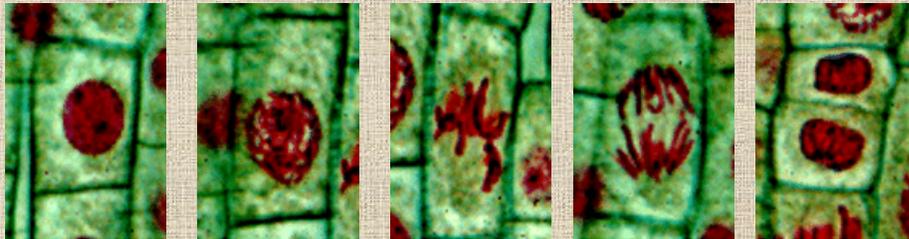


Cell Division

...the formation of new cells



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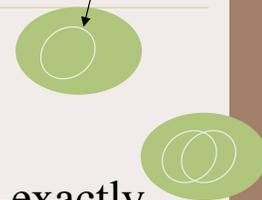
lev 1cell division.ppt

1

1. Bacteria divide in a simple form of reproduction called Binary Fission.

- A. Bacterium - the single circular chromosome is duplicated
- B. Cell pinches together - 2 new cells - exactly the same genetic info.

CHROMOSOME



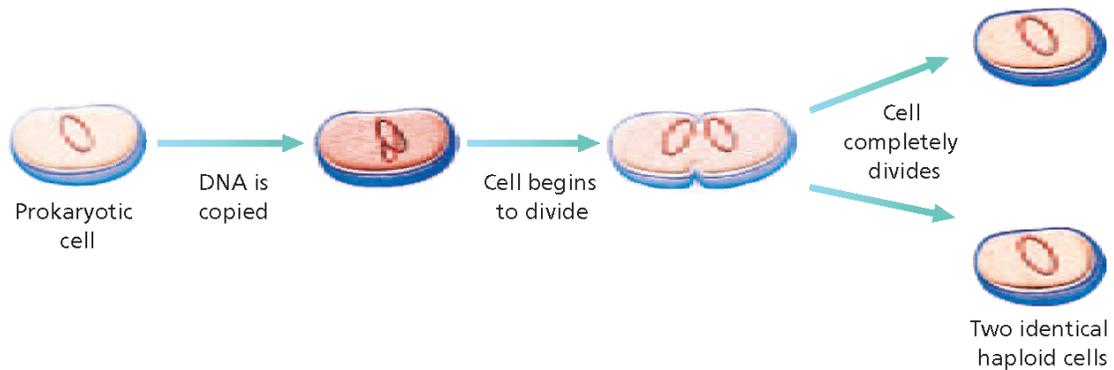
Question.. Is this more complicated or less complicated than a eukaryotic cell?



5/19/14

2

Binary fission in bacteria



5/19/14

3

Q. What types of problems could occur, if the information stored in cells is copied incorrectly?

- Answers:
 - Cancer
 - Passage of genetic problems to offspring
- FYI: Genetic variation can be a plus or a minus

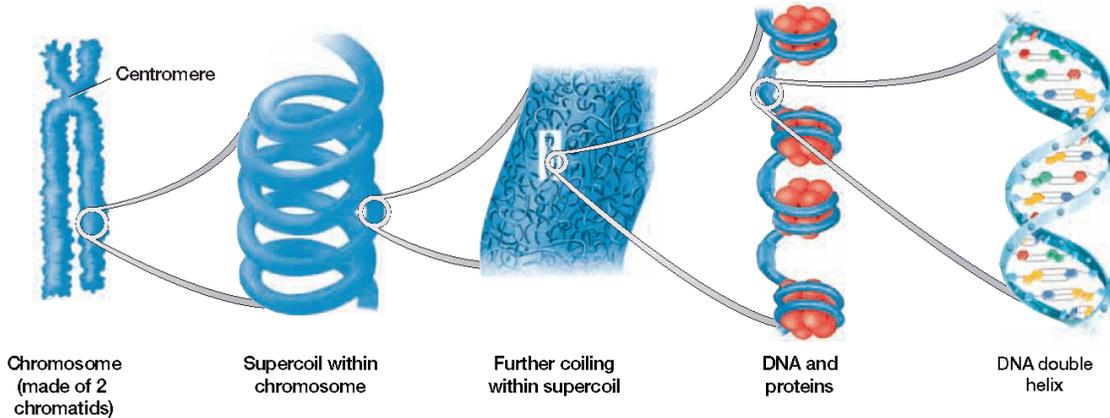
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4

