

Regents Biology

(pp. 397 - 415)

* Class Notes *

(pp. 397 - 415)

North Salem High School

MISSION: *Engage students to continuously learn, question, define and solve problems through critical and creative thinking.*

Mitosis

(Asexual Reproduction)

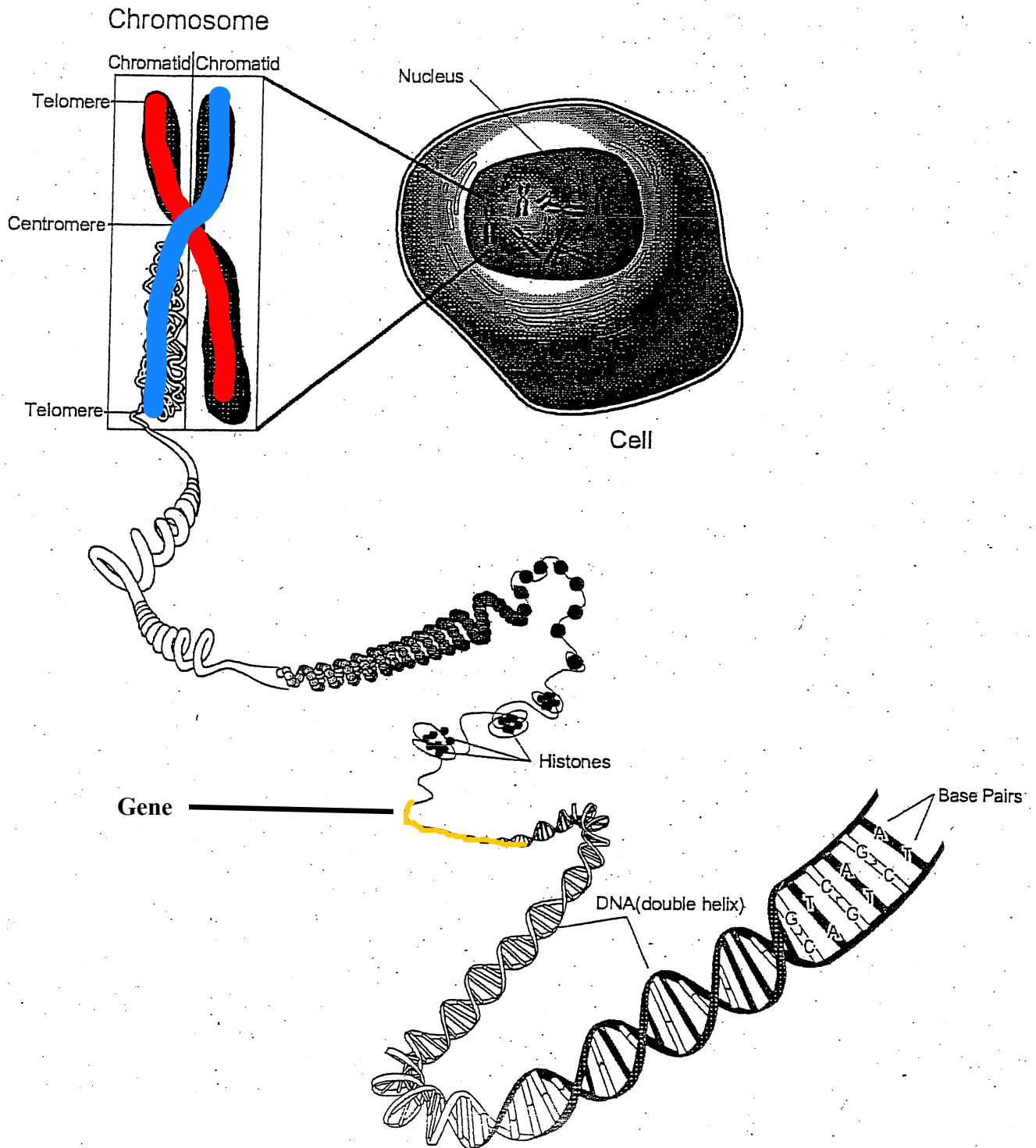
*Now that you know how the DNA molecule located in the nucleus of every cell can make a copy or replicate itself, this unit will look at the stages of **cell division** that separates this replicated DNA → replicated chromosomes into 2 genetically identical daughter cells. We will also discuss the disease associated with uncontrolled cell division called **cancer**.*

Let's get to work!

If you have any problems – please sign up for extra help after school.

