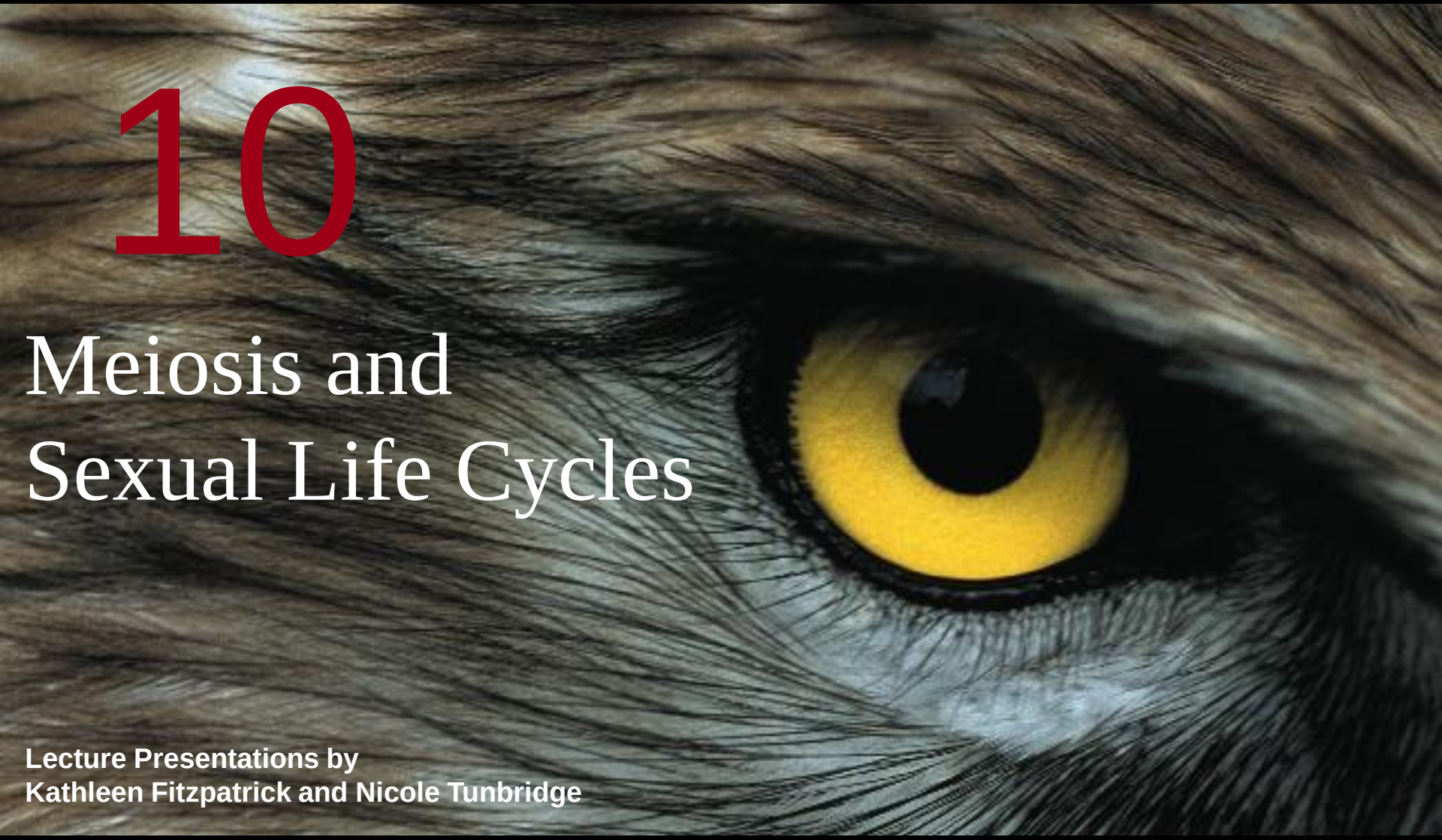
CAMPBELL **BIOLOGY IN FOCUS**

Urry • Cain • Wasserman • Minorsky • Jackson • Reece



10

Meiosis and Sexual Life Cycles

Lecture Presentations by
Kathleen Fitzpatrick and Nicole Tunbridge

Objective: You will be able to explain how meiosis results in the transmission of chromosomes from one generation to the next.

Do Now:

- Do you know any of the answers below?
  - Identify the ways that somatic cells are different from gametes (sex cells)
  - Differentiate between autosomes and sex chromosomes
  - Differentiate between diploid and haploid cells
  - Describe homologous chromosomes

