

Mitosis



CELL DIVISION FOR GROWTH OF
EUKARYOTIC ORGANISMS AND
REPLACEMENT OF SOME
EUKARYOTIC CELLS



THIS WORK IS LICENSED UNDER A [CREATIVE COMMONS
ATTRIBUTION-NONCOMMERCIAL-SHAREALIKE 4.0
INTERNATIONAL LICENSE](https://creativecommons.org/licenses/by-nc-sa/4.0/).

History of Understanding Cancer



- Rudolf Virchow (1821-1902) – First to recognize leukemia in mid-1800s, believing that diseased tissue was caused by a breakdown within the cell and not from an invasion of foreign organisms.
- Louis Pasteur (1822-1895) – Proved Virchow to be correct in late 1800s.
- Virchow's understanding that cancer cells start out normal and then become abnormal is still used today.
- If cancer is the study of abnormal cell division, let's look at normal cell division.

Types of Normal Cell Division

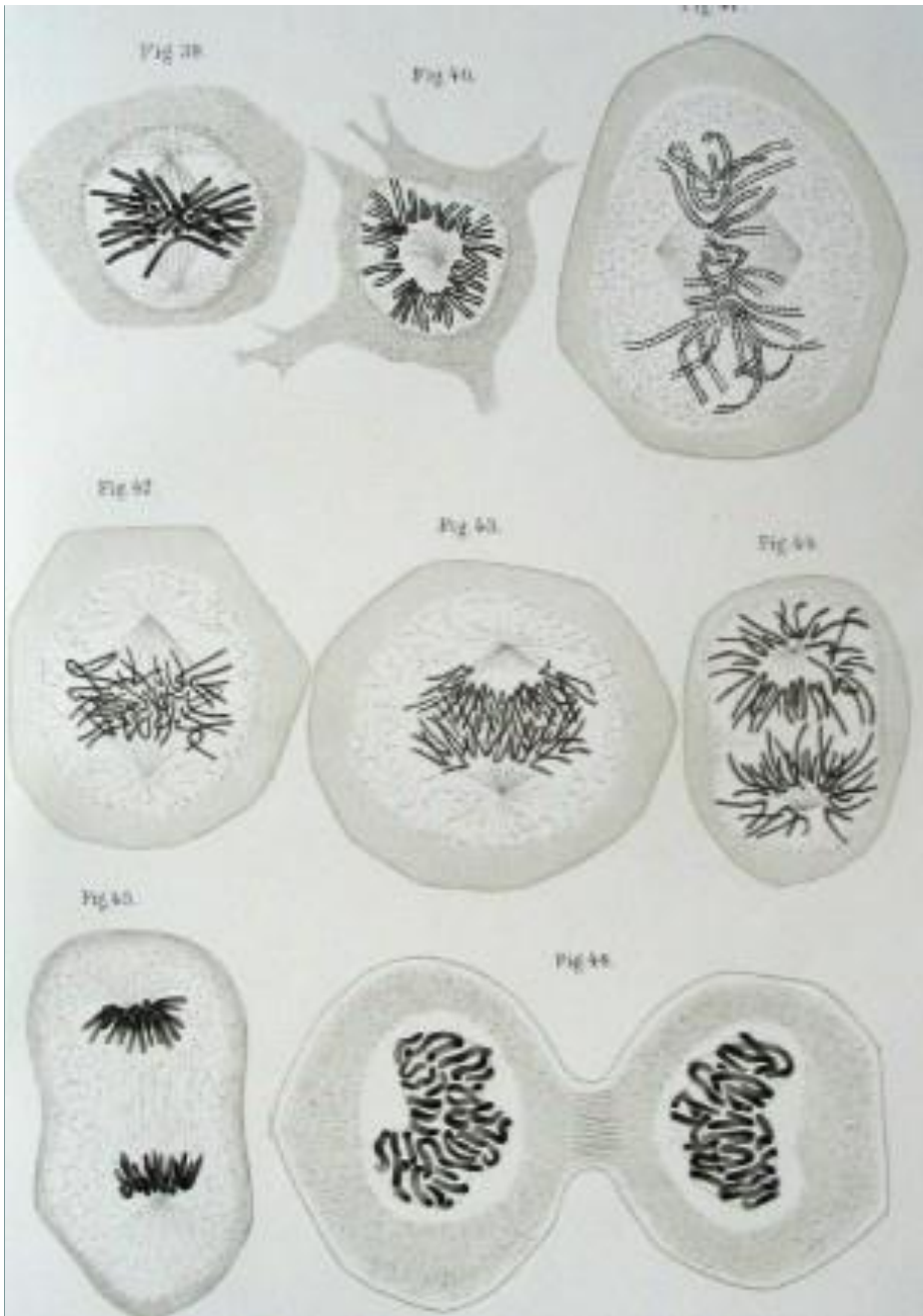


- There are two types of normal cell division – mitosis and meiosis.
