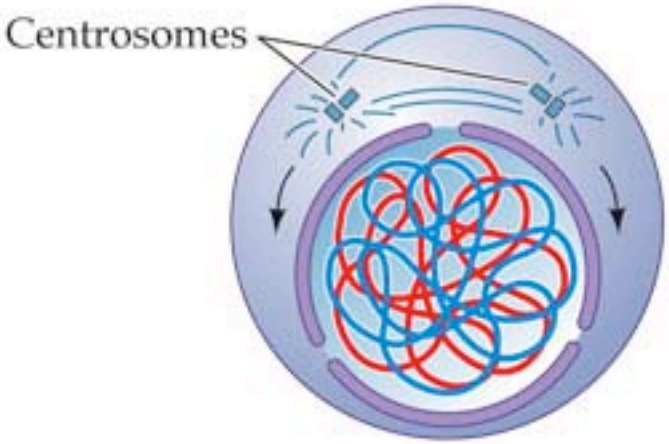
Start at G2 (2 chromatids/chromosome), like mitosis;
divide twice without intervening chromosome doubling



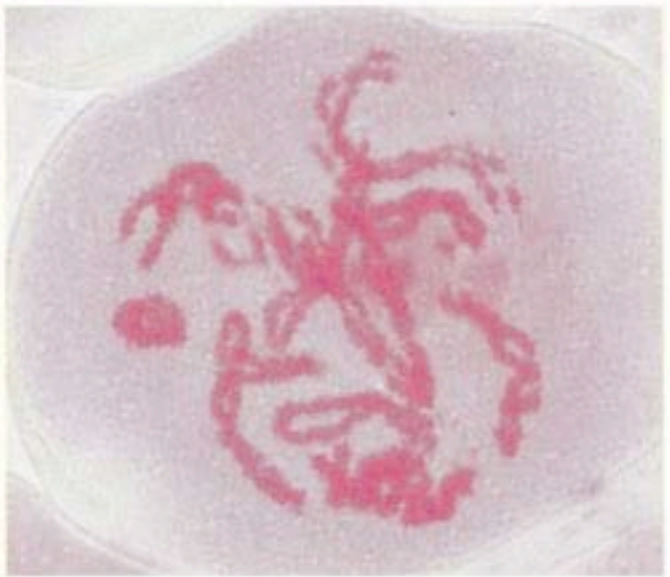
MEIOSIS I

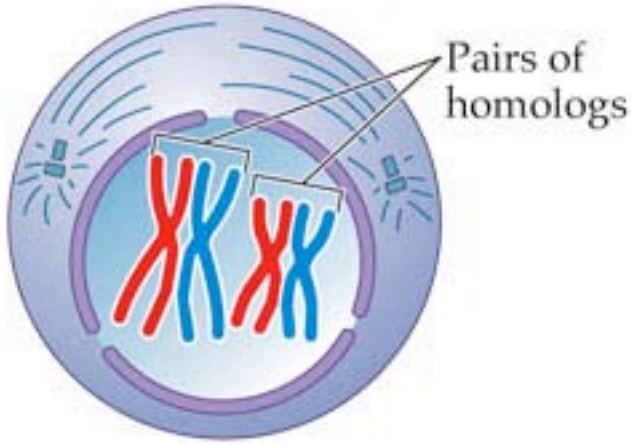