2. A gene is a segment of DNA that codes for a protein or RNA molecule

a) DNA coils around proteins to fit inside nucleus

b) Versions of genes are contained on chromosomes



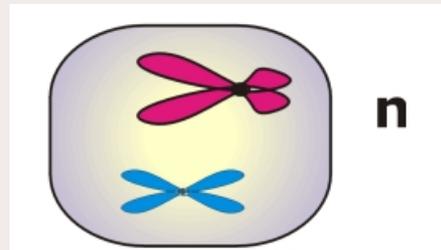
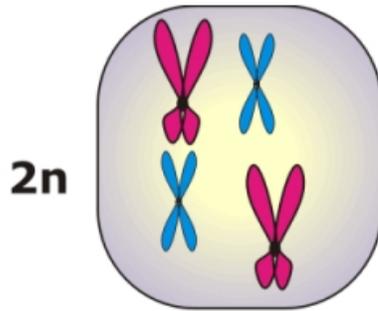
Chromosome vs. gene



Visual Concept

3. Chromosome terms

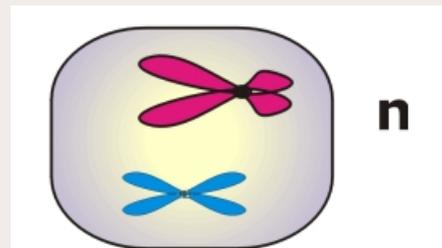
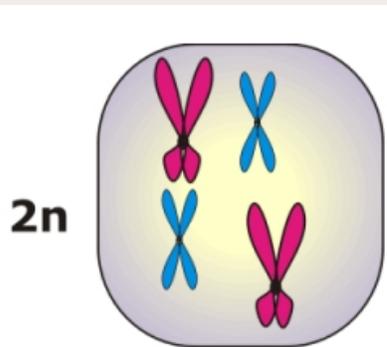
- a) Sister chromatids -IDENTICAL sides attached at centromere
- b) Homologous chromosomes- SIMILAR in size, shape, and genetic info, not attached



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3. continued

- c) Haploid- “n” one set of chromosomes- 2 common examples: gametes in eukaryotes & chromosome in bacterial cell
- d) Diploid- “2n” two sets of chromosomes
Examples: somatic cells and germ cells