- **Mitosis** is cell division which begins in the fertilized egg (or zygote) stage and continues during the life of the organism in one way or another. Each diploid ($2n$) daughter cell is genetically identical to the diploid ($2n$) parent cell.
- **Meiosis** is cell division in the ovaries of the female and testes of the male and involves the formation of egg and sperm cells, respectively. Each diploid ($2n$) parent cell produces haploid (n) daughter cells.
- Meiosis will be discussed more fully in Chapter 5 of the Oncofertility Curriculum.



Walther Flemming (1843 – 1905)

- Described the process of cell division in 1882 and coined the word 'mitosis'
- Also responsible for the word "chromosome" which he first referred to as stained strands
- Co-worker Eduard Strasburger named the mitotic stages 'prophase, metaphase, anaphase, telophase' in 1884



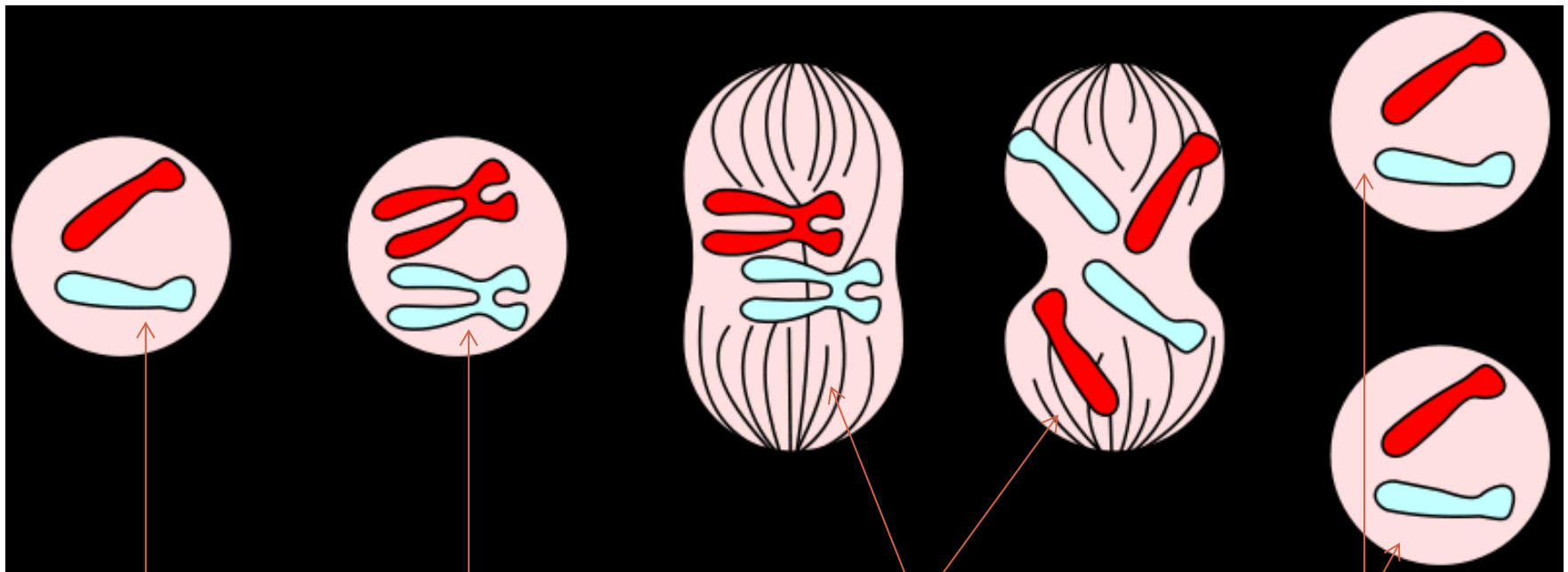
What is Mitosis?