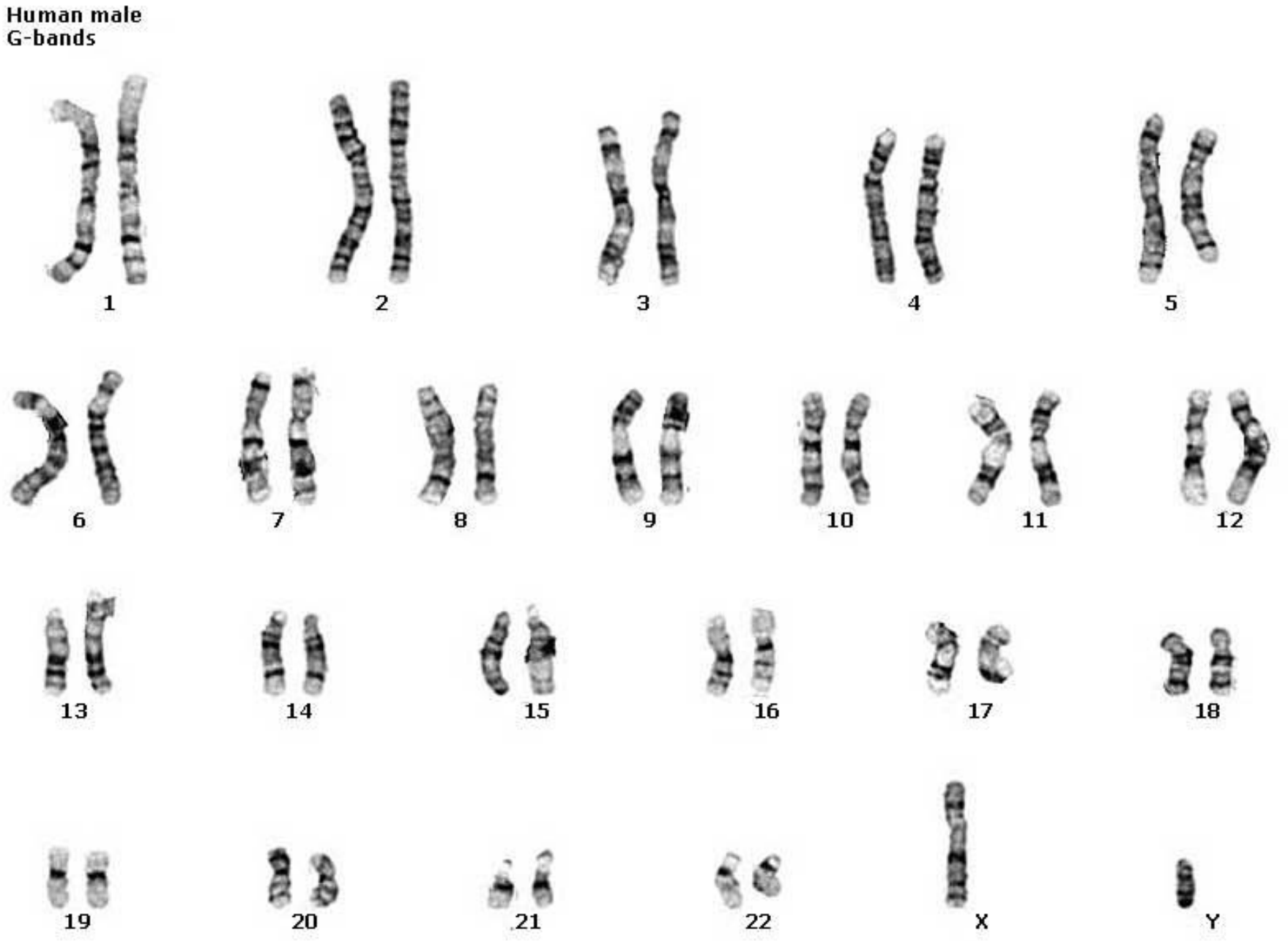
Homologous Chromosomes

Karyotype

Non-homologous

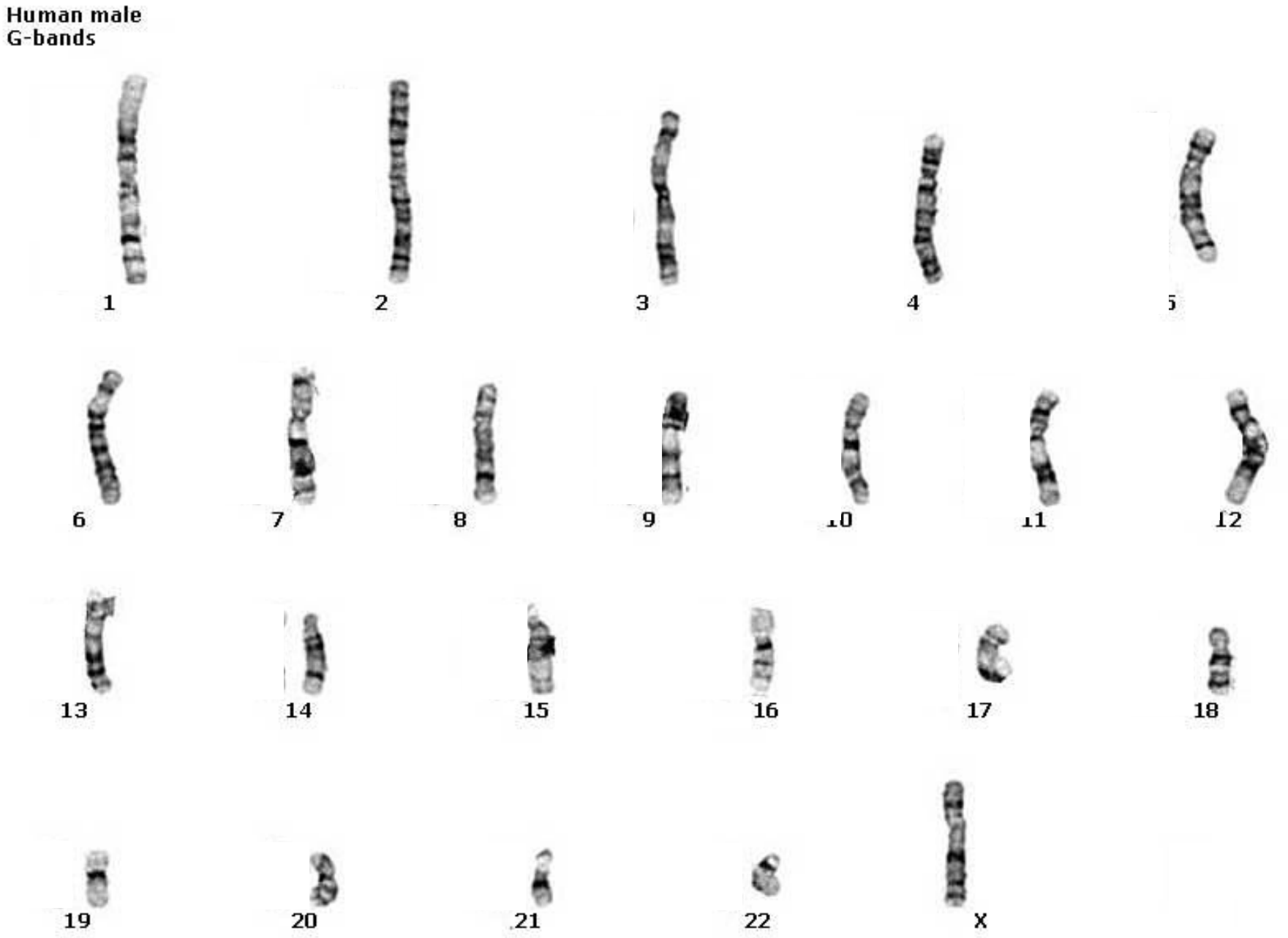
- A diploid cell (2n)
  - Has two sets of each of its chromosomes ***(homologous pairs)***
  - In a human has 46 chromosomes (2*n* = 46)