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8

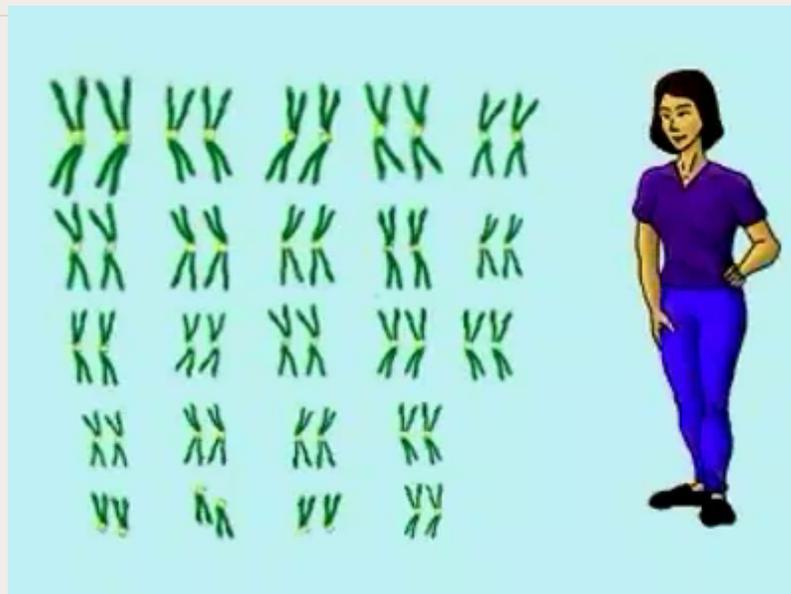
Homologous Chromosomes



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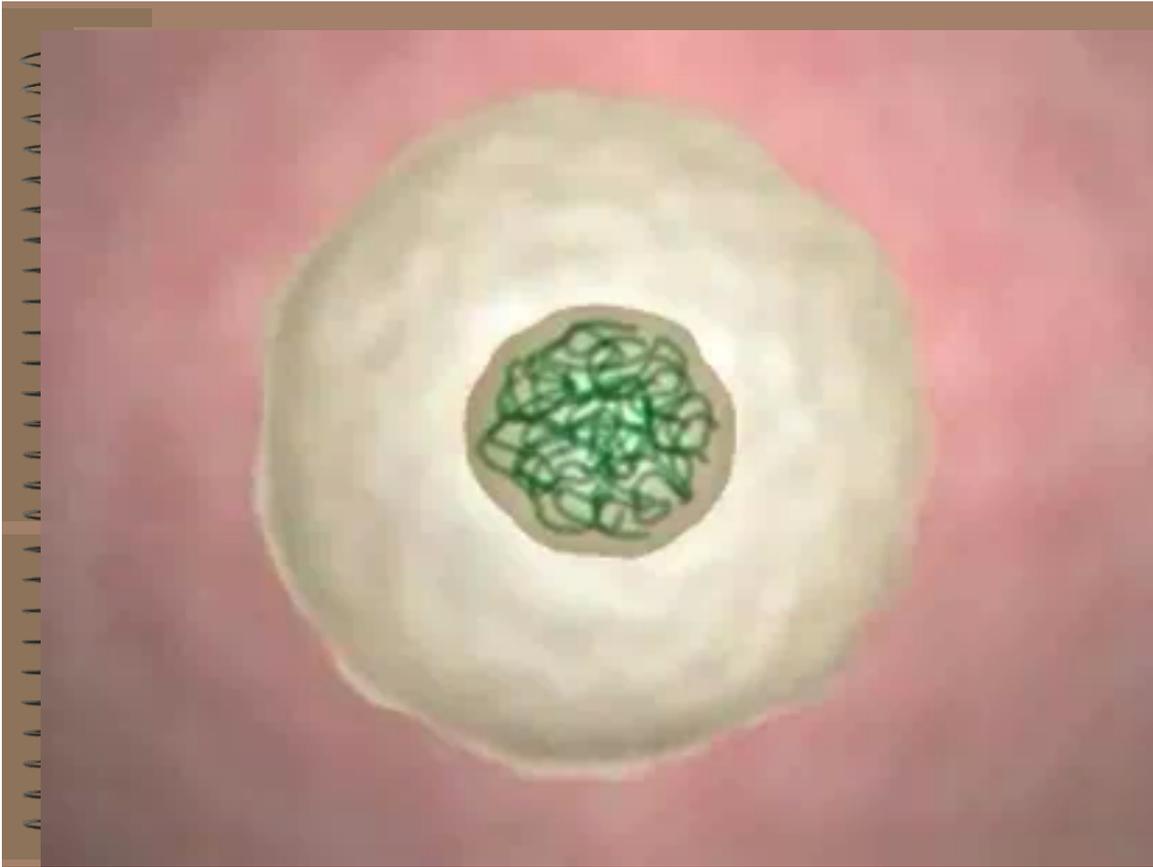
9

Comparing Haploid and Diploid



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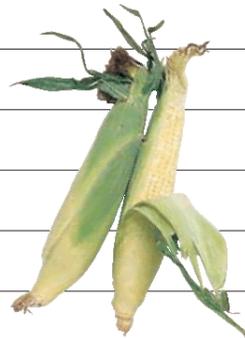
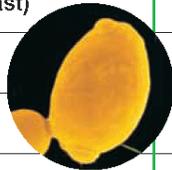
10