**Walther Flemming's
book:**

**Zellsubstanz, Kern
und Zelltheilung
(Cell-Substance,
Nucleus, and Cell-
Division)**

Illustration showing
chromosomes and the
process of mitosis, 1882

DNA Replication and Cell Division



Diploid
Parent Cell

DNA Replication

Mitosis

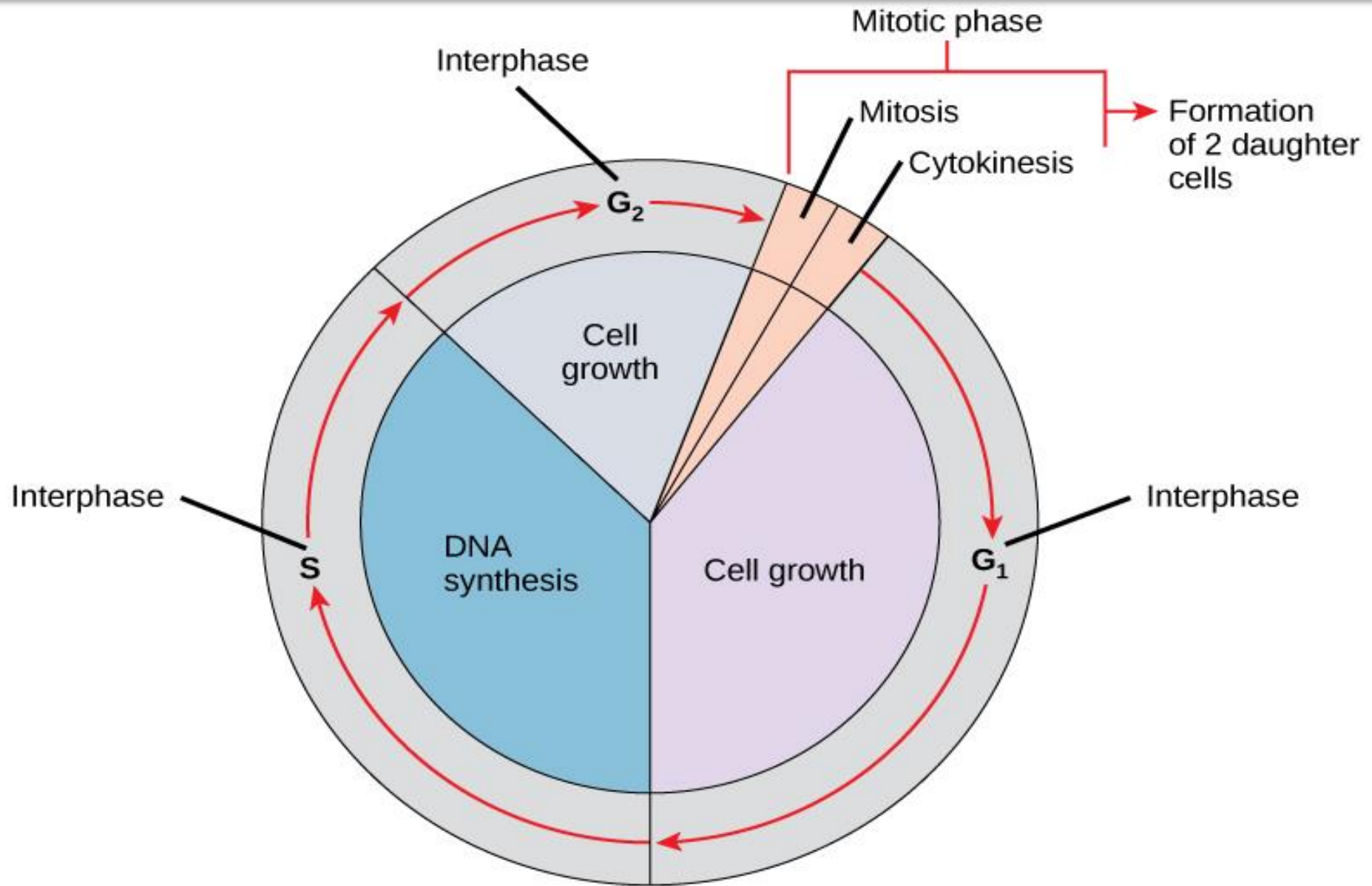
Result – Two Diploid
Cells Identical to the
Parent Cell