Early Prophase I





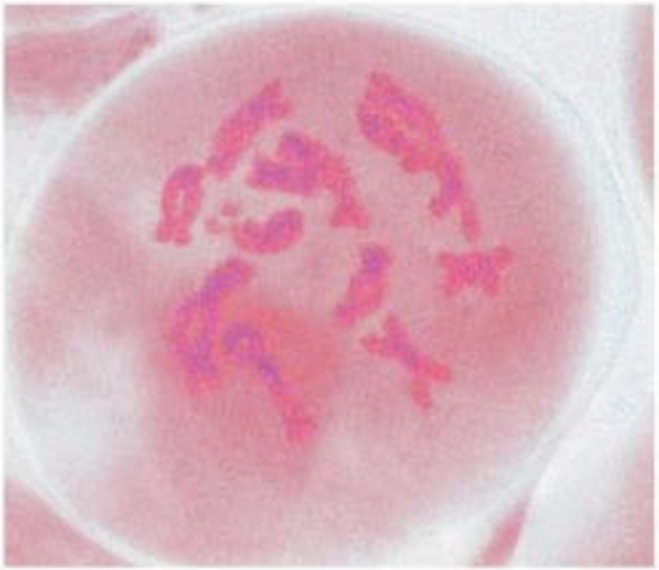
Mid-Prophase I



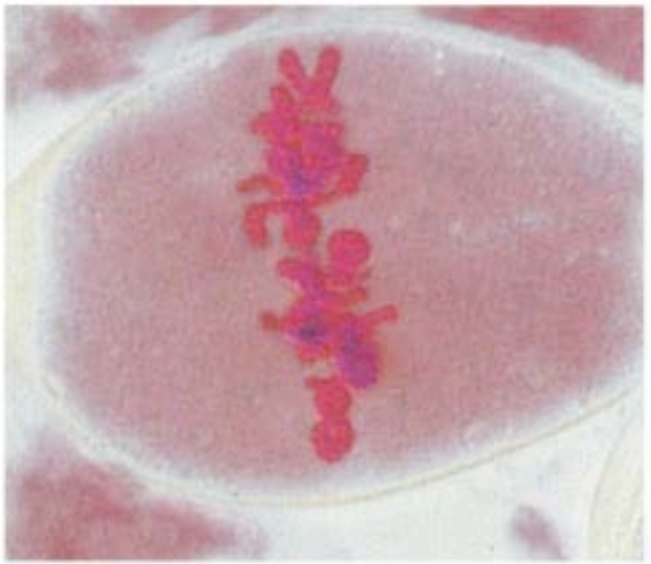


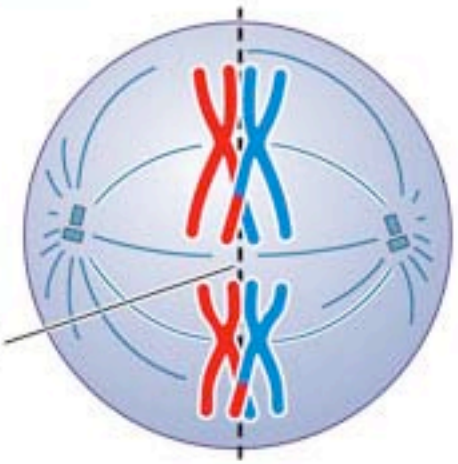
LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, **Figure 9.14 Meiosis (Part 1)**

