

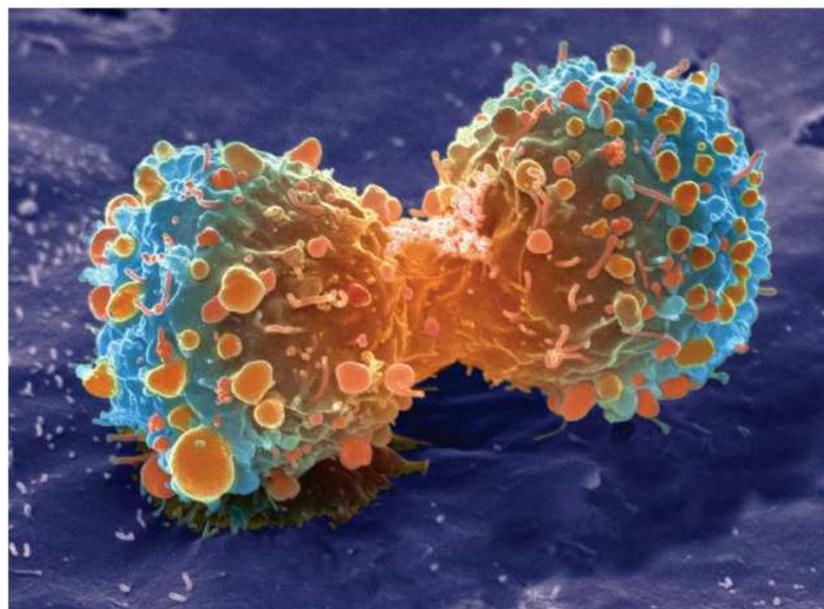
Kickoff:

1. Which organelle is responsible for controlling what goes in and out of a cell?
2. How do you know when to stop filling up a water balloon?

5.1 The Cell Cycle

KEY CONCEPT

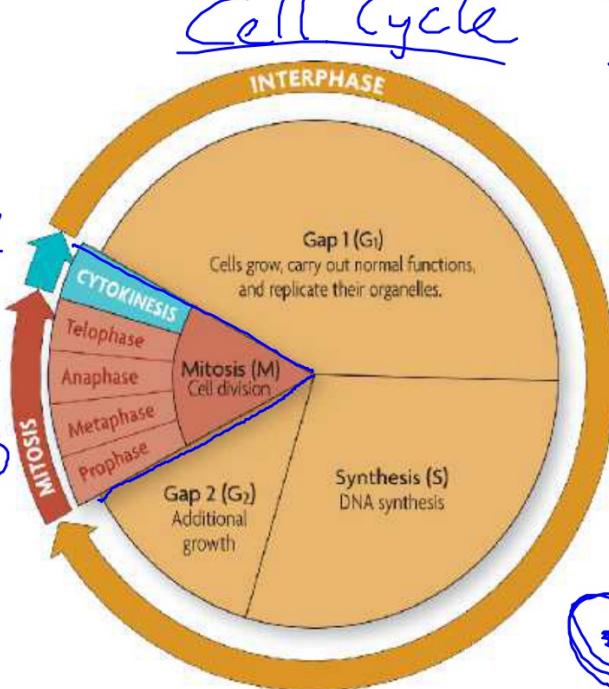
Cells have distinct phases of growth, reproduction, and normal functions.



► The cell cycle has four main stages.

- The cell cycle is a regular pattern of growth, DNA replication, and cell division.

M / mitosis
Prophase
Metaphase
Anaphase
Telophase
Cytokinesis



Interphase: longest of cell

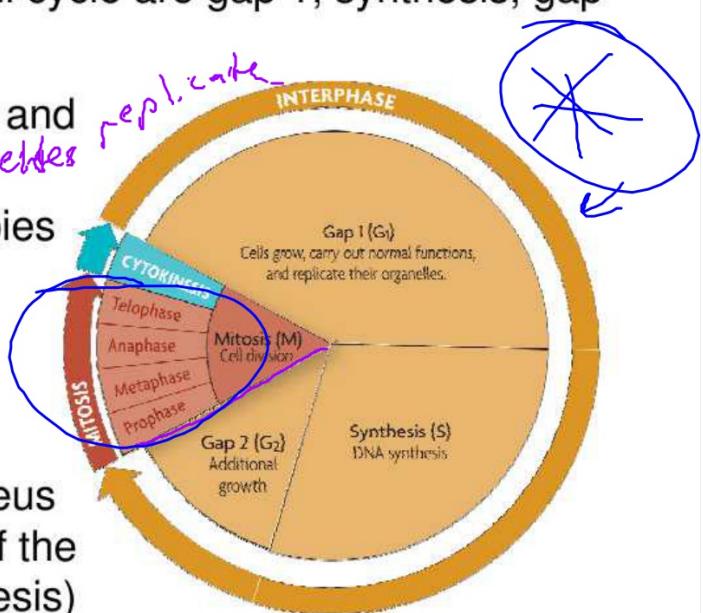
G₁/Gap 1
- cell gro
- organelles
- cell work

S/Synthesis
- Copying

G₂/Gap 2
- Additional gro

5.1 The Cell Cycle

- The main stages of the cell cycle are gap 1, synthesis, gap 2, and mitosis.
 - Gap 1 (G_1): cell growth and normal functions; organelles *replicate*
 - DNA synthesis (S): copies DNA
 - Gap 2 (G_2): additional growth
 - Mitosis (M): includes division of the cell nucleus (mitosis) and division of the cell cytoplasm (cytokinesis)
- Mitosis occurs only if the cell is large enough and the DNA undamaged.



5.1 The Cell Cycle

Cells divide at different rates.

- The rate of cell division varies with the need for those types of cells.