Why Do Cells Undergo Mitosis?

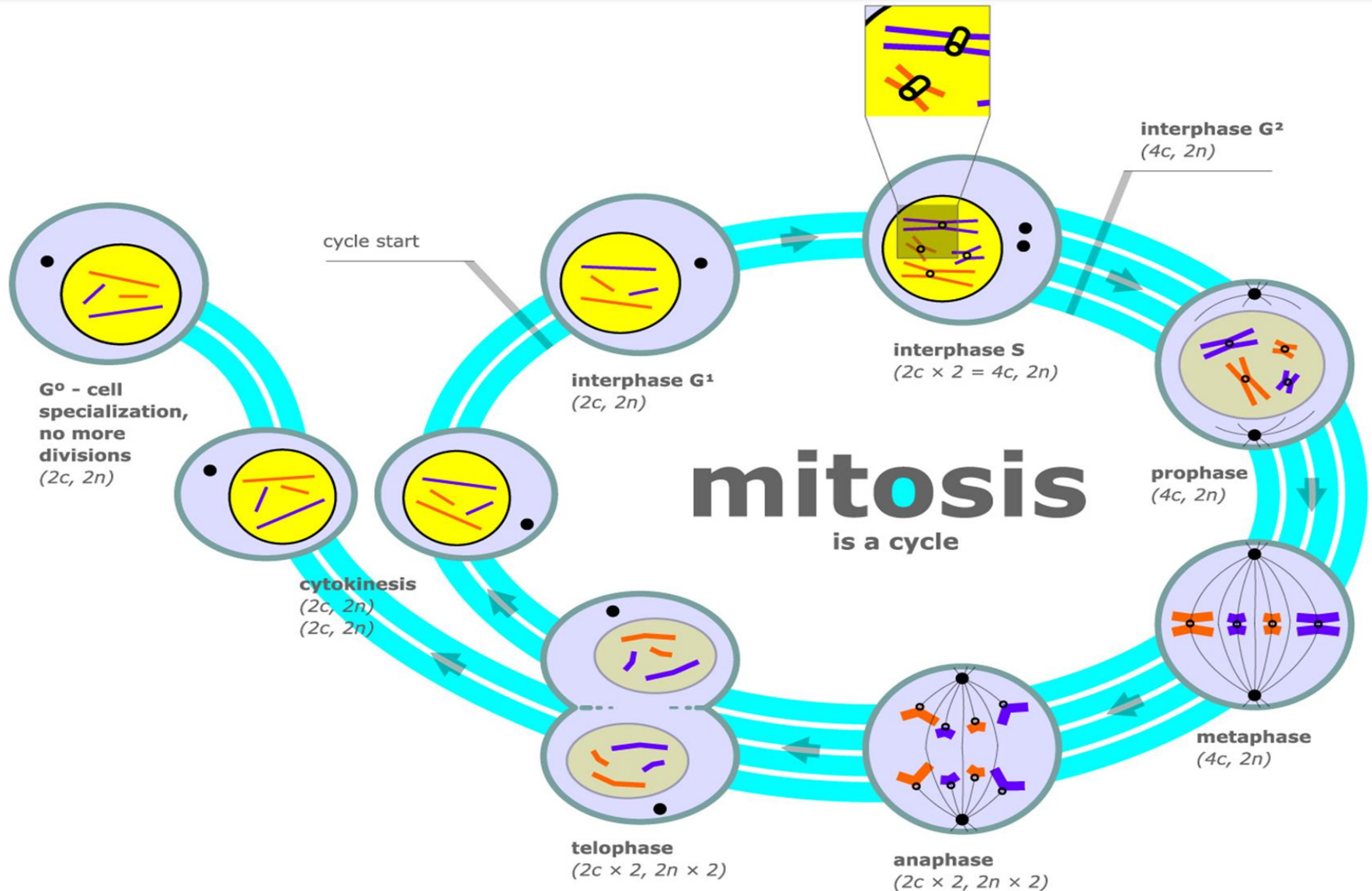


- Mitosis is exact nuclear division. The DNA in the parent cell is copied exactly and then the cell nucleus divides exactly so each of the two daughter cells has the same kind and number of genetic base pairs arranged in chromosomes as the parent cell.
- Mitosis is necessary because when cells reach a surface area to volume ratio that is too small relative to