Chromosome Number

2n Diploid

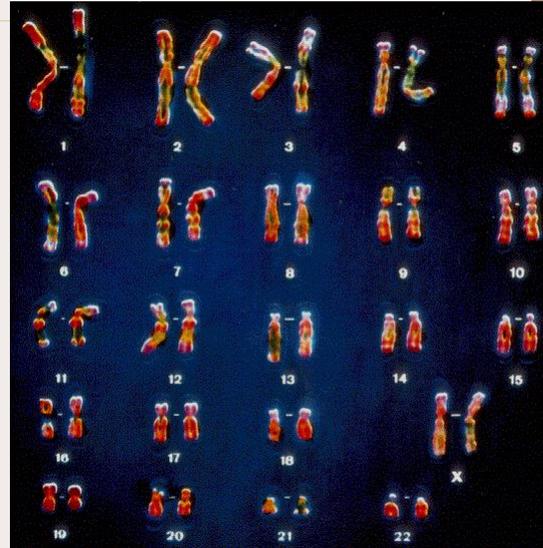
Organism	Number of chromosomes
<i>Penicillium</i>	1-4
<i>Saccharomyces</i> (yeast)	18
Mosquito	6
Housefly	12
Garden pea	14
Corn	20
Adder's tongue fern	1,262
Frog	26
Human	46
Orangutan	48
Dog	78



4. A Karyotype shows each chromosome aligned with its homologous partner.

A. Humans have
46 chromosomes
($2n=46$)

B. homologous pair -
one chromosome
from dad and one
from mom



5/19/14

13

5. Sex Chromosomes & Autosomes

A. Each somatic cell has 22 pairs of
homologous chromosomes (autosomes) and
1 pair of sex chromosomes.

B. Females-XX, Males-XY

How many pairs of chromosomes do humans have?

What is the diploid chromosome #?

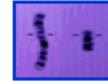
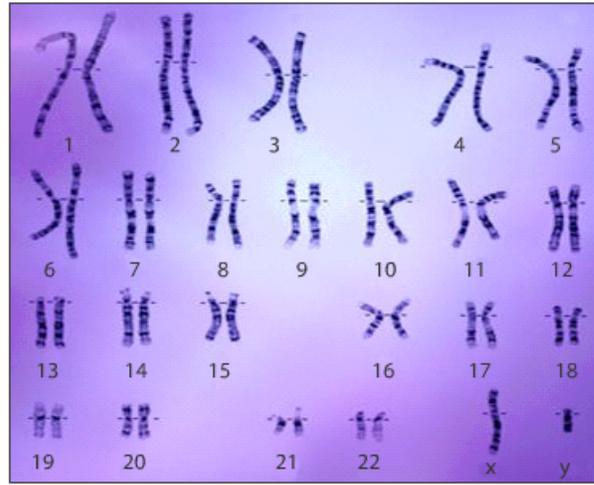
What is the haploid chromosome #?

How many autosomes do humans have?

5/19/14

14

Autosomes vs Sex Chromosomes



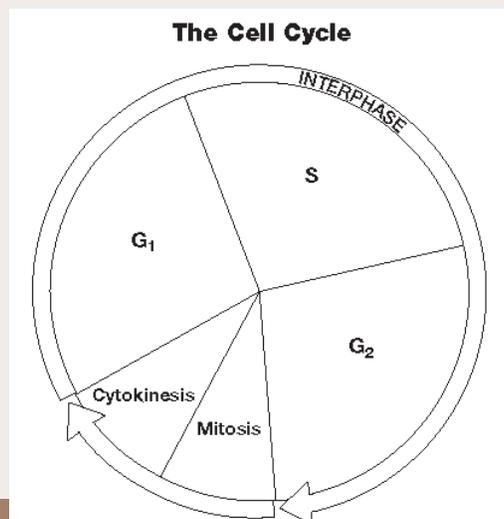
Visual Concept

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15

6. The Cell Cycle describes the life of a Eukaryotic cell

a) Cell Cycle (4 stages- G_1 S G_2 M)



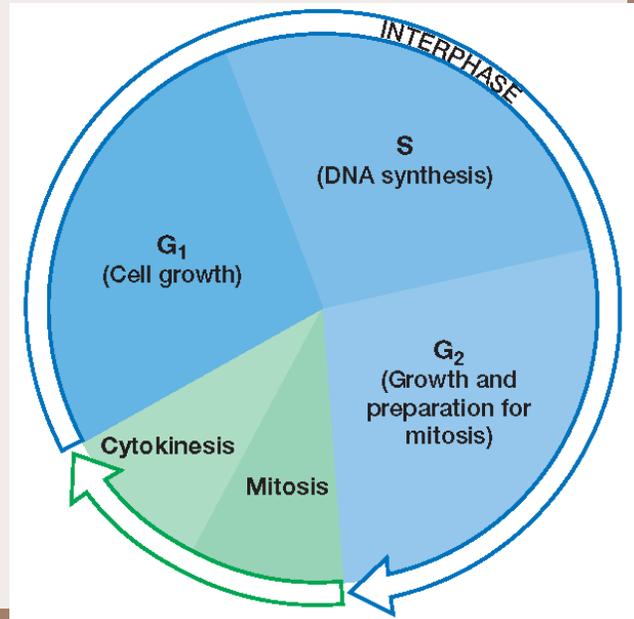
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16

6. Continued...

b) A cell spends 90% of its life in the first 3 phases of the cell cycle called Interphase (G_1 , S & G_2).