FIGURE 5.2 CELL DIVISION

CELL TYPE	APPROXIMATE LIFE SPAN
Skin cell	2 weeks
Red blood cell	4 months
Liver cell	300–500 days
Intestine—internal lining	4–5 days
Intestine—muscle and other tissues	16 years

- Some cells are unlikely to divide (G_0). Nelson

Interphase

5.1 The Cell Cycle

► Cell size is limited.

- Volume increases faster than surface area.

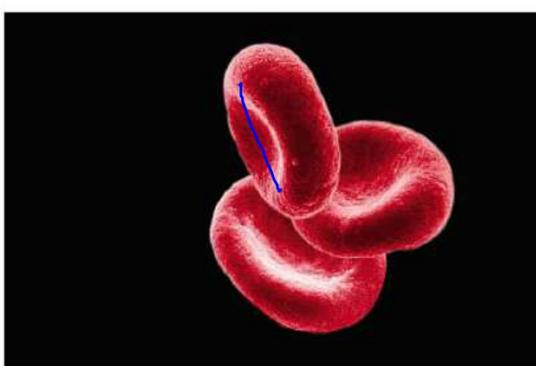
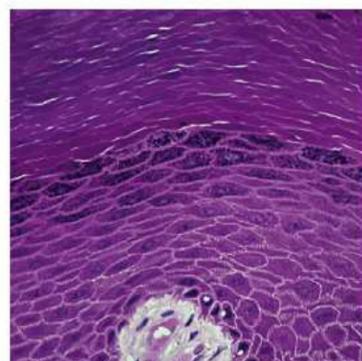
cytoplasm

cell membrane

Relative size	1	2	3
Surface area (length × width × number of sides)	6	24	54
Volume (length × width × height)	1	8	27
Ratio of surface area to volume	$\frac{6}{1} = 6:1$	$\frac{24}{8} = 3:1$	$\frac{54}{27} = 2:1$

5.1 The Cell Cycle

- Surface area must allow for adequate exchange of materials.
 - Cell growth is coordinated with division.
 - Cells that must be large have unique shapes.



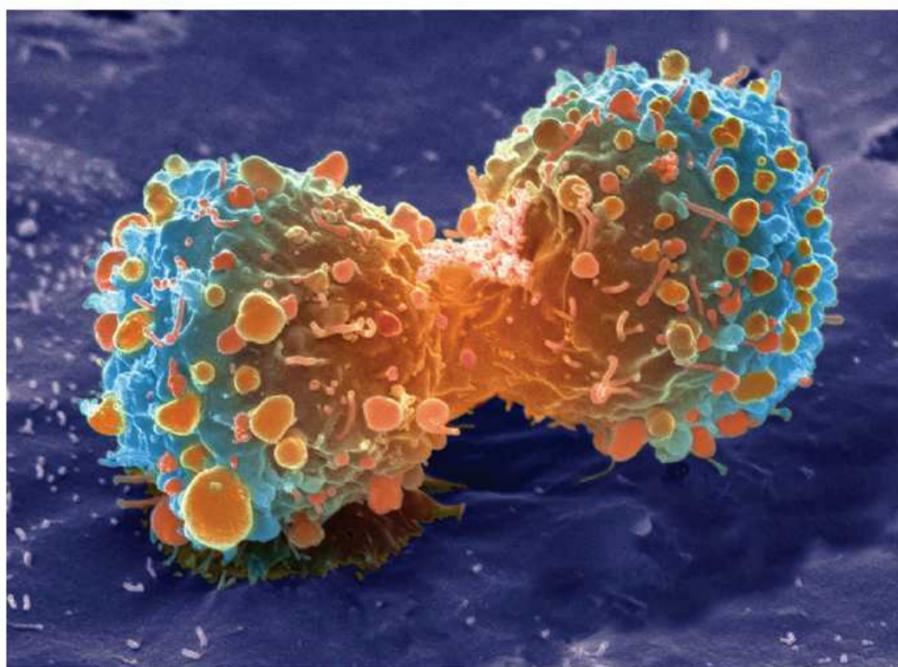
Kickoff:

1. If a cell has 24 chromosomes in its nucleus, how many chromatids would it have just after the S phase of the cell cycle?
2. If a mutation caused histone proteins to bind less tightly to DNA, how might the cell cycle be affected?

5.2 Mitosis and Cytokinesis

KEY CONCEPT

Cells divide during mitosis and cytokinesis.