Late Prophase I–Prometaphase



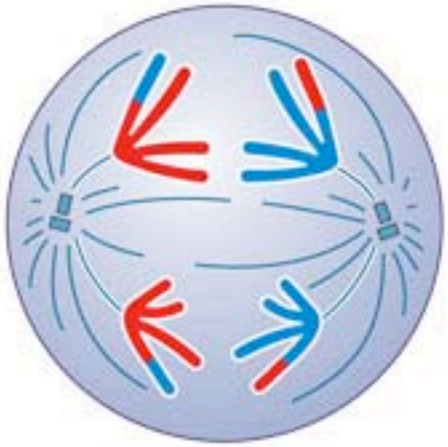
Metaphase I



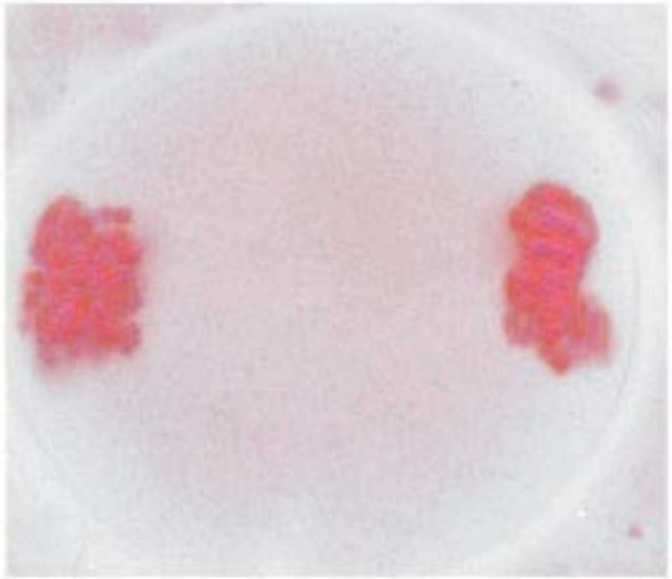


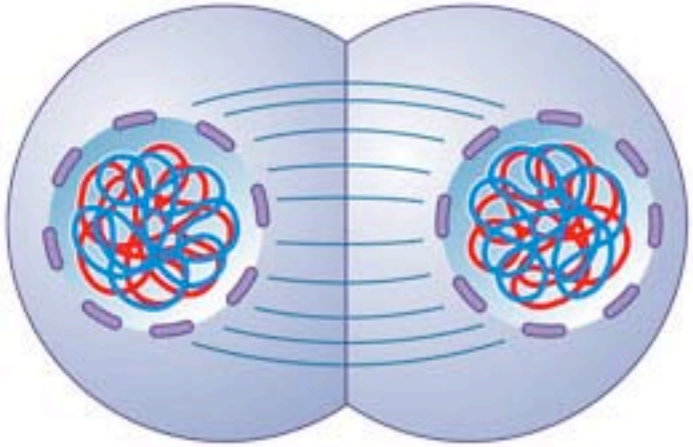
LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, **Figure 9.14 Meiosis (Part 2)**

Anaphase I



Telophase I

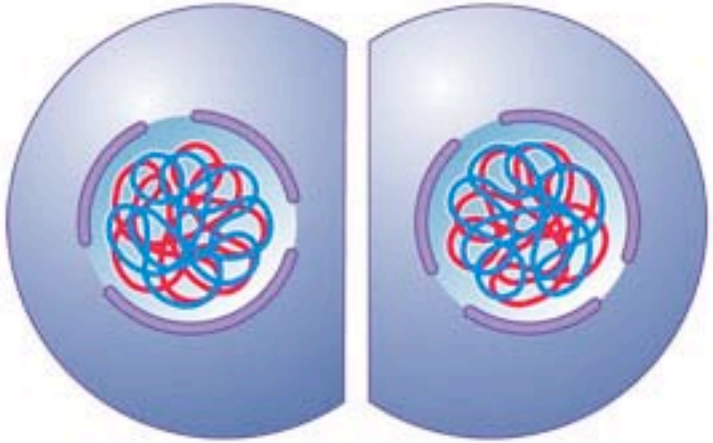




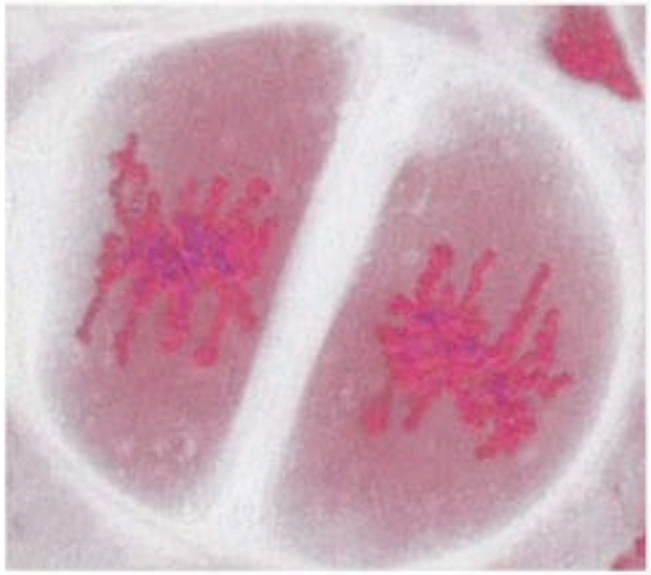
LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, **Figure 9.14 Meiosis (Part 3)**