**Mr. Collea
Room W-19**

Chromosome



I. MITOSIS (pp. 397-404)

Upon completion of this unit the student will:

- __ 1. Describe the process of DNA replication.
- __ 2. Recognize that the process of mitosis occurs in *autosomes* (non-sex cells).
- __ 3. Recognize that the process of mitosis involves only **ONE** DNA replication and **ONE** cell division which produces cells with the **SAME** numbers and **SAME** kinds of chromosomes as the parent cell.
- __ 4. Explain the difference between *mitosis* and *cytokinesis*.
- __ 5. List the major phases and describe the major events in each phase during the process of mitosis and cytokinesis in a typical animal cell.
- __ 6. Explain the difference between a *chromatid*, *centromere*, and a *centriole*.
- __ 7. List two ways the process of mitosis differs between plant and animal cells.
- __ 8. List the significant results of mitosis.
- __ 9. Define the term *cancer*.
- __ 10. List the major causes to the major cancers found in humans.
- __ 11. Define the term *telomeres*.
- __ 12. Explain the possible role telomeres play in the aging process.
- __ 13. Explain the difference between asexual reproduction and sexual reproduction.
- __ 14. Correctly define what is meant by the following methods of asexual reproduction and list examples of each; *binary fission*, *budding*, *sporulation*, *regeneration*, and *vegetative propagation*.
- __ 15. Recognize that asexual reproduction is a form of mitosis and that individuals produced during asexual reproduction are **GENETICALLY IDENTICAL** to their parent.

VOCABULARY

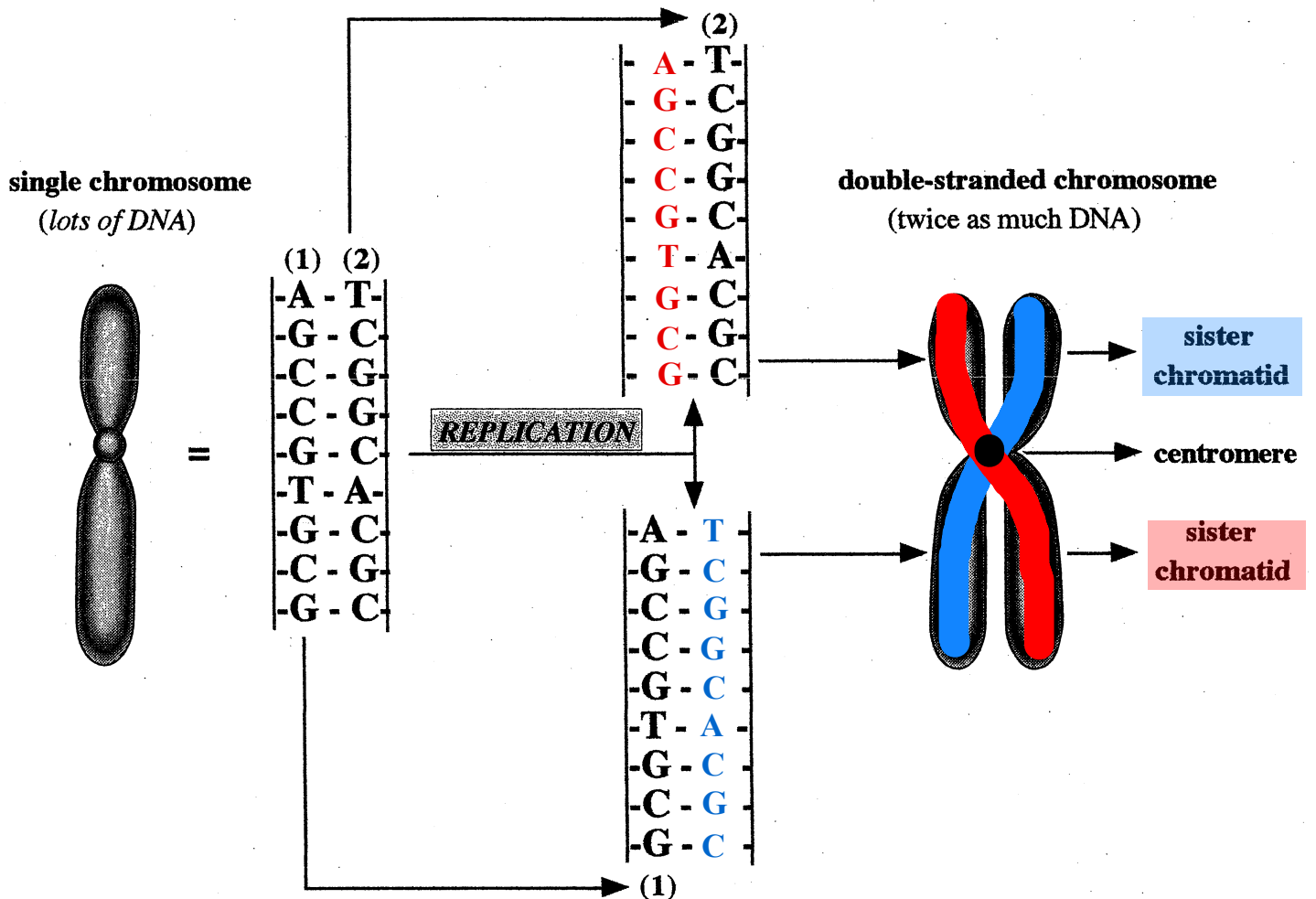
asexual reproduction
sexual reproduction
DNA replication
chromosome
chromatid
centromere
mitosis
telomere