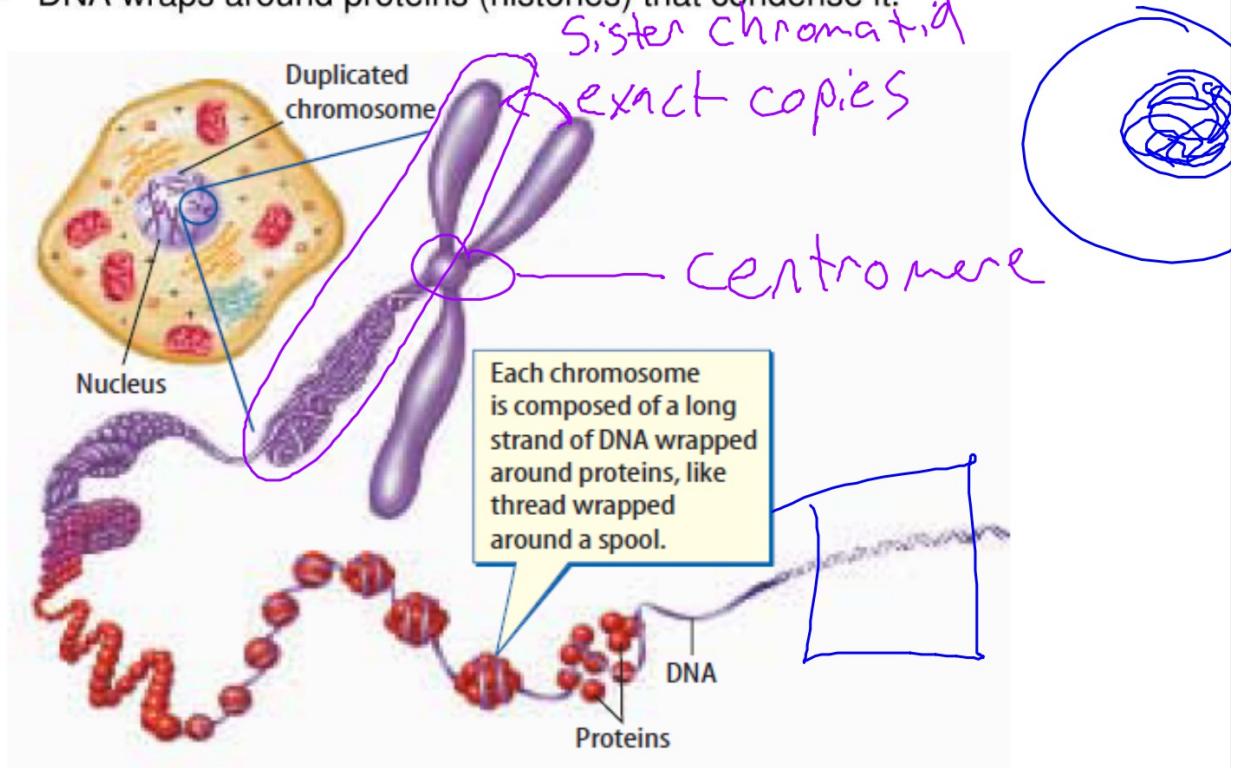


5.2 Mitosis and Cytokinesis

- Chromosomes condense at the start of mitosis.

Chromosomes =

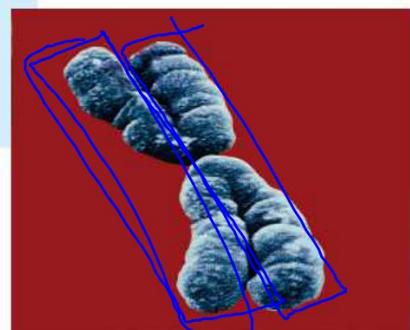
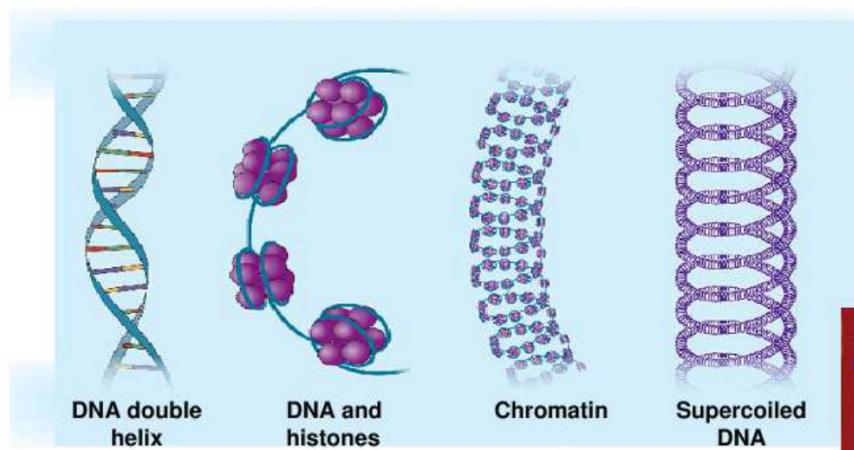
- DNA wraps around proteins (histones) that condense it.



5.2 Mitosis and Cytokinesis

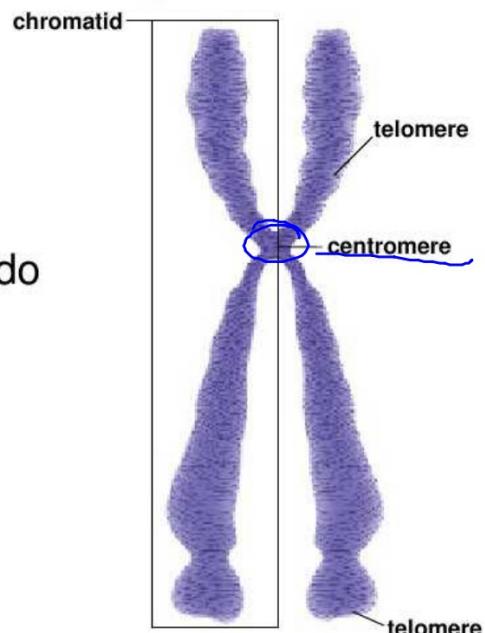
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5.2 Mitosis and Cytokinesis

