

SNC2D BIOLOGY

TISSUES, ORGANS & SYSTEMS OF ...
☛ The Cell Cycle
(P.28-32)

The Cell Cycle

Cell division affects how an organism grows, repairs injuries, and reproduces. Just as you will go through many stages in your life, cells go through stages as they grow and divide. These stages are called the **cell cycle**.



NOTE!

The cell cycle is made up of three stages.

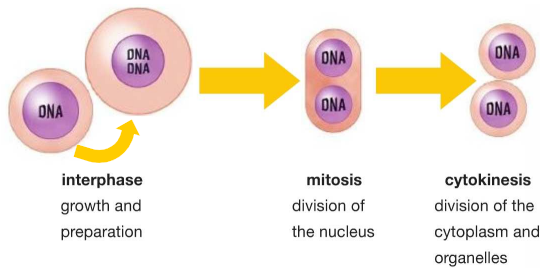
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2DBIOL - The Cell Cycle

1

The Cell Cycle

STAGE 1 STAGE 2 STAGE 3



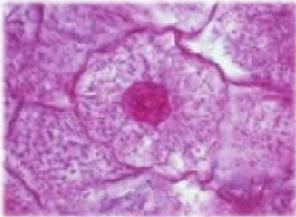
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2

Interphase

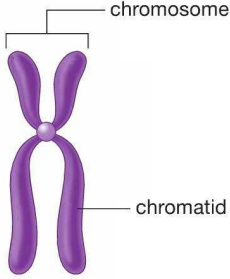
Interphase is usually the longest of the three stages of the cell cycle. This is when the cell grows and performs all of its normal functions except division. It is also when the cell prepares to divide by duplicating its DNA and organelles so they can be shared between the two new cells.



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Interphase

NOTE!
During interphase, the DNA are in long, thin strands called chromosomes. To prepare for cell division, the chromosomes copy themselves. Each chromosome is now made up of two identical strands of DNA. Each strand is called a chromatid. Duplication is essential so that each new cell will have all the genetic information from the parent cell.




chromosome

chromatid

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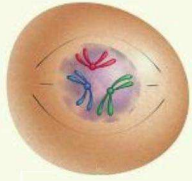
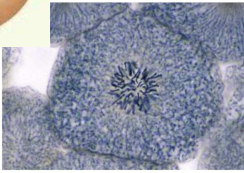
Mitosis

NOTE! Next stage of cell division is when the contents of the nucleus divide. This stage is called mitosis. Mitosis can be divided into four phases. Prophase is when the two copies of DNA separate and leave to form two nuclei. The cell will not be able to function properly and would probably die.



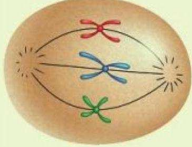
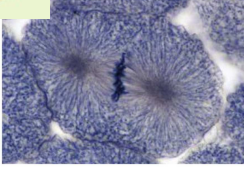
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The Phases of Mitosis (P.30 & 31)

Phase of mitosis	Illustration	Photo
<p>Prophase The chromosomes thicken and become visible. Because the chromosomes were duplicated in interphase, each chromosome is made up of a pair of identical strands. Each strand is called a chromatid. The membrane around the nucleus starts to dissolve.</p>		

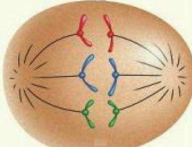
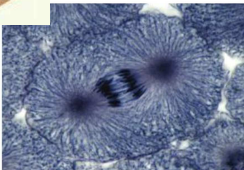
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The Phases of Mitosis (P.30 & 31)

Phase of mitosis	Illustration	Photo
<p>Metaphase The chromosomes line up along the middle of the cell. The membrane around the nucleus is completely dissolved.</p>		

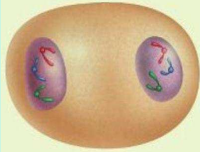
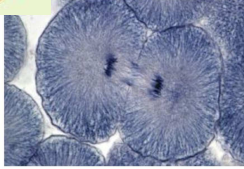
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The Phases of Mitosis (P.30 & 31)

Phase of mitosis	Illustration	Photo
<p>Anaphase The chromatids separate. Each separate chromatid is now called a daughter chromosome. The two daughter chromosomes are pulled toward opposite sides of the cell.</p>		

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The Phases of Mitosis (P.30 & 31)

Phase of mitosis	Illustration	Photo
<p>Telophase Daughter chromosomes stretch out, and become thin and invisible again. A new membrane begins to form around the nucleus at each end of the cell.</p>		

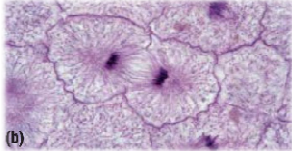
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Cytokinesis

*In the last stage of the cell cycle, **cytokinesis**, the cytoplasm and other organelles are distributed to the two ends of the cell. In plant cells, a new cell wall forms along the middle (a) while in animal cells, the cell membrane pinches together in the middle (b).*



(a)




(b)

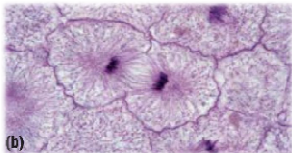
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Cytokinesis

In either case, it separates the dividing cell into two new daughter cells. Each daughter cell has a nucleus with a complete copy of the parent cell's DNA and its own organelles. The new cells are at the beginning of interphase, ready to begin the cell cycle again.