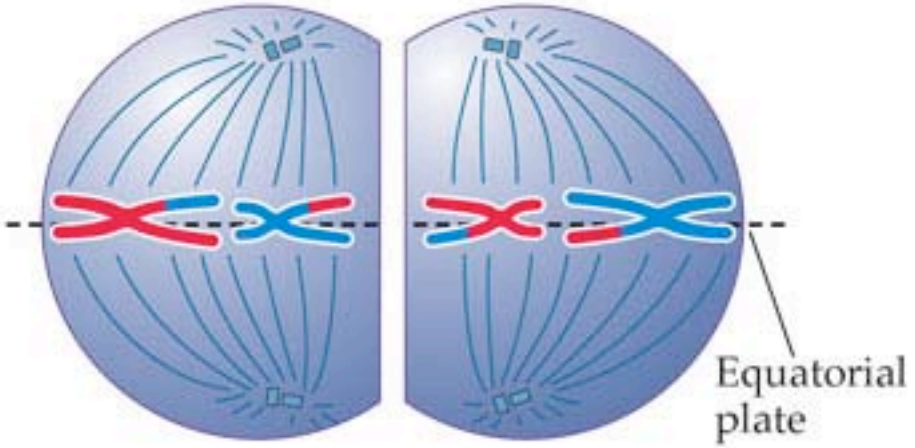
MEIOSIS II

Prophase II



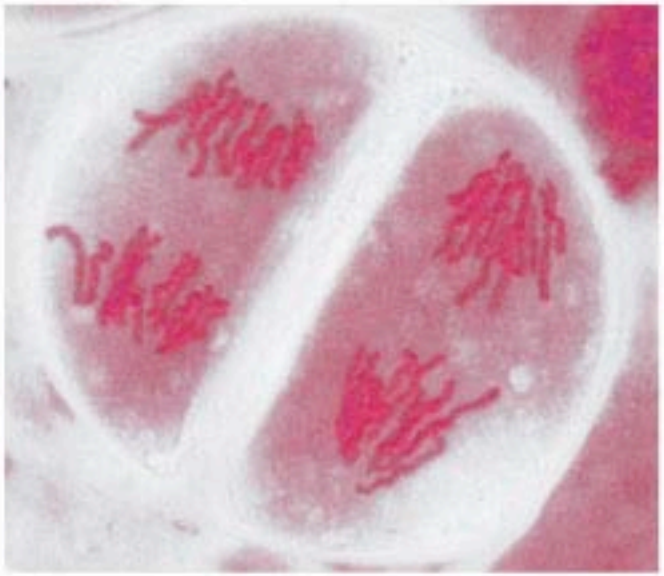
Metaphase II

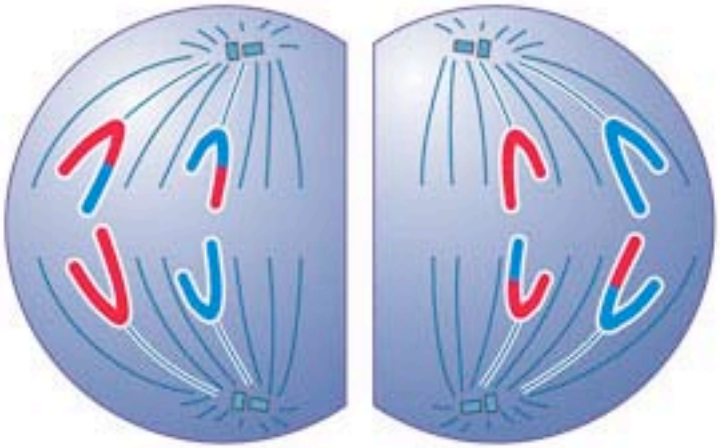




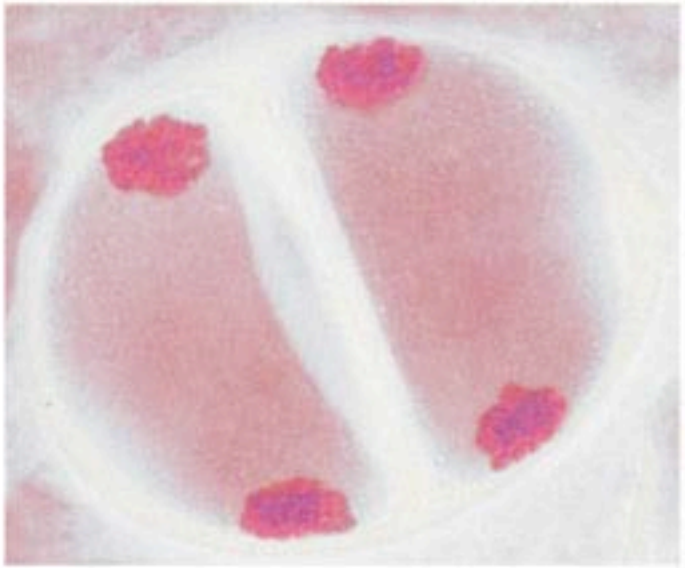
LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.14 Meiosis (Part 4)

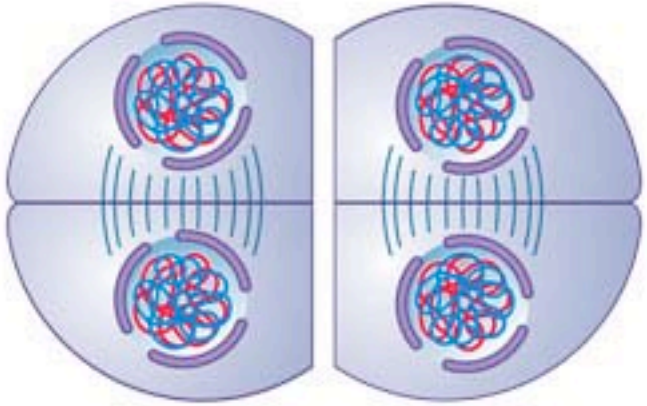
Anaphase II





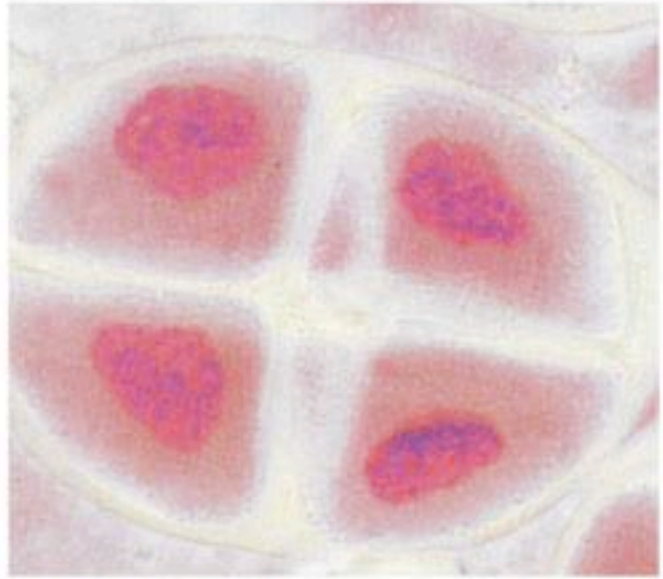
Telophase II

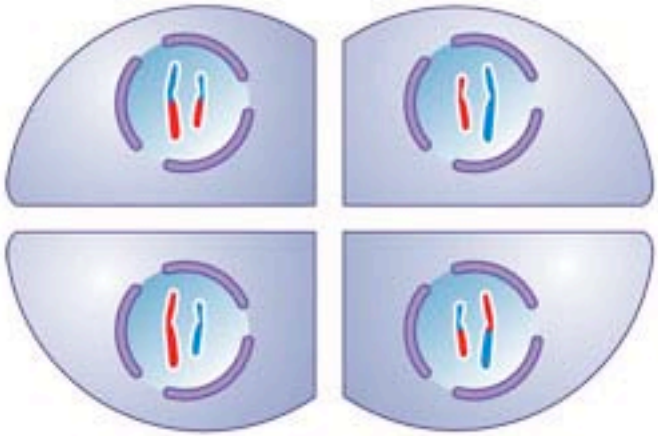




LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, **Figure 9.14 Meiosis (Part 5)**

Products





LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, **Figure 9.14 Meiosis (Part 6)**

These cells, from a lily anther, are forming pollen mother cells by meiosis. Can you identify the phases?