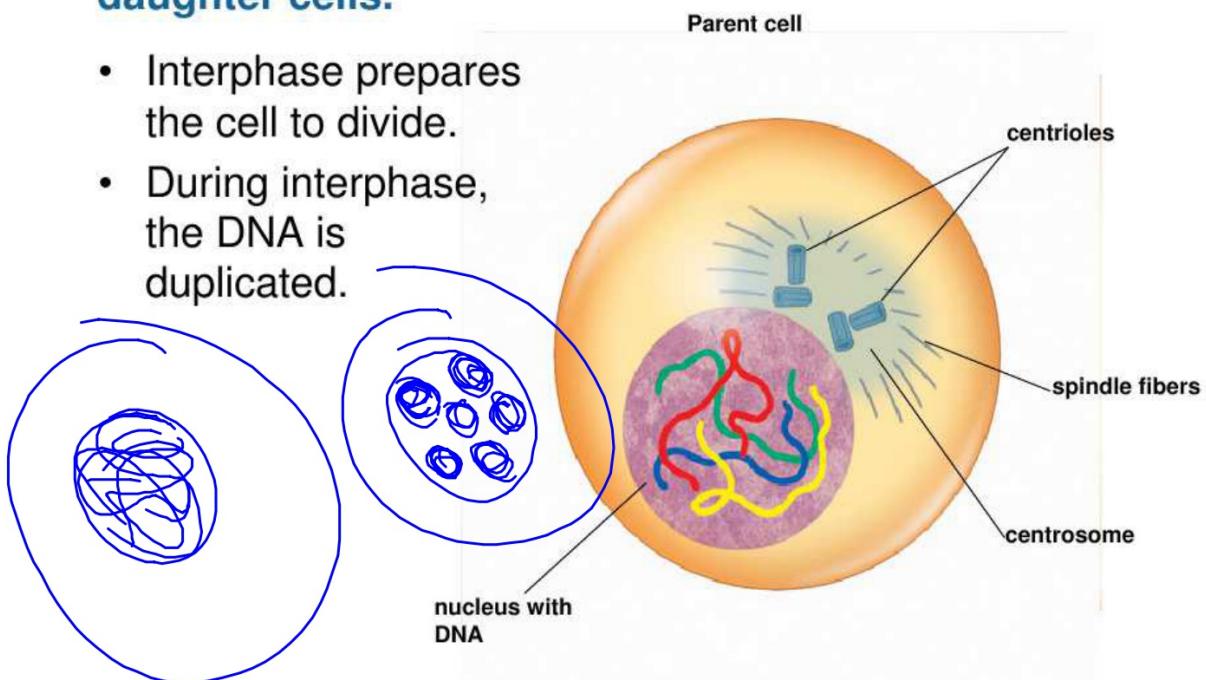
- DNA plus histones is called chromatin.
- One half of a duplicated chromosome is a chromatid.
- Sister chromatids are held together at the centromere.
- Telomeres protect DNA and do not include genes. ^{"end caps"}



Condensed, duplicated chromosome

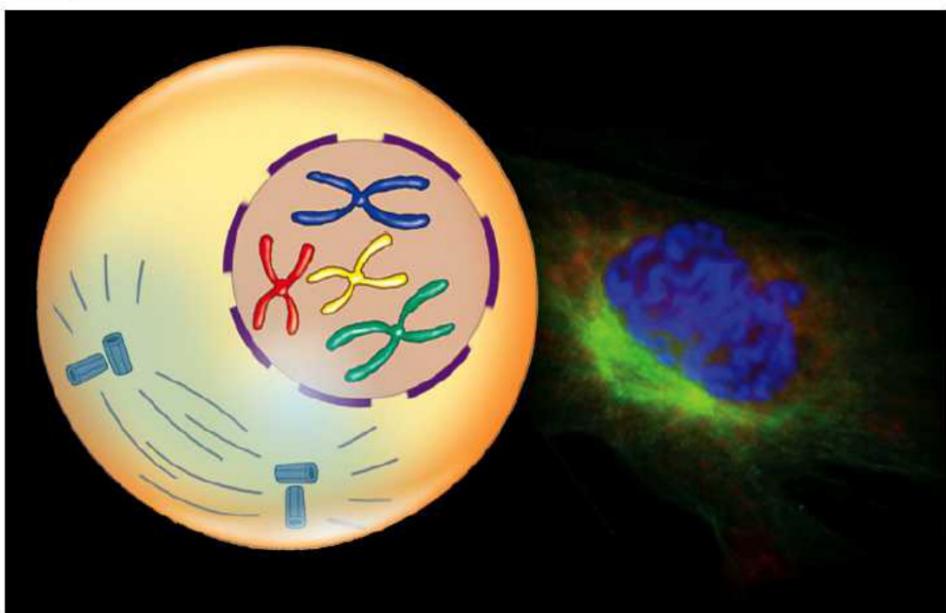
5.2 Mitosis and Cytokinesis

- Mitosis and cytokinesis produce two genetically identical daughter cells.



5.2 Mitosis and Cytokinesis

- Mitosis divides the cell's nucleus in four phases.
 - During prophase, chromosomes condense and spindle fibers form.

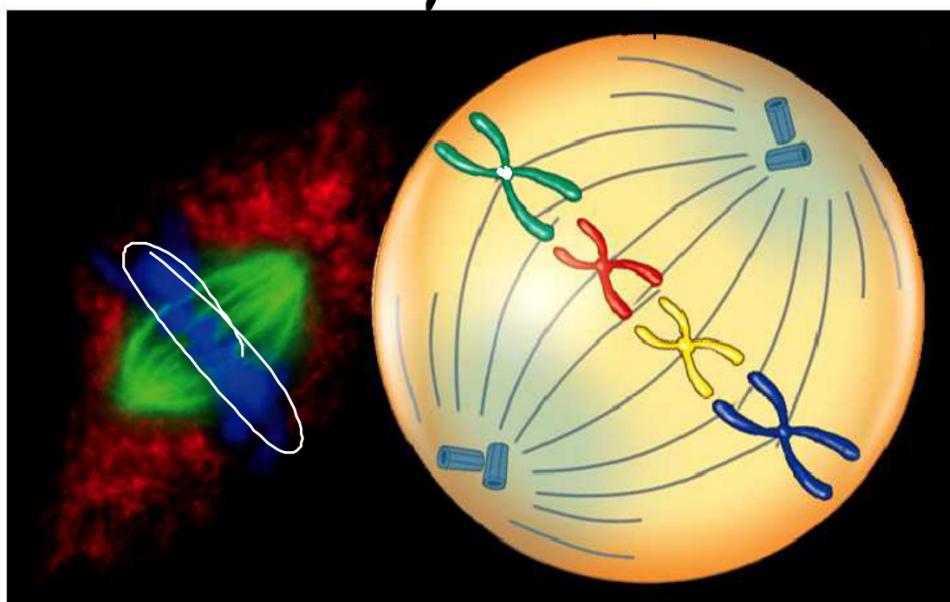


Mitosis begins
- nuclear membrane breaks apart
- Centrioles move towards opposite sides (poles)