autosomes
cytokinesis
centriole
interphase
prophase
metaphase
anaphase
telophase

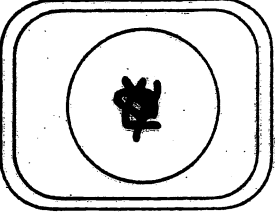
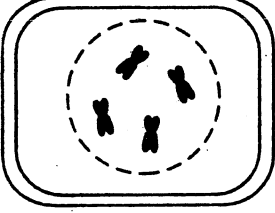
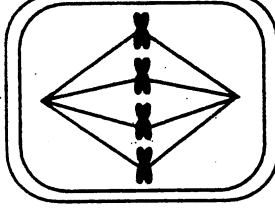
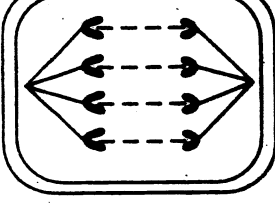
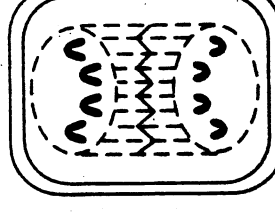
daughter cells
cloning
binary fission
budding
sporulation
regeneration
vegetative propagation
cancer

A. DNA REPLICATION

- During replication DNA "unzips" or splits down the center allowing the base pairs to separate. This produces 2 distinct strands of DNA.
- Free nucleotides come in, match up with the correct bases, and join together to form a *complimentary* strand for each original strand. The result is 2 identical strands of DNA which coil up tightly to form a replicated chromosome held together at the centromere.
- The double-stranded chromosome then divides and each chromosome ends up in the nucleus of each genetically identical daughter cell. (sister chromatid)
- This replication and division of the nucleus is called mitosis.



B. STAGES OF MITOSIS: ()

<i>Stage Name:</i>	<i>Stage Description:</i>
 <p>(1) INTERPHASE</p>	<p>(1) DNA Replication occurs.</p>
 <p>(2) PROPHASE</p>	<p>(1) Double-stranded chromosomes condense. (2) Nuclear membrane breaks down. (3) Centrioles move to opposite sides of the cell. (4) Spindle fibers emerge from the centrioles.</p>
 <p>(3) METAPHASE</p>	<p>(1) Double-stranded chromosomes line up along the equator (center) of the cell.</p>
 <p>(4) ANAPHASE</p>	<p>(1) Double-stranded chromosomes separate at the centromere. (2) Chromosomes migrate (move) to opposite sides of the cell.</p>
 <p>(5) TELOPHASE</p>	<p>(1) 2 sets of chromosomes reach opposite sides of the cell. (2) Nuclear membrane reforms around the 2 nuclei. RESULT = 1 cell with 2 genetically identical nuclei</p>

C. CYTOKINESIS (movement of the cytoplasm)

CYTOLOGY REVIEW:

Do you remember the **MAIN** differences between animal and plant cells?

- (1) Animal cells have centrioles used in cell division.
- (2) Plant cells have chloroplast filled with chlorophyll used in photosynthesis.
- (3) Plant cells have a cell wall composed of cellulose.

- *(telophase)* At the end of mitosis, we are left with 1 cell with 2 genetically identical nuclei. In order to get TWO cells, the cytoplasm must divide forming two separate cells.
- This process is called cytokinesis.
- Due to the structural differences between animal and plant cells, the process of cytokinesis is NOT the same for both kinds of cells.