How do we know that we are looking at a diploid cell?



- A haploid cell (n) …also called monoploid
  - Has only one member from each homologous pair
  - In a human this is 23 chromosomes (*n* = 23)

How do we know that we are looking at a haploid cell?



Meiosis divides diploid cells into haploid cells

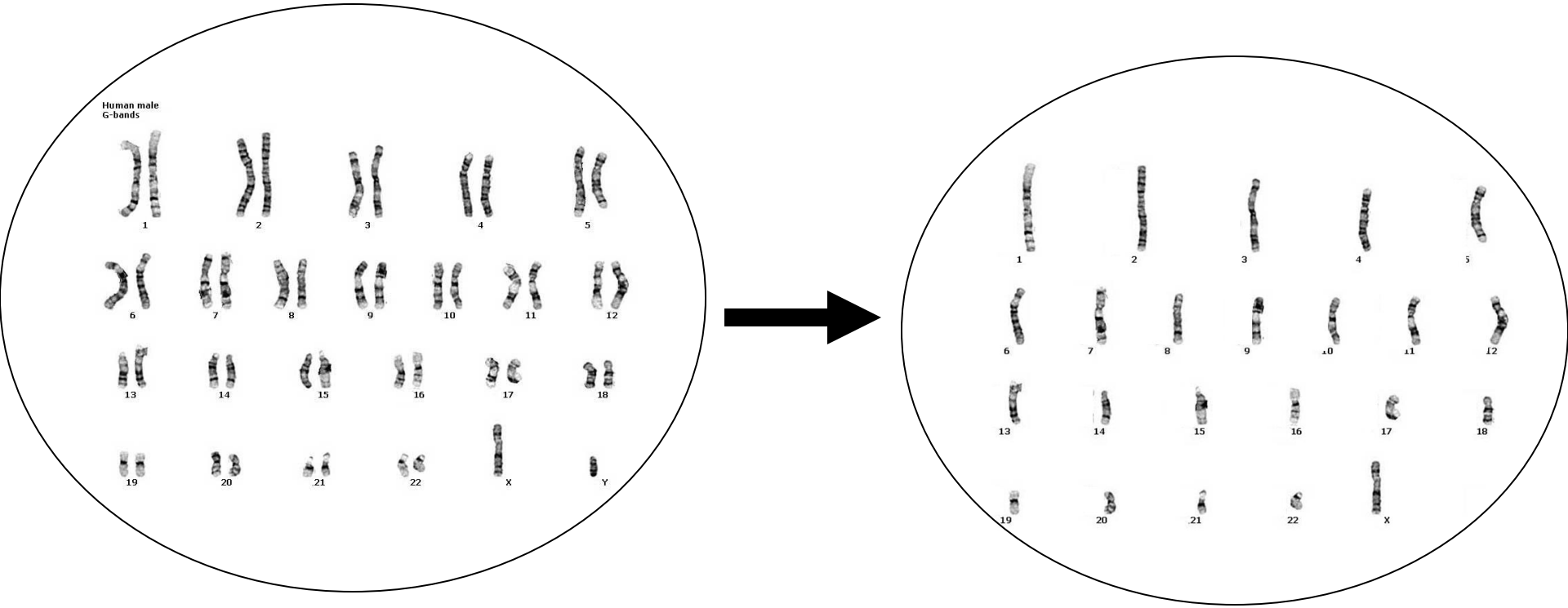
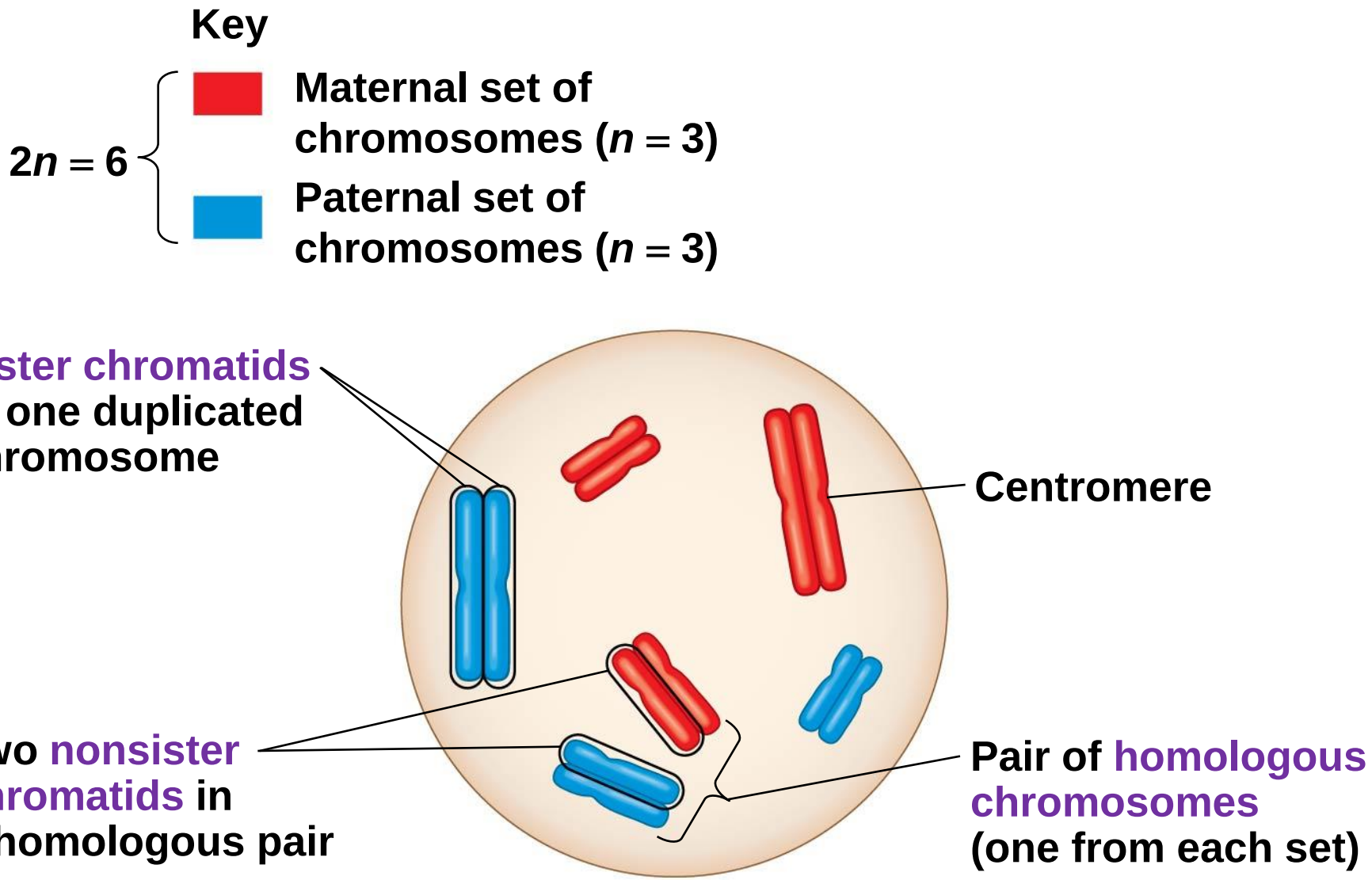