5.2 Mitosis and Cytokinesis

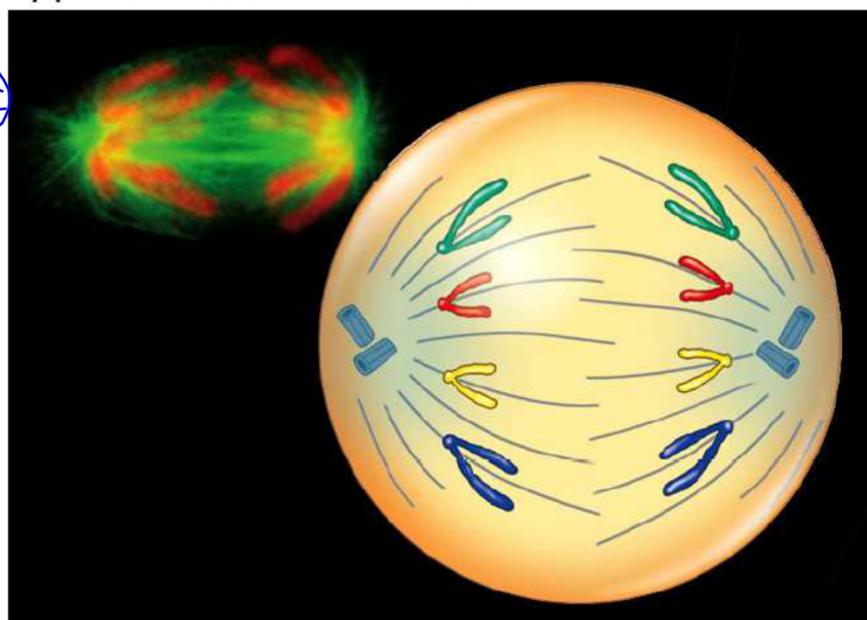
- Mitosis divides the cell's nucleus in four phases.

During metaphase, chromosomes line up in the middle of the cell. Spindle fibers attach to Centrosome



5.2 Mitosis and Cytokinesis

- Mitosis divides the cell's nucleus in four phases.
 - During anaphase, sister chromatids separate to opposite sides of the cell.



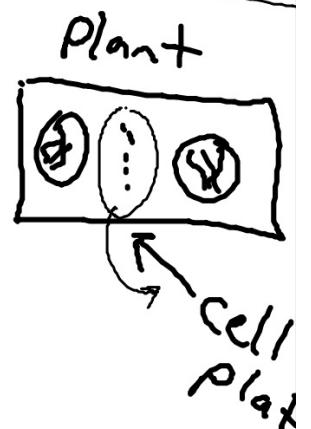
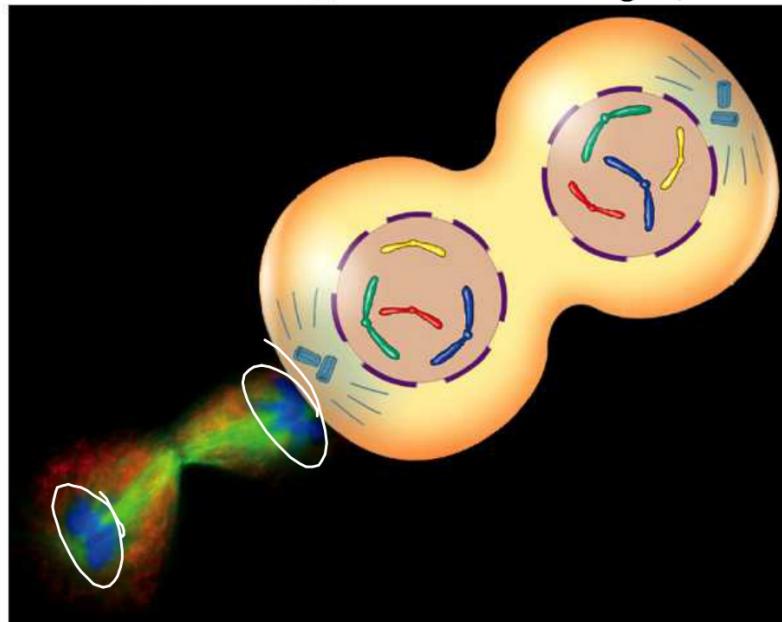
5.2 Mitosis and Cytokinesis

- Mitosis divides the cell's nucleus in four phases.

During telophase, the new nuclei form and chromosomes begin to uncoil. *two identical*