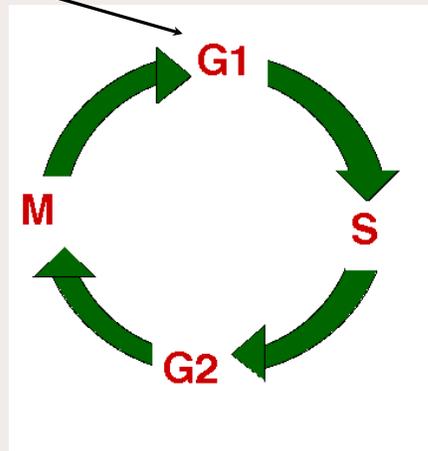
c) mitosis=nuclear division



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The Cell Cycle

After formation of a new cell, the cycle begins at G_1



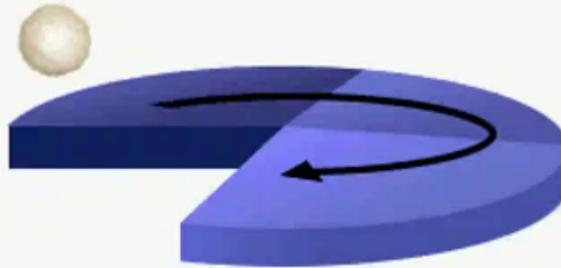
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18

7. G1 (First growth phase) a cell grows rapidly and carries out normal cell functions.

fyi...G1 is when a cell does the things that it is made to do.

Interphase
Growth and synthesis



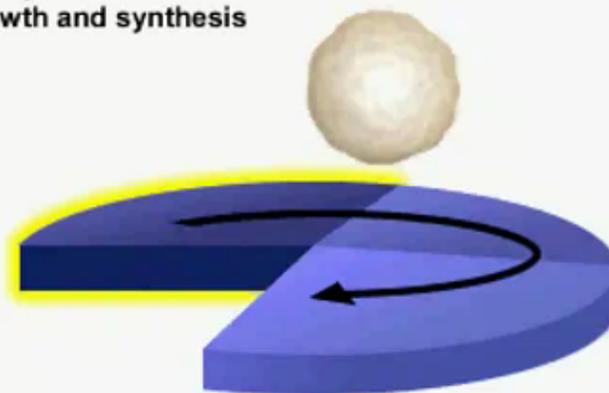
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19

8. During S (Synthesis) phase a cell's DNA is copied (replication).

(Where does this happen?)

Interphase
Growth and synthesis

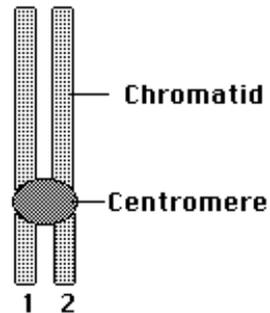


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20

9. Before division, each chromosome must be copied and condensed.

A. This results in two identical sister chromatids



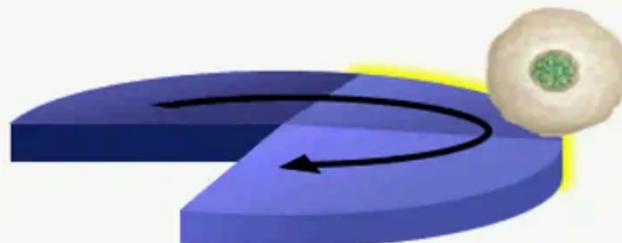
Replicated Chromosome

21

10. G₂ (Second growth phase)- preparations are made for the nucleus to divide.

- a) Microtubules (spindle apparatus) built to move chromosomes around. (Centrioles come from centrosome to build it.)
- b) Organelles are duplicated