the rate of diffusion of nutrients and water into the cell, and thus the nutritional demands of the cell cannot be met.
- In order to address this, the cell undergoes mitosis to form two identical, but smaller cells, which increases the surface area to volume ratio, and thus the rate of diffusion can meet the nutritional demands of the entire cell.

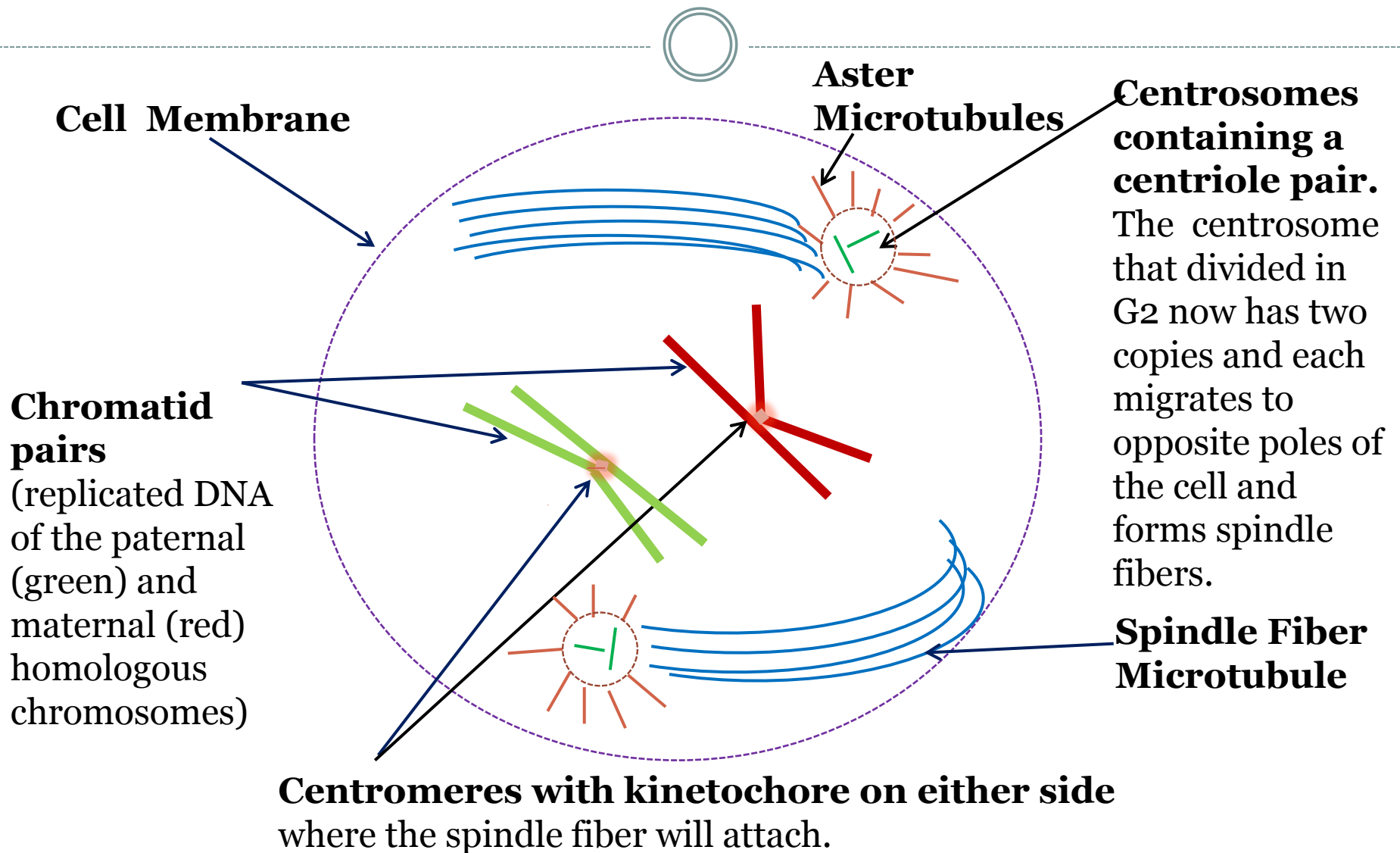
The Stages of Interphase and Cell Division