Last pha
5 sta

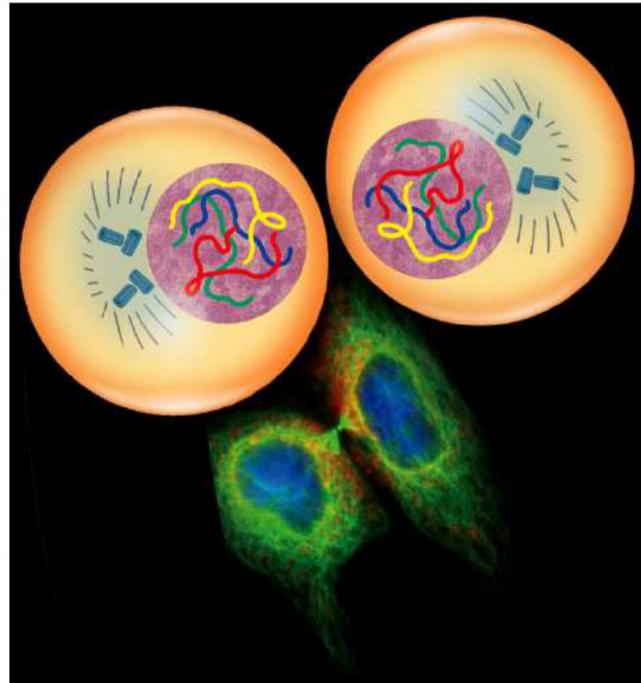
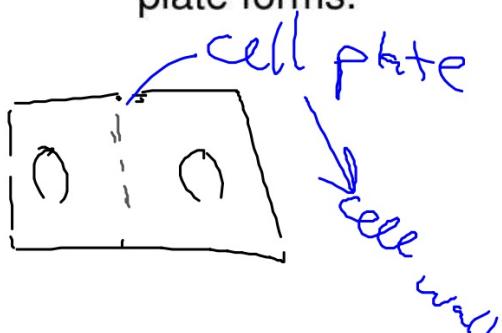
Mitosis ends



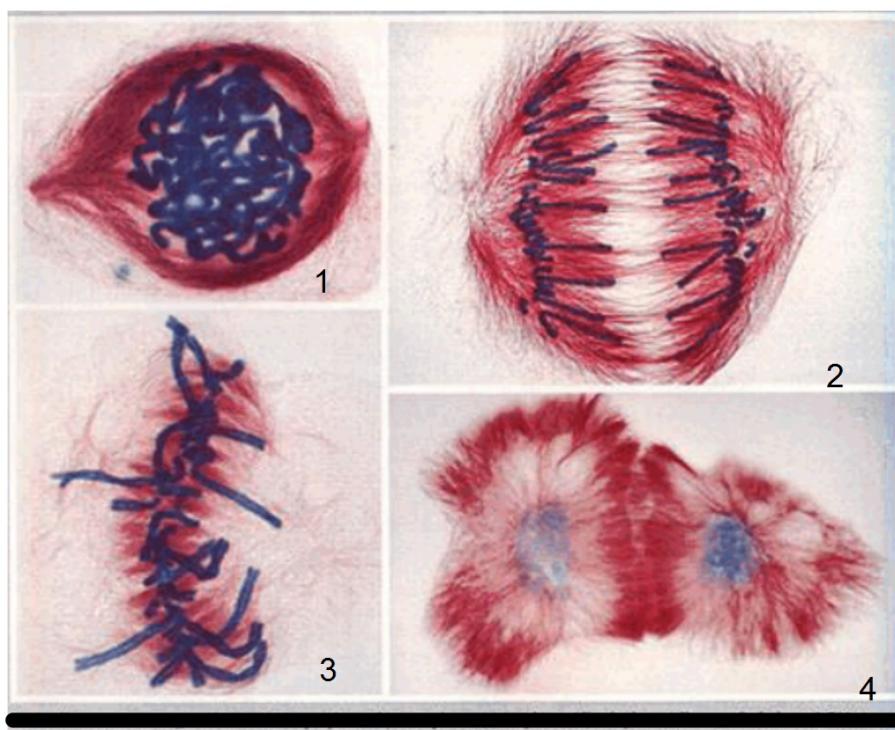
5.2 Mitosis and Cytokinesis

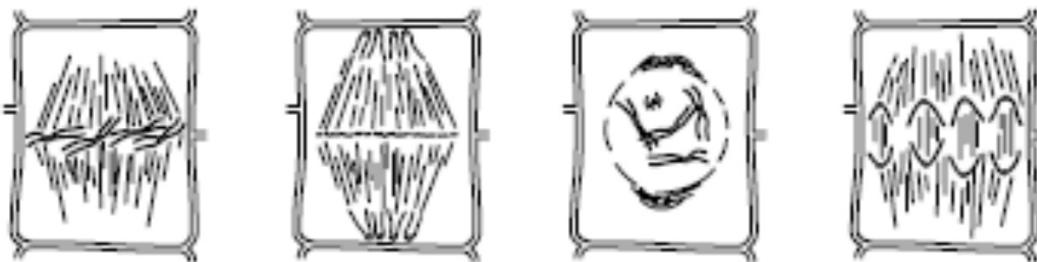
Cytoplasm - separated organelles

- Cytokinesis differs in animal and plant cells.
 - In animal cells, the membrane pinches closed.
 - In plant cells, a cell plate forms.



Sketch and label the four cells according to their phase in mitosis.





13

During which stage of mitosis do the chromosomes line up along the center of the cell?

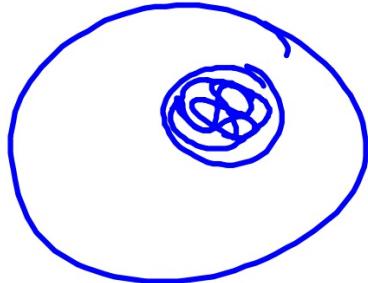
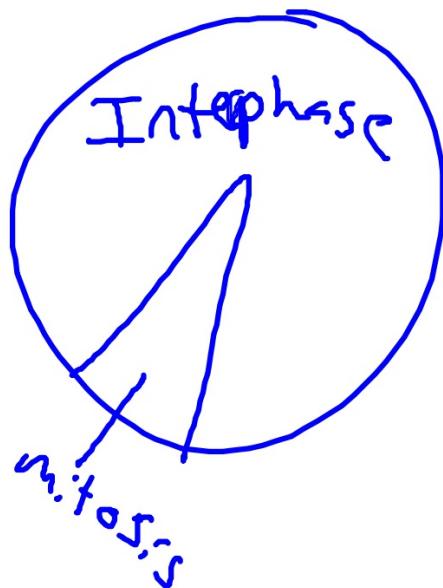
- A prophase
- B metaphase
- C anaphase
- D telophase