Figure 10.4

Review



Summary of Meiosis

- Creates four daughter cells, each with a haploid set of chromosomes

- Each daughter cell is genetically distinct from the others and from the parent cell

Objective: You will be able to describe similarities and/or differences between the phases and outcomes of mitosis and meiosis.

Figure 10.8a

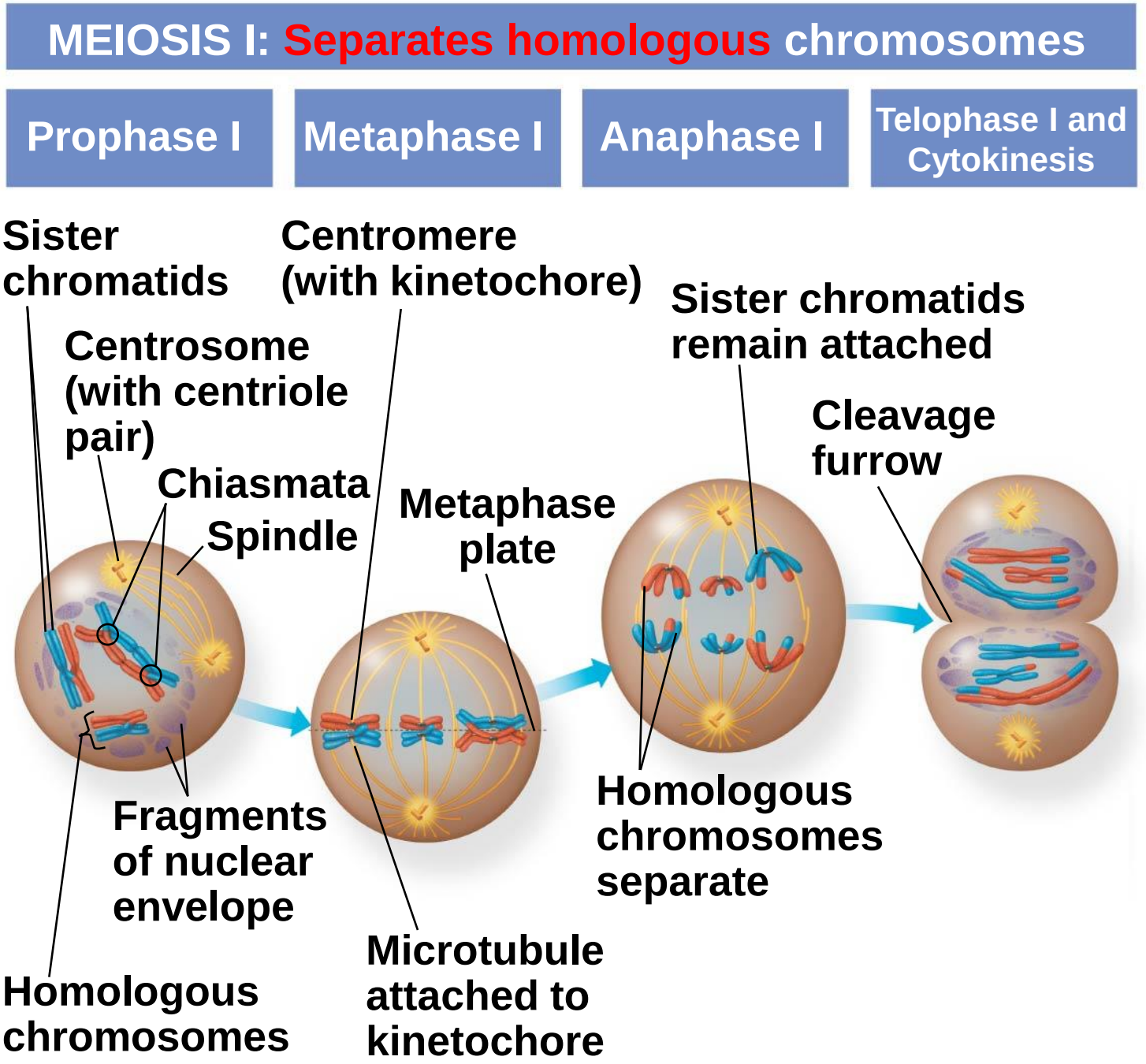
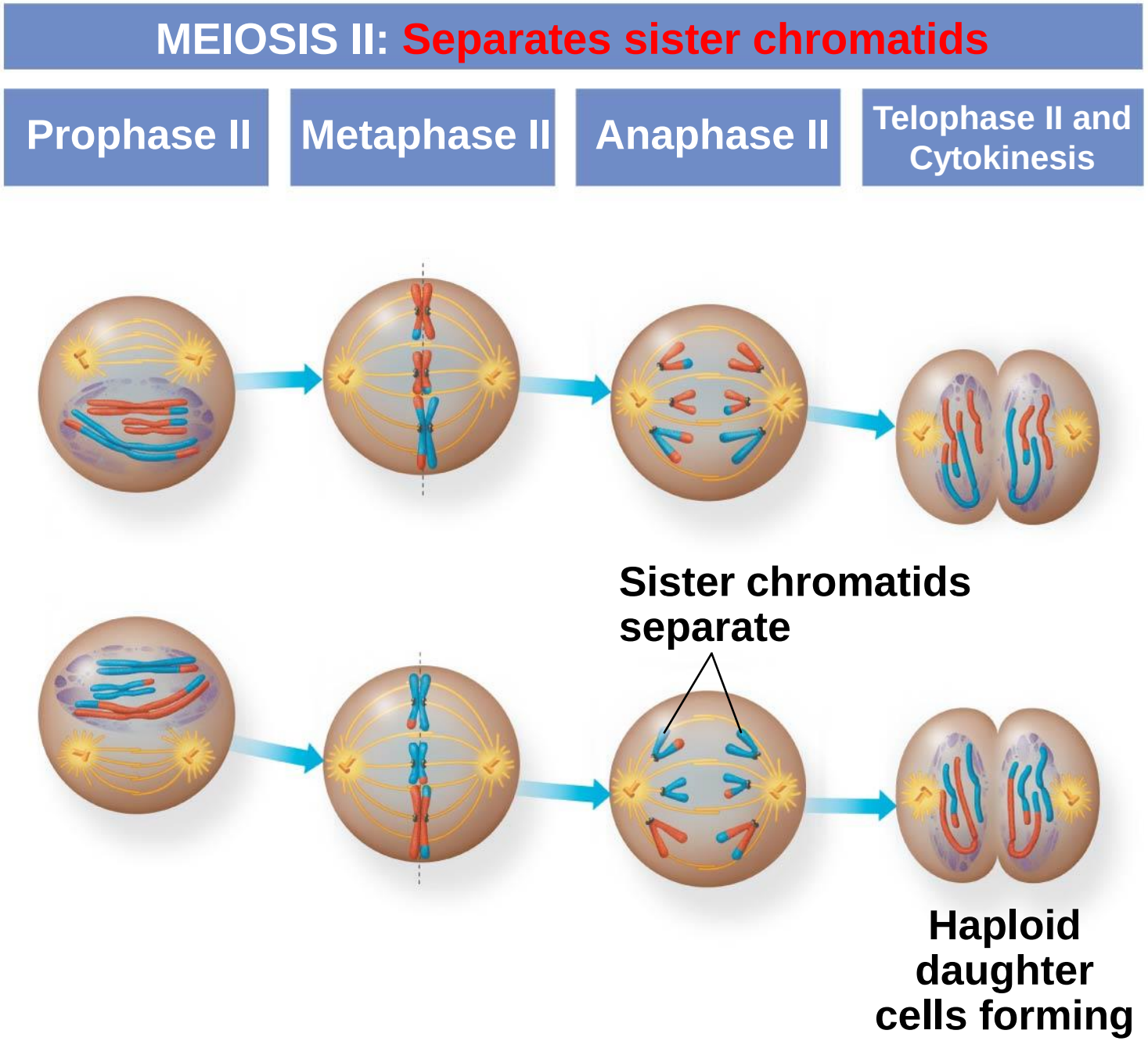