1. CYTOKINESIS IN ANIMAL CELLS [Figure 20-4]

- Cytoplasmic division occurs by the pinching in of the cytoplasm

2. CYTOKINESIS IN PLANT CELLS [Figure 20-6]

- Cytoplasmic division occurs by the formation of a cell plate that joins with and turns into the cytoplasm

II. ASEXUAL REPRODUCTION (404 - 411)

REPRODUCTION - the life function by which living things produces new organisms of their *own kind* or species.

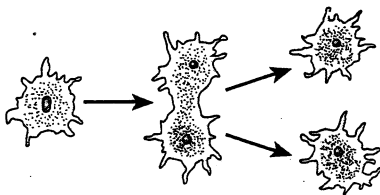
A. 2 TYPES OF REPRODUCTION

ASEXUAL	SEXUAL
<p>(1) Involves only <u>1</u> parent.</p> <p>(2) Offspring are genetically <u>IDENTICAL</u> to parent.</p> <p style="text-align: center;">↓</p> <p style="text-align: center;"><u>CLONES</u></p>	<p>(1) Involves <u>2</u> parents</p> <p>(2) Offspring contain genetic material (<u>DNA</u>) from <u>2</u> parents and are <u>NOT</u> genetically identical to either one.</p> <p style="text-align: center;">↓</p> <p style="text-align: center;"><u>VARIATION</u> <i>(genetically different)</i></p>

B. EXAMPLES OF ASEXUAL REPRODUCTION

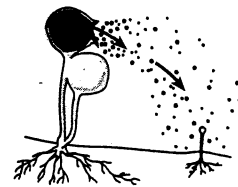
(1) Binary Fission

- Parent organism divides into two EQUAL parts.



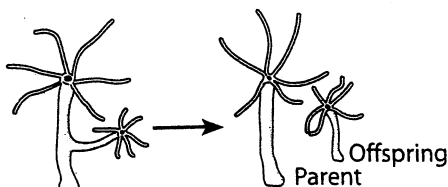
(3) Sporulation

- Bread mold forms SPORES to produce more bread mold.



(2) Budding

- Parent organism divides into two UNEQUAL parts.



(4) Vegetative Propagation

- When plants reproduce using roots, stems, and leaves.



III. THE SCIENCE OF AGING (1960's)

Review of Biological Organization

Atoms → Molecules → Organelles → Cells → Tissue → Organs → Organ Systems → Organisms

C	Carbohydrates	Mitochondria			Heart	Circulatory	
H	Fats/Lipids	Cytoplasm			Stomach	Digestive	
O	Proteins	Nucleus			Brain	Nervous	
N	DNA	Cell Membrane					
	Water						

A. Possible Causes of Cellular Aging

- (1) _____
- (2) _____
- (3) _____

B. The Telomere Hypothesis

“Normal” cells can only divide by mitosis a limited number of times and this number of cell divisions is related to the age and lifespan of an organism.

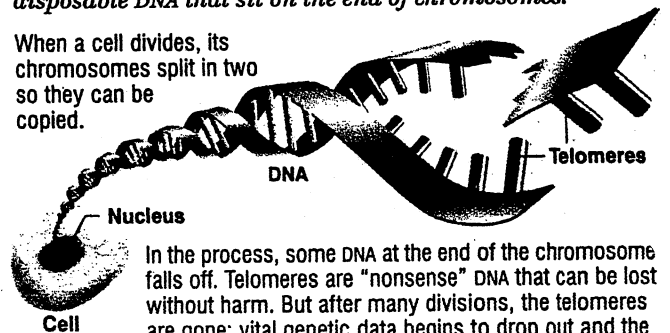
EXAMPLES:

Organism	Cell Divisions	Life Span
Fruitfly	15	30 days
Butterflies	15	84 days
Mice	20	2-4 years
Dogs	30	15 years
Humans	50	122 years
G. Tortoise	100	175 years

The cellular time bomb

One theory of aging focuses on telomeres, bits of disposable DNA that sit on the end of chromosomes.

When a cell divides, its chromosomes split in two so they can be copied.



In the process, some DNA at the end of the chromosome falls off. Telomeres are “nonsense” DNA that can be lost without harm. But after many divisions, the telomeres are gone; vital genetic data begins to drop out and the cell begins to malfunction.