14. Order them in sequence.

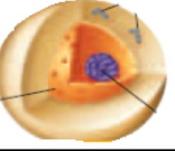
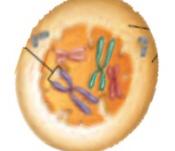
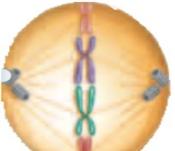
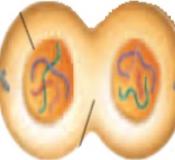
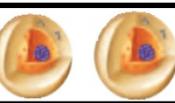
Cell Cycle

Interphase:

- Not mitosis
- Period of cell growth
- DNA copies itself
- longest stage



STAGES OF MITOSIS

Interphase <i>(Initial Phase)</i>		WHAT'S HAPPENING? 1. DNA is loose and begins to replicate
Prophase <i>(Preparation Phase)</i>		WHAT'S HAPPENING? 1. 2.
Metaphase <i>("Middle" Phase)</i>		WHAT'S HAPPENING? 1. 2.
Anaphase <i>(Apart Phase)</i>		WHAT'S HAPPENING? 1.
Telophase <i>(Two Nuclei Phase)</i>		WHAT'S HAPPENING? 1. 2.
Cytokinesis		WHAT'S HAPPENING?

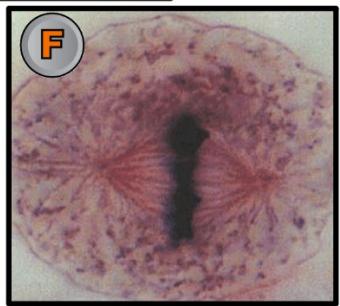
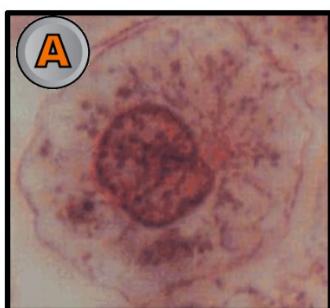
MITOSIS MASH-UP!: Match the pictures with the correct phases

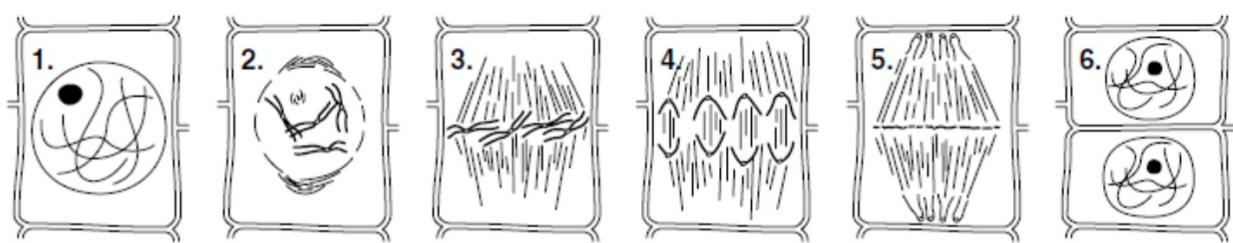
1. Interphase

- 2. Prophase**
- 3. Metaphase**
- 4. Anaphase**
- 5. Telophase**

mitosis

6. Cytokinesis





1. What is stage 4 called?
2. Is this a plant or animal cell dividing?
3. What part forms in plant cells but not in animal cells (stage 5)?

Name _____

Date _____

Class _____

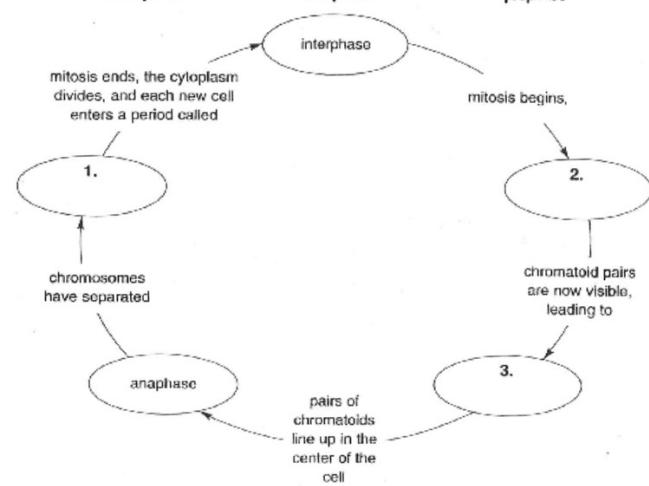
Directed Reading for
Content Mastery **Overview**
Cell Reproduction

Directions: Complete the concept map using the terms in the list below.