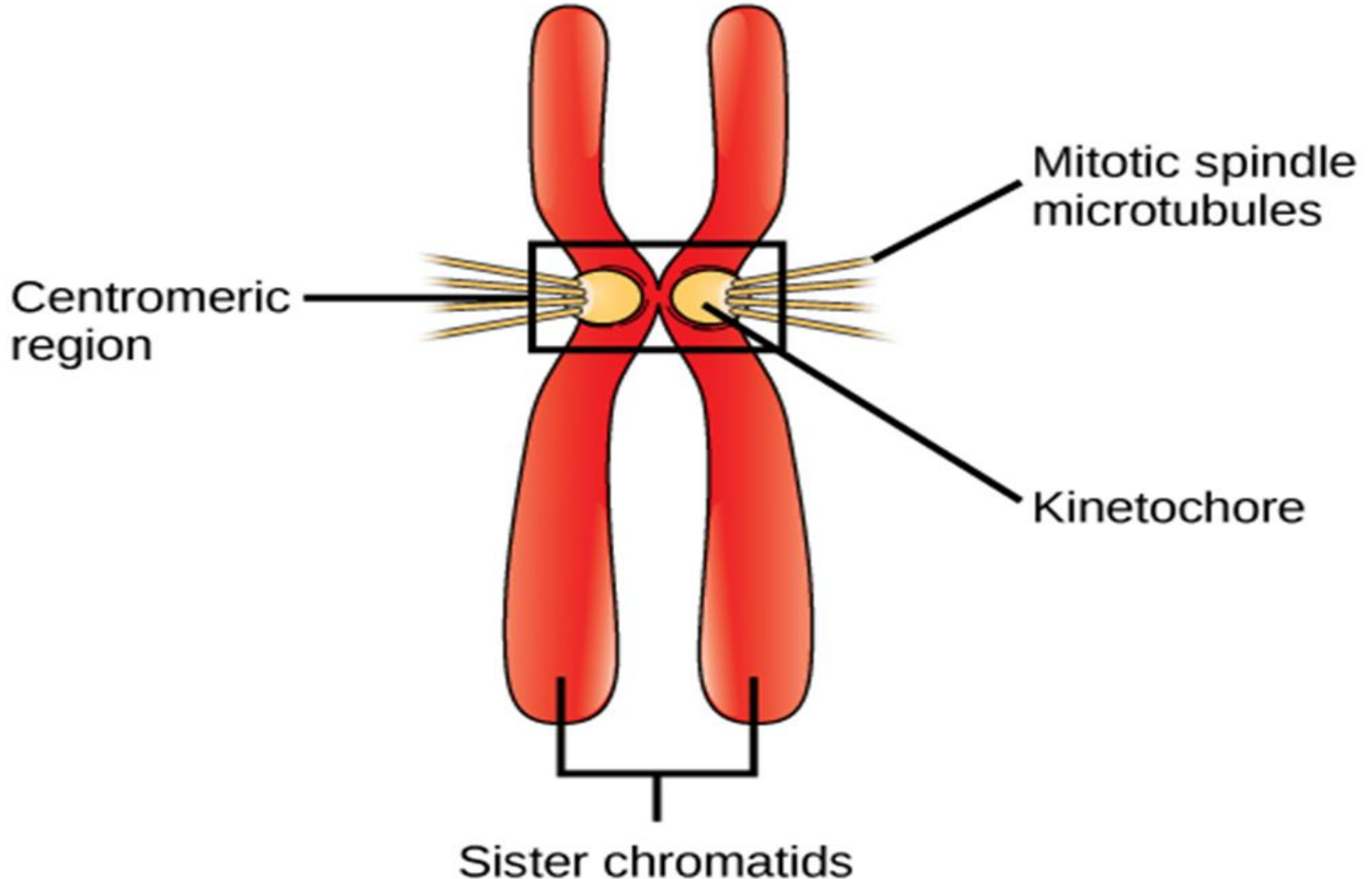
Mitotic Cell Division



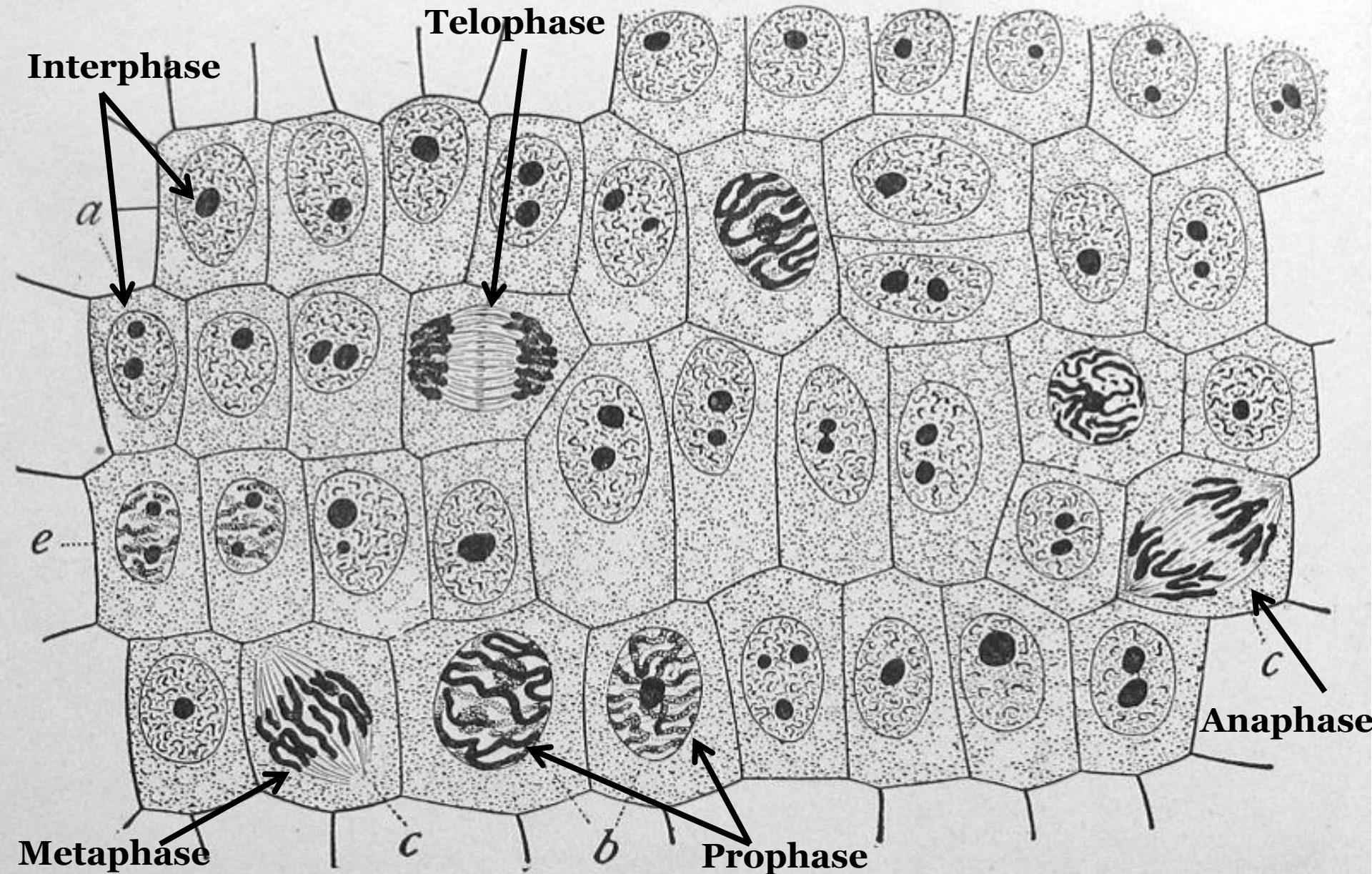
