

Meiosis and Mitosis

The Chromosome Dance

The purpose of this exercise is to illustrate what happens to one pair of homologous chromosomes as they go through mitosis, then meiosis. You will represent chromosomes with your bodies, and act out mitosis and meiosis.

Review of Meiosis and Mitosis

Interphase The genetic information contained by each chromosome is duplicated. As a result of this duplication, two genetically identical sister chromatids are created. These sister chromatids are connected to each other by a centromere.

Mitosis

Prophase Chromosomes shorten, thicken, and become visible by light microscopy.

Centrioles move apart and mitotic spindle begins to form.

Centrioles migrate to opposite sides of nucleus and nuclear envelope begins to disappear.

Metaphase Nuclear envelope disappears completely.

Replicated chromosomes held together at the centromere are aligned on equator of the spindle (metaphase plate).

Anaphase Centromeres split and daughter chromosomes migrate to opposite poles. Cell division (cytokinesis) begins.

Telophase Nuclear envelopes reform, chromosomes become extended and less visible, and cell division continues.

Each daughter cell is genetically identical to the parent cell. Final cells are diploid (2 cells $2n = 23$ in humans)

Interphase The genetic information contained by each chromosome is duplicated. As a result of this duplication, two genetically identical sister chromatids are created. These sister chromatids are connected to each other by a centromere.

Meiosis I

Prophase I Homologous chromosomes arrange into pairs and cross-over.

Spindle apparatus begins to form, and nuclear envelope disappears.

Metaphase I Chromosome pairs (bivalents) align across equatorial plane.

Different from metaphase of mitosis because independent alignment of homologous does not occur.

Random assortment occurs here.

Anaphase I Homologous chromosome pairs separate and migrate toward opposite poles.

Telophase I Chromosomes complete migration, and new nuclear envelopes form, followed by cell division.

Meiosis II

Prophase II Chromosomes condense.

Metaphase II Spindle forms and centromeres align on the equatorial plane.

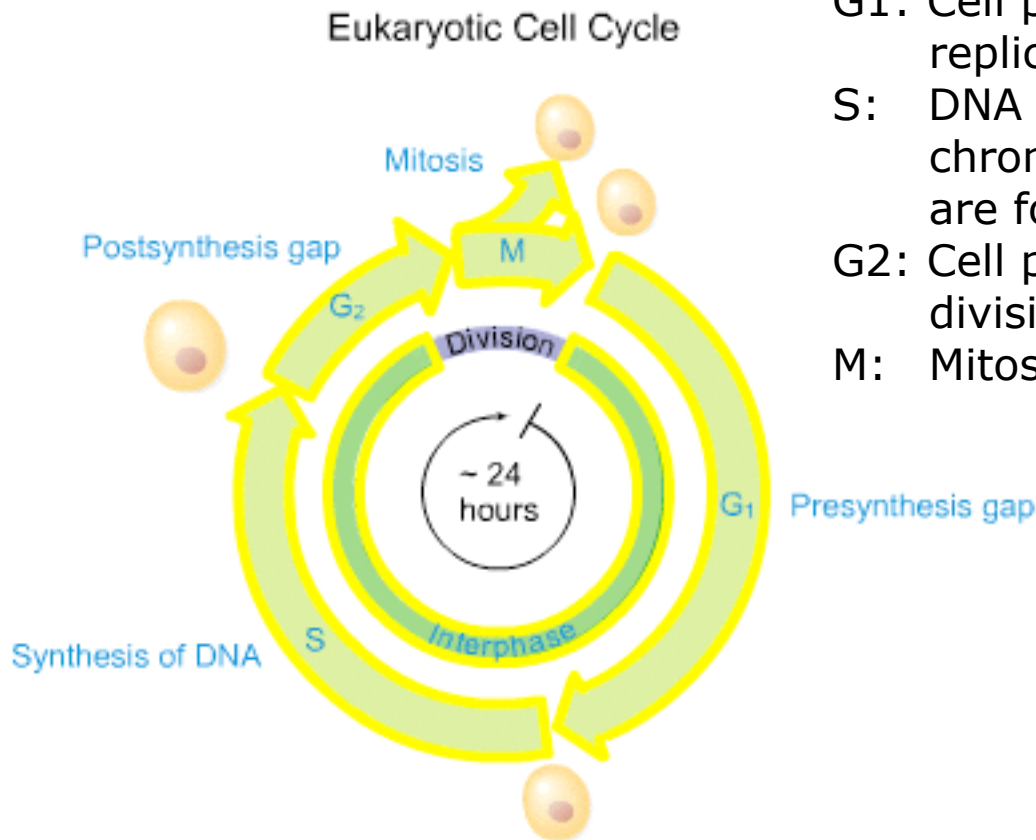
Anaphase II Centromeres split and chromatids are pulled to opposite poles of the spindle (one sister chromatid from each pair goes to each pole).

