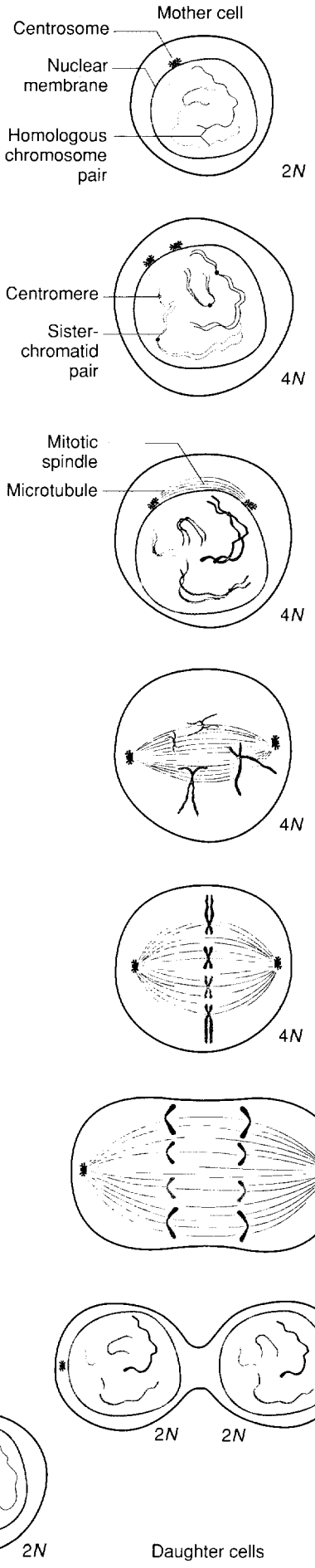
MITOSIS

Mitosis is the type of cell division that produces two daughter cells from a single mother cell. Each daughter cell has a set of chromosomes identical to the set possessed by the mother cell. Mitosis is the mechanism whereby a multicellular organism increases in size and replaces dead cells and whereby single-celled eukaryotic organisms reproduce asexually. The interested reader can find a striking series of photomicrographs of mitosis in the lily *Haemanthus katherinae* on page 7 of *Genes and Genomes: A Changing Perspective* by Maxine Singer and Paul Berg (University Science Books, 1991).



INTERPHASE

G_1—During G_1 (see "The Eukaryotic Cell Cycle") the chromosomes of the mother cell are very long and very thin. Only two of the cell's *N* pairs of homologous chromosomes are shown, and the members of each homologous pair are depicted in different shades of the same color. The centrosome is the source of fibrous proteins called microtubules. One function of microtubules is to direct the motion of chromosomes during mitosis (and meiosis).

G_2—The mother cell has replicated its complement of chromosomes (during the preceding S phase) and all other cellular material required for cell division, including the centrosome. The two identical copies of each chromosome are bound together along their centromeres into a so-called sister-chromatid pair.

MITOTIC PHASE

Prophase

The onset of mitosis is signaled by the ordered compaction, or condensation, of chromosomes into microscopically visible threads. Microtubules radiating from the two centrosomes collectively compose the mitotic spindle.

Prometaphase

The chromosomes have condensed further, and the centrosomes have migrated to opposite sides of the cell. Disintegration of the nuclear membrane has allowed microtubules to bind to each chromosome at a region within its centromere.

Metaphase

The chromosomes have assumed their most condensed configuration, and the sister-chromatid pairs have assumed the familiar X shape. Under the influence of opposing forces exerted by microtubules radiating from both centrosomes, each sister-chromatid pair has become aligned along the midplane of the cell.

Anaphase

The bond joining each sister-chromatid pair has broken, and the members of each former sister-chromatid pair have begun moving toward opposite sides of the cell. As a result, a set of chromosomes identical to the set initially possessed by the mother cell becomes segregated in each side of the cell. The cell has begun to elongate and narrow at the midplane.

Telophase

A new nuclear membrane has formed around each segregated set of chromosomes, the chromosomes have begun to decondense, and the cell has begun to divide.

INTERPHASE

G_1—Cleavage of the extranuclear cellular material has produced two daughter cells, and the chromosomes in each have decondensed further in preparation for the biosynthetic activities of G_1.