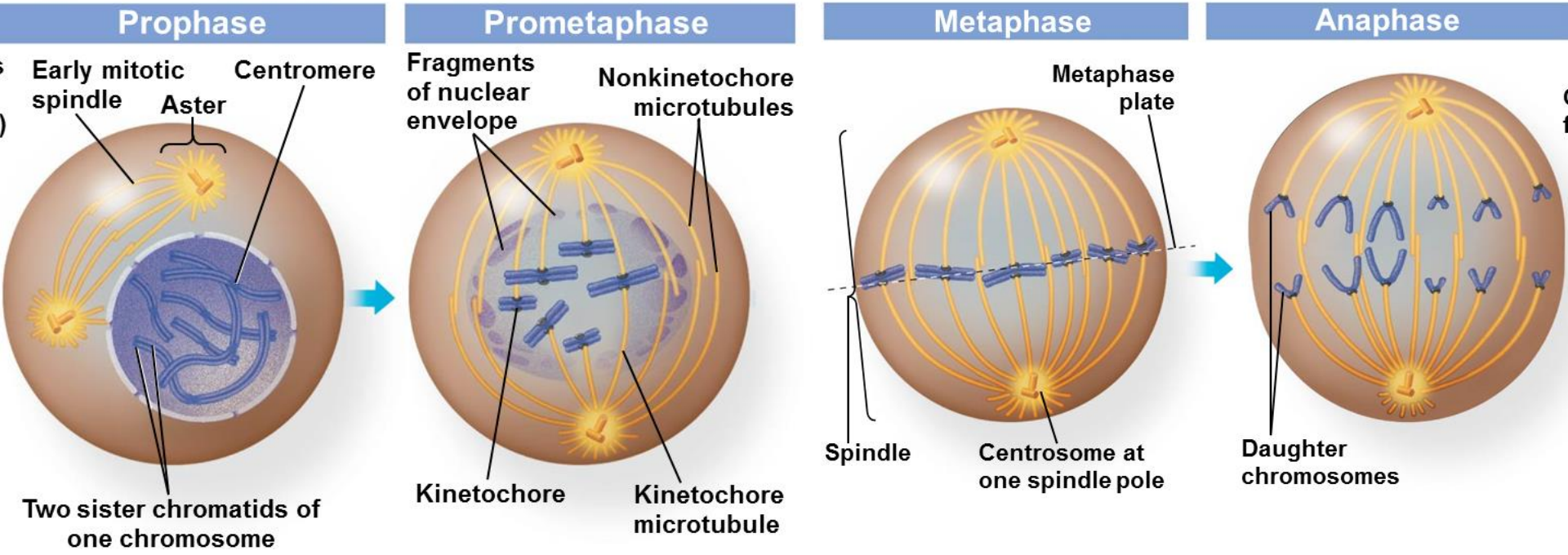
Figure 10.8b



Open your textbook to the p. 206-207 that shows meiosis

Compare the stages of <u>mitosis</u> (below) with the stages of <u>meiosis</u>

MITOSIS



Three events are unique to meiosis, and all three occur in meiosis I

- Synapsis and crossing over in prophase I: Homologous chromosomes physically connect and exchange genetic information
- At the metaphase plate, there are paired homologous chromosomes (tetrads), instead of individual doubled chromosomes
- At anaphase I, it is homologous chromosomes, instead of sister chromatids, that separate

Meiosis

- During meiosis, homologous chromosomes are paired, with one homologue originating from the maternal and the other from the paternal parent.

- Orientation of the chromosome pairs is random with respect to the cell poles.

- Separation of the homologous chromosomes ensures that each gamete receives a haploid (1n) set of chromosomes composed of both maternal and paternal chromosomes.

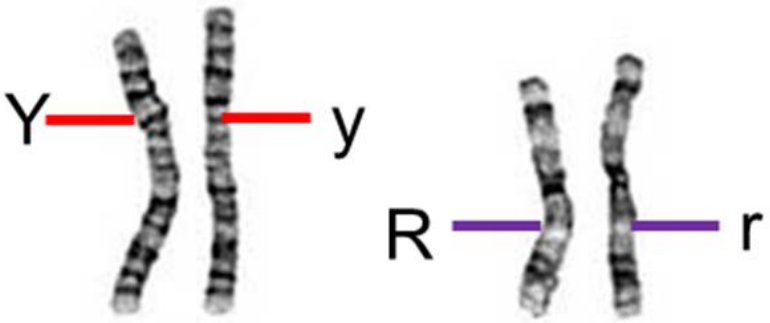
Look at p. 206-207…find where each of the statements above are occurring. (old book pages 198-199)

Objective: **You will be able to explain how meiosis contributes to genetic variation.**

- **Do Now:**

Individual Activity

- Take out your meiosis drawings
  - Add the following genes and alleles to the G_1 phase:
  - Add these throughout the phases of meiosis



- Explain independent assortment using your diagram
- Add in crossing over to your diagrams
- Random fertilization of these gametes will greatly add to genetic diversity in the next generation

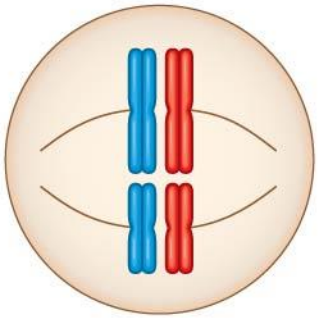
Meiosis and Genetic Variation

- Three mechanisms that contribute to genetic variation due to meiosis:
  - Independent assortment of chromosomes
  - Crossing over
  - Random fertilization

- Using the cells, genes and chromosomes you just drew, describe evidence to support how each of the three mechanisms contribute to genetic variation.