Interphase
Growth and synthesis



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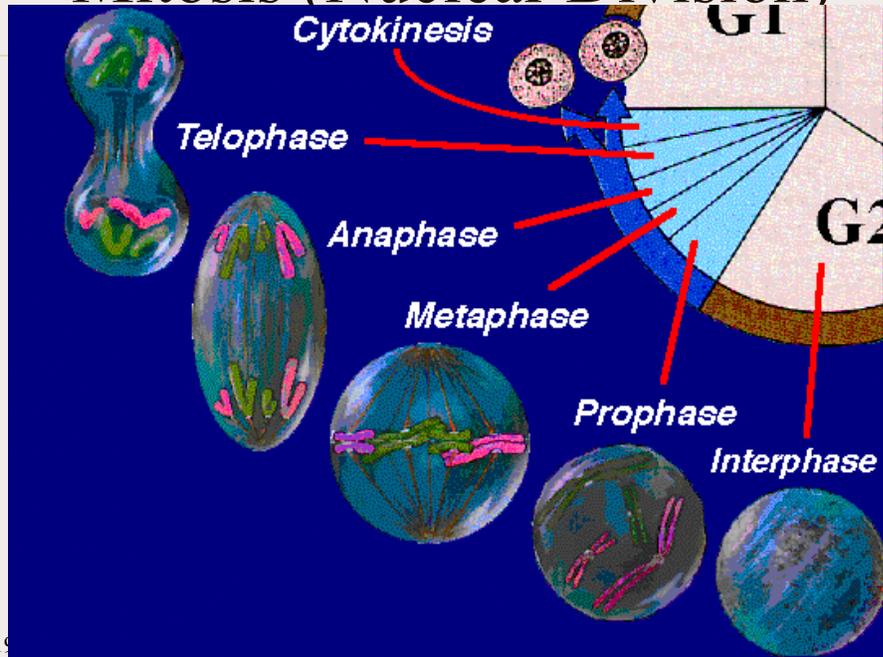
Dr. Octopus



5/19/14

23

Mitosis (Nuclear Division)



5/19

24

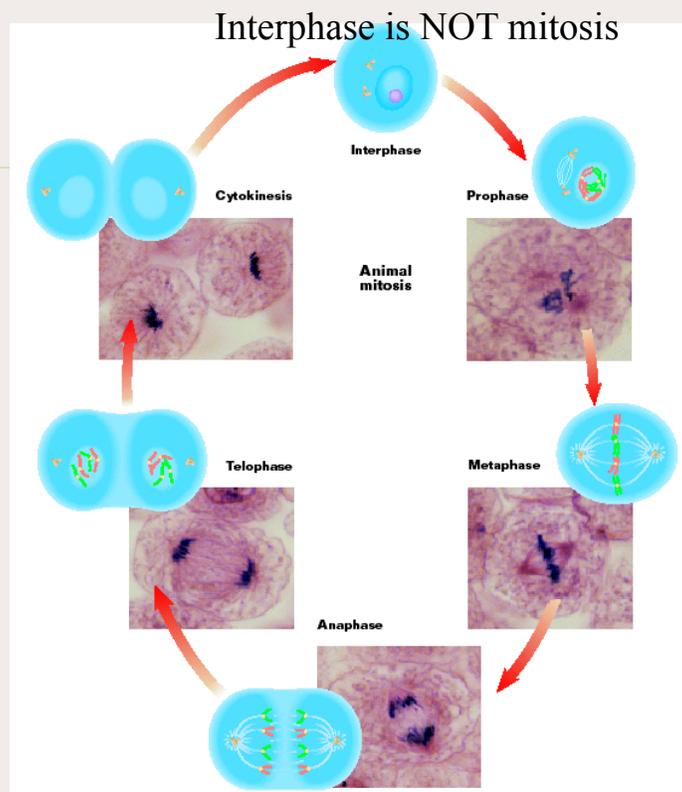
11. Mitosis - nucleus is divided into two nuclei.

- a. Chromosomes made during “S” are pulled into place by the microtubules built during G2.
- b. After mitosis each nucleus has the same number of chromosomes containing **EXACTLY** the same versions of all genes.
- c. Somatic cells undergo mitosis
 - Somatic- normal body cells (2n)

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