(a)



(b)

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Cell Division – The Big Picture (P.38)

Beginning of Interphase
The two new daughter cells enter interphase, and the cell cycle continues.

Interphase
The cell grows. New organelles are made. The DNA is duplicated and the cell is ready to divide.

Prophase
The chromosomes thicken. Each chromosome is made up of two chromatids. The nuclear membrane starts to dissolve.

Metaphase
The chromosomes line up along the middle of the cell. The nuclear membrane is completely dissolved.

Anaphase
The chromatids separate. The separate chromatids, now called daughter chromosomes, are pulled toward opposite sides of the cell.

Telophase
The daughter chromosomes reach opposite sides of the cell and start to lengthen. A nuclear membrane forms around each group of chromosomes.

Cytokinesis
The cytoplasm and organelles are divided. In animal cells, the cell membrane pinches off in the middle to form two new cells.

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Cell Division

NOTE!
The rate at which cells divide is different for every type of cell. Cells that form new skin or form the lining of your stomach divide at a steady rate to replace cells that are worn away. Cells that form your muscles and nerves may become larger up to a certain size, but once they form, they do not divide again.


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The Cell Cycle

CELL CYCLE

- ① interphase: the cell grows, new organelles are made, the DNA is duplicated
- ② mitosis: the cell nucleus divides into two nuclei (each nuclei has the same DNA as the original nucleus) – 4 stages (PMAT)
- ③ cytokinesis: the cytoplasm is divided in two (each half contains a nucleus and half the organelles)


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 **Checkpoints In The Cell Cycle – DYK?**

During the cell cycle, the cell's activities are controlled at specific points, or checkpoints. At each checkpoint, specialized proteins monitor cell activities and the cell's surroundings. These proteins send messages to the nucleus. The nucleus then instructs the cell whether or not to divide. A cell should remain in interphase and not divide if:


- *signals from surrounding cells tell the cell not to divide*
- *there are not enough nutrients to provide for cell growth*
- *the DNA within the nucleus has not been replicated*
- *the DNA is damaged*

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 **Checkpoints In The Cell Cycle – DYK?**

NOTE!
If the DNA is damaged and it is early enough in the cell cycle, there may be enough time for the cell to repair the damaged DNA. If there is too much damage to the DNA, the cell is usually destroyed. This is a vital process that helps keep organisms healthy.

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 **Activity: The Cell Cycle**

INSTRUCTIONS

- A. Watch the animation (next screen).
- B. Complete 2DBIOL - WS4 (Cell Growth & Division).
- C. Complete 2DBIOL - WS5 (Cell Division Explained).

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Activity: The Cell Cycle

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Activity: The Cell Cycle

ANSWERS (2DBIOL - WS4)

Cell Growth ⇨ A H C F E D G B

Cell Division ⇨ Q V U W T S R P

- Q – interphase
- V – prophase
- U – metaphase (early)
- W – metaphase
- T – anaphase
- S – anaphase (late)
- R – telophase
- P – cytokinesis


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Activity: The Cell Cycle

ANSWERS (2DBIOL - WS5)

	PHASE	WORDS
A	interphase	organelles, DNA, genetic
B	prophase	thicken, visible, identical, chromatids, dissolve
C	metaphase	chromosomes, middle, centrioles, spindle fibres, completely
D	anaphase	separate, daughter, opposite
E	telophase	cell, membrane
F	cytokinesis	cytoplasm, cell wall, pinches, formed
G	interphase	interphase, cell cycle


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 **Check Your Learning**

1. (a) What are the three stages of the cell cycle and what takes place during each?
(b) Why would you expect cells to spend the greatest percentage of their cycle in interphase?

(a) interphase – the DNA and the organelles are duplicated
mitosis – the DNA is divided
cytokinesis – the cell splits
(b) the DNA and organelles being duplicated – it takes time to get it right and to check it!


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 **Check Your Learning**

2. A skin cell in a cat has 38 chromosomes. It divides and produces two daughter cells.
(a) How many chromosomes will each daughter cell have?
(b) Why is this important?

(a) 38
(b) the chromosomes contain the genetic information


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 **Check Your Learning**

3. During which phase of mitosis do the chromatids separate from each other?

anaphase


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 **Check Your Learning**

4. The nerve cells in our bodies rarely undergo mitosis. Use this information to explain why complete recovery from injuries to our nervous system may not occur.

mitosis is responsible for healing and tissue repair so ...


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 **Check Your Learning**

5. Radiation and toxins in tobacco smoke and other chemicals can break chromosomes apart. Why is this dangerous?

chromosomes contain genetic information – the cell will attempt to fix the DNA and put it back together if possible – if the DNA sequence is wrong then it could lead to mutations/birth defects or cancer or ...

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 **Check Your Learning**

TEXTBOOK
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