Prophase of Mitosis



Kinetochores and Mitotic Spindle

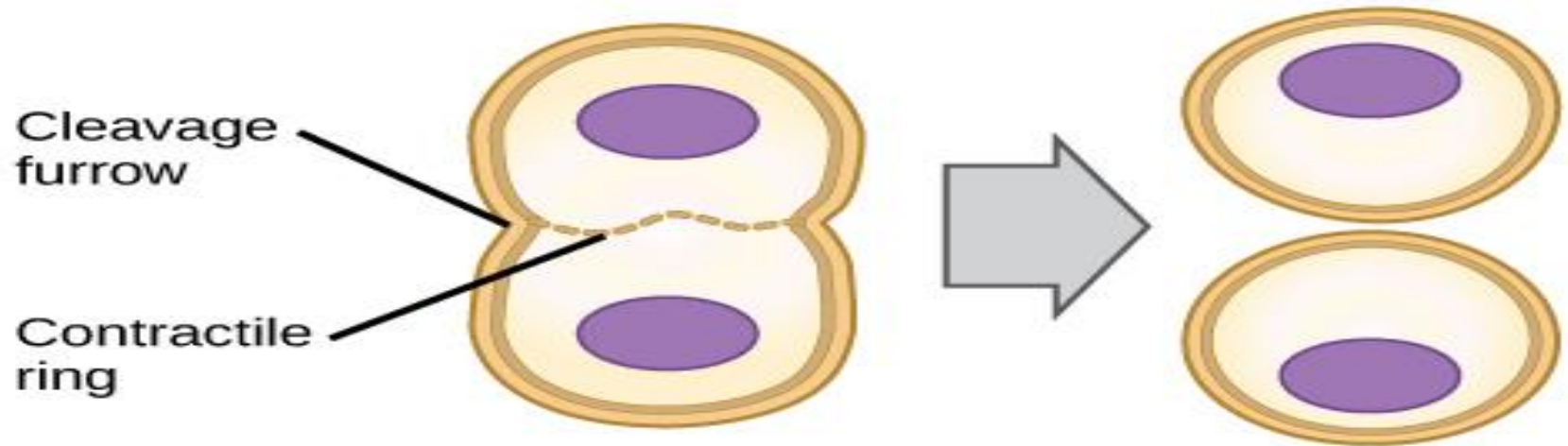


Mitosis in an Onion Root Tip



Cytokinesis

Animal cell



Plant cell