Independent Assortment

Possibility 1



Two equally probable arrangements of chromosomes at metaphase I

Possibility 2

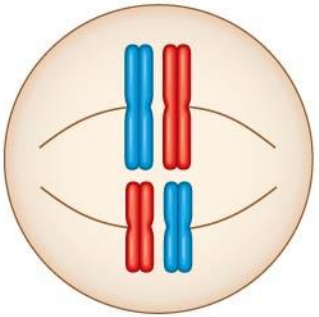


Figure 10.10-2

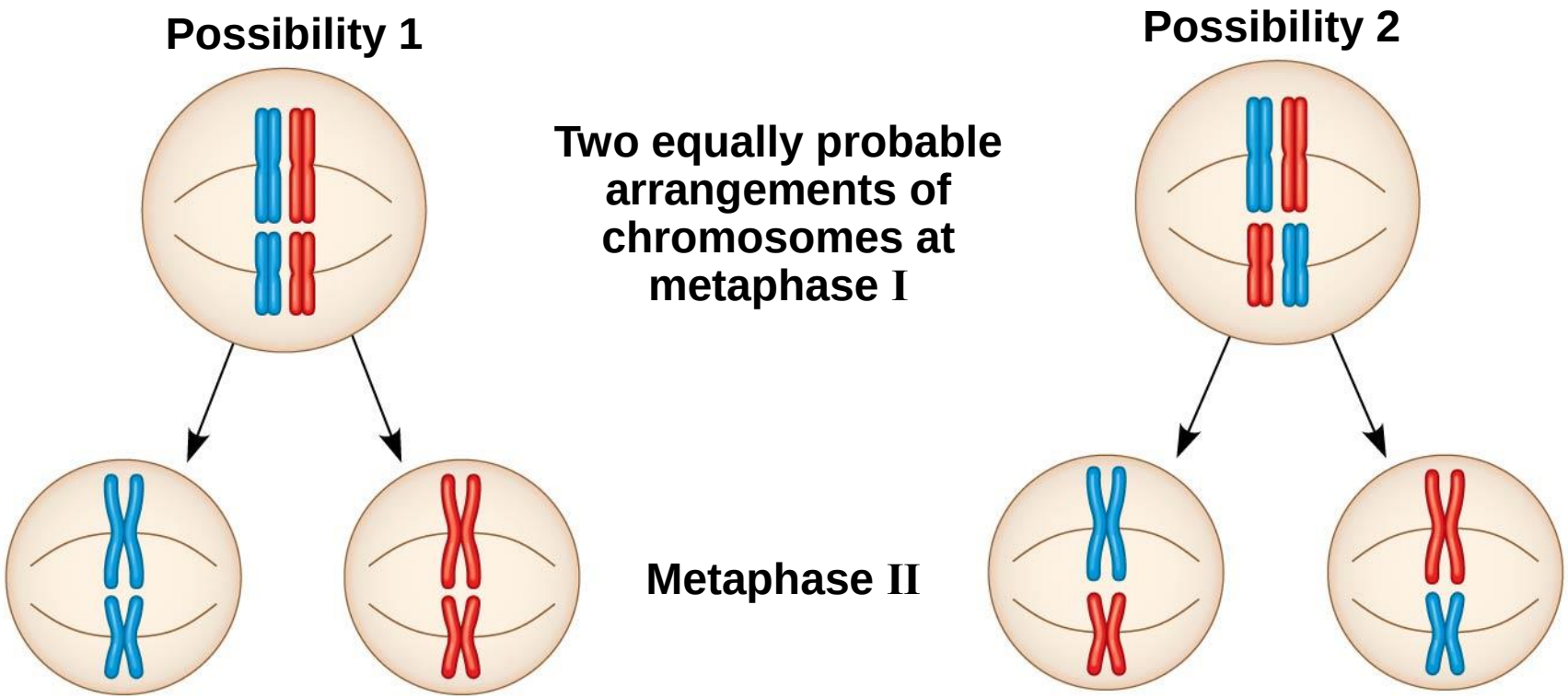
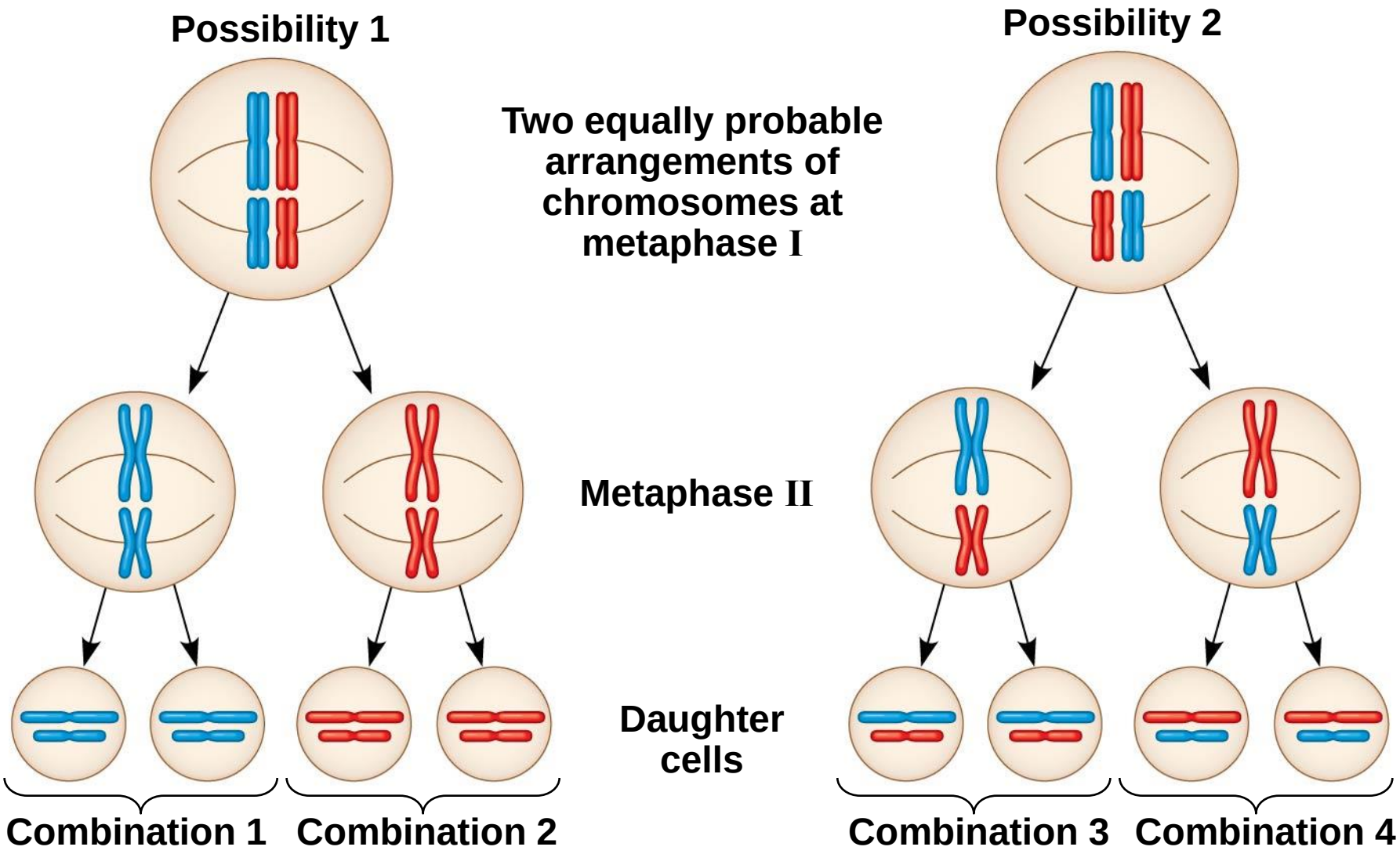


