

## Cell division distributes identical sets of chromosomes to daughter cells

- A cell's genetic information, packaged as DNA, is called its ***genome***.
  - In prokaryotes, the genome is often a single long DNA molecule.
  - In eukaryotes, the genome consists of several DNA molecules.
- A human cell must duplicate about 3 m of DNA and separate the two copies so that each daughter cell ends up with a ***complete genome***.
- DNA molecules are packaged into **chromosomes**.
  - Every eukaryotic species has a characteristic number of chromosomes in the nucleus.
  - Human **somatic cells** (body cells) have 46 chromosomes.
  - Human **gametes** (sperm or eggs) have 23 chromosomes, half the number in a somatic cell.
- Each eukaryotic chromosome consists of a long, linear DNA molecule.
- Each chromosome has hundreds or thousands of genes, the units that specify an organism's inherited traits.
- Associated with DNA are proteins that maintain its structure and help control gene activity.
- This DNA-protein complex, ***chromatin***, is organized into a long thin fiber.
- After the DNA duplication, chromatin condenses, coiling and folding to make a smaller package.
- Each ***duplicated chromosome*** consists of two **sister chromatids** which contain identical copies of the chromosome's DNA.
- As they condense, the region where the sister chromatids shrink to a narrow area is called the **centromere**.
- Later, the sister chromatids are pulled apart and repackaged into two new nuclei at opposite ends of the parent cell.

- The process of the formation of the two daughter nuclei, **mitosis**, is usually followed by division of the cytoplasm, **cytokinesis**.
- These processes take one cell and produce two cells that are the genetic equivalent of the parent.
- Each of us inherited 23 chromosomes from each parent: one set in an egg and one set in sperm.
- The fertilized egg or zygote underwent trillions of cycles of mitosis and cytokinesis to produce a fully developed multicellular human.
- These processes continue every day to replace dead and damaged cell.
- Essentially, these processes produce clones - cells with the same genetic information.
- In contrast, gametes (eggs or sperm) are produced only in gonads (ovaries or testes).
- In the gonads, cells undergo a variation of cell division, **meiosis**, which yields four daughter cells, each with half the chromosomes of the parent.
  - In humans, meiosis reduces the number of chromosomes from 46 to 23.
- Fertilization fuses two gametes together and doubles the number of chromosomes to 46 again.