Telophase II Chromatids complete migration, nuclear envelope forms, and cells divide, resulting in 4 haploid cells.

Each daughter cell has one chromosome from each homologous pair, but these are not exact copies due to crossing-over. Final cells are haploid ($1n = 23$).

Eukaryotic cell cycle:

cell growth, mitosis, and interphase



- G₁: Cell prepares for chromosome replication.
- S: DNA replicates and new chromosomes (sister chromatids) are formed.
- G₂: Cell prepares for mitosis and cell division.
- M: Mitosis

Fig. 1.22 Comparison of mitosis and meiosis in a diploid cell

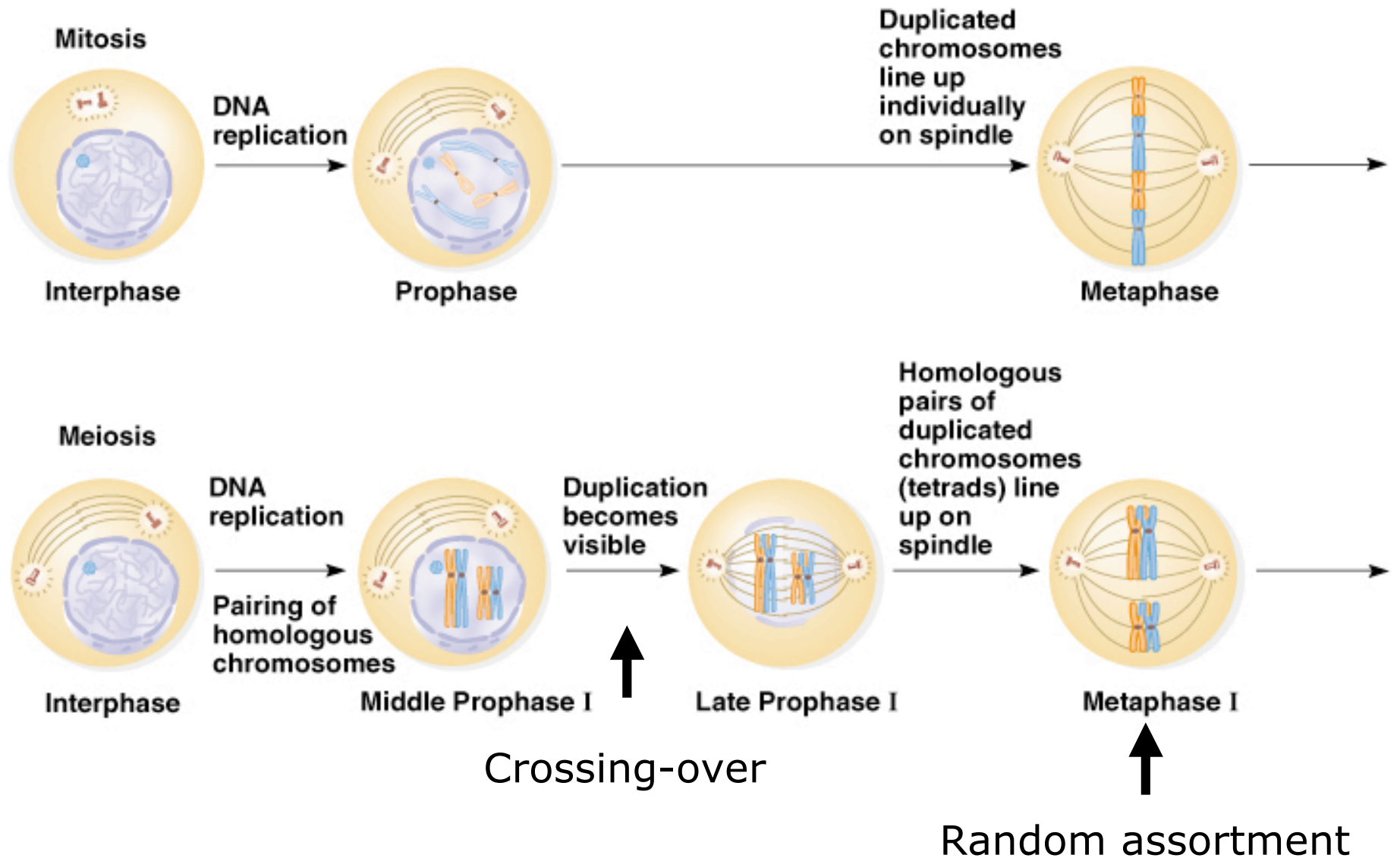


Fig. 1.22 Comparison of mitosis and meiosis in a diploid cell
(continued)