Figure 10.10-3



Crossing Over

- Crossing over results form homologous chromosomes exchanging segments of DNA

- Crossing over begins in prophase I

Crossing Over

Prophase I of meiosis

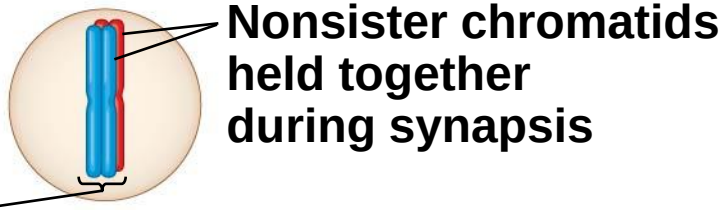
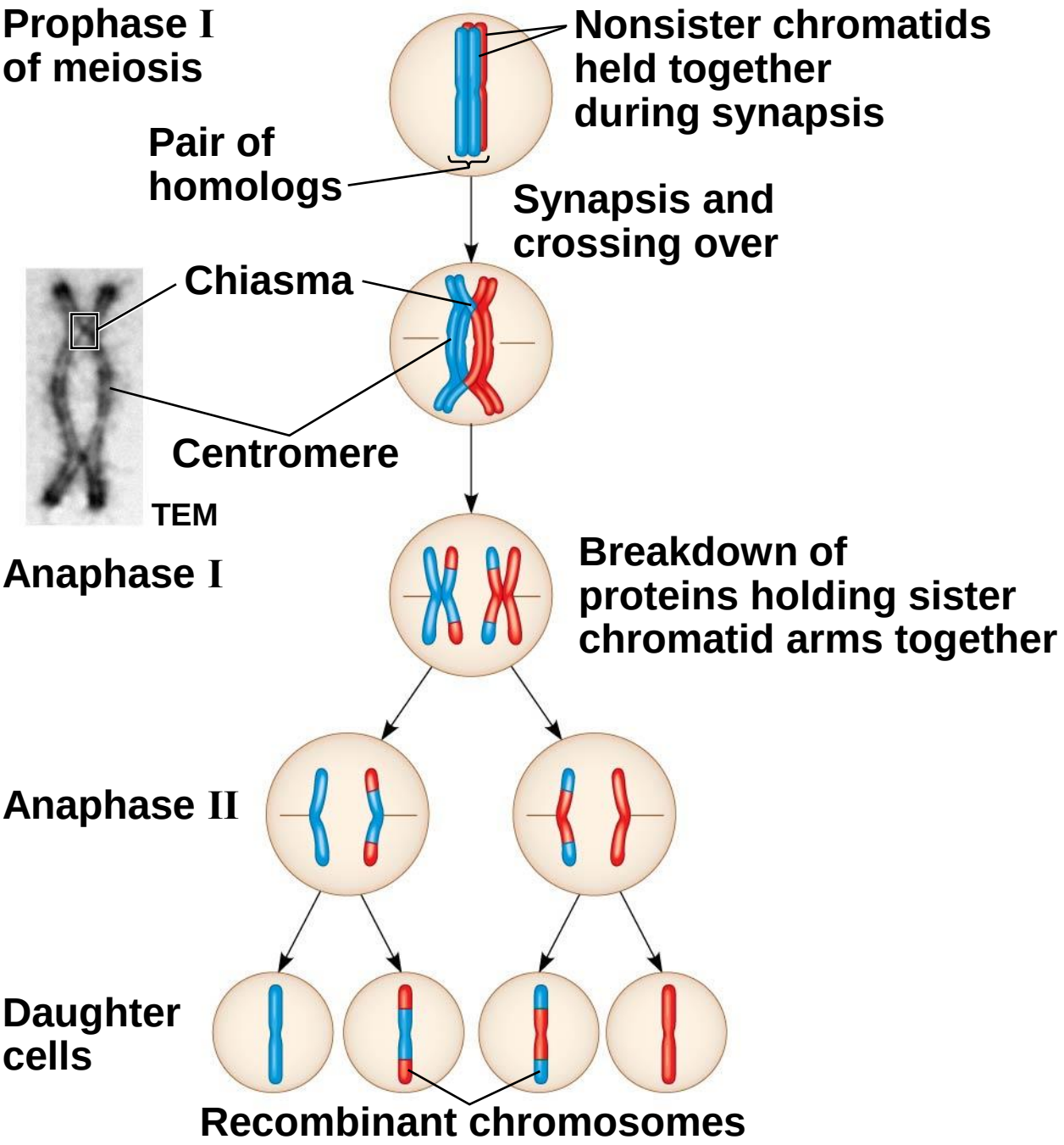


Figure 10.11-5



Random Fertilization

- Each person can make 8.4 million different sex cells from independent assortment

- That means parents can produce a zygote with about 70 trillion diploid combinations
    - That's without accounting for crossing over