metaphase

telophase

prophase



Meeting Individual Needs

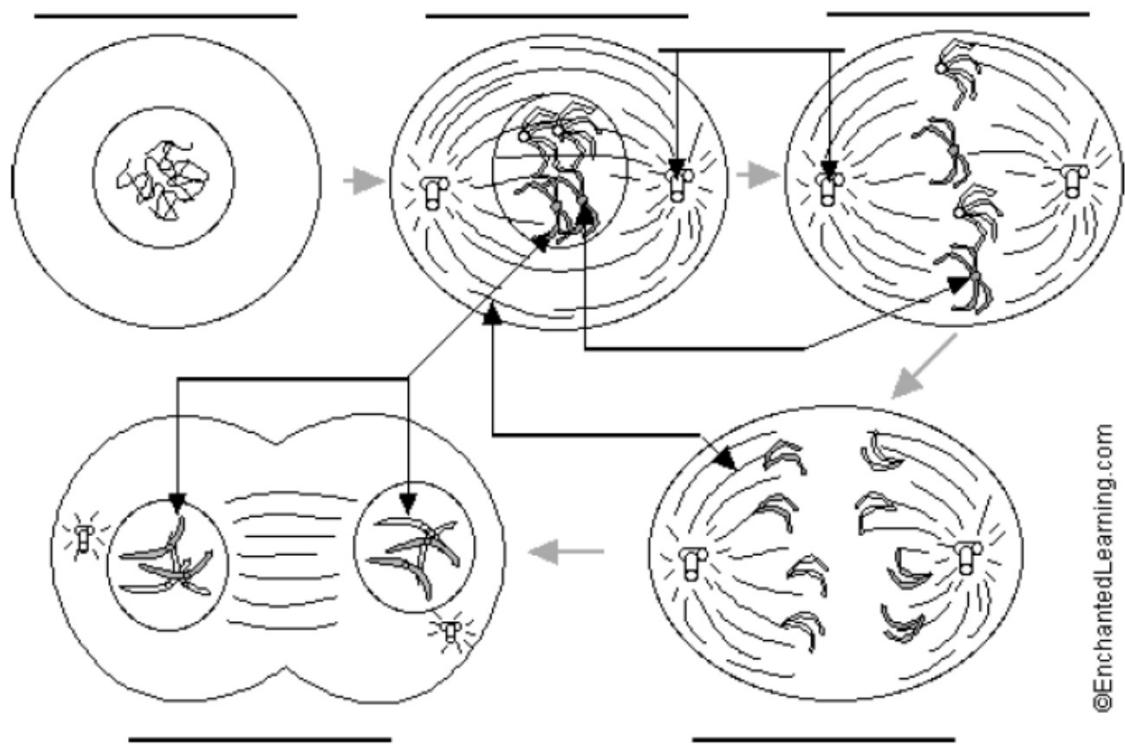
Directions: Use the five terms in the concept map to identify the steps of the cell cycle below.

Description

Step of Cell Cycle

4. Spindle fibers start to disappear, nuclear membrane forms, and cytoplasm begins to divide.
5. Chromatid pairs are fully visible, the nucleolus and the nuclear membrane disintegrate, and spindle fibers begin to form.
6. Chromatid pairs line up across center of cell, the centromere of each pair attaches to spindle fibers.
7. Each chromatid pair splits at the centromere and separates to opposite ends of the cell, where they become identical chromosomes.
8. Cell grows and makes copies of its hereditary material.

1. Label the following diagram of mitosis of an animal cell.

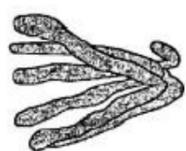


2. During which stage of a cell's cycle do the replicated chromosomes thicken and become visible? _____

3. In animal cells, which structure is thought to produce the spindle fibers that help separate the sister chromatids during anaphase? _____

4. Is this structure found in plant cells? _____

5. The drawing below has been made from a photograph showing a cell undergoing mitosis. Based on the drawing, in what stage of mitosis must the cell have been in?



6. The drawings A-E show stages of mitosis in an plant cell.



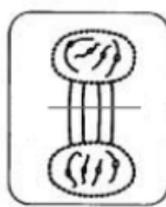
A



B



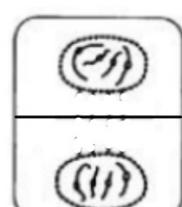
C



D



E



F

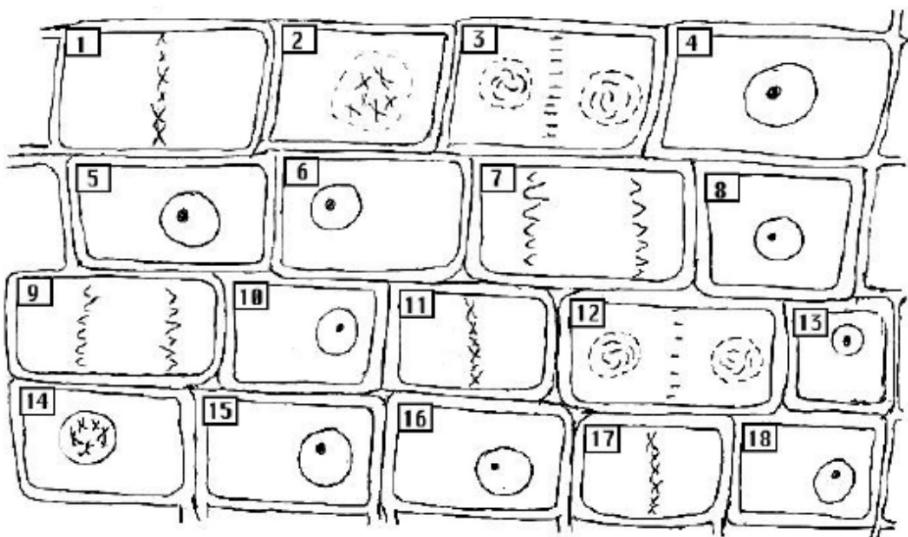
(a) Which of the drawings A -E shows

- (i) interphase _____ (**DNA** is replicated)
- (ii) prophase _____ (**chromosomes** – 2 **sister chromatids** – shorten)
- (iii) metaphase _____ (**sister chromatids** line up)
- (iv) anaphase _____ (**sister chromatids** separate)
- (v) telophase _____ (new nucleus forms at each end)
- (vi) cytokinesis _____ (cell contents divided between 2 **daughter cells**)

- (b) Give two processes which occur during interphase and which are necessary for nuclear division to take place.

_____ of the cell and _____ of the DNA

7. This drawings shows various stages of mitosis in a fast growing onion root tip.



Identify the cells (by number) which are in the following stages of mitosis:

interphase _____

prophase _____

metaphase _____

anaphase _____

telophase _____

8. Using colored pens or pencils, show how 2 chromosomes are passed from mother cell to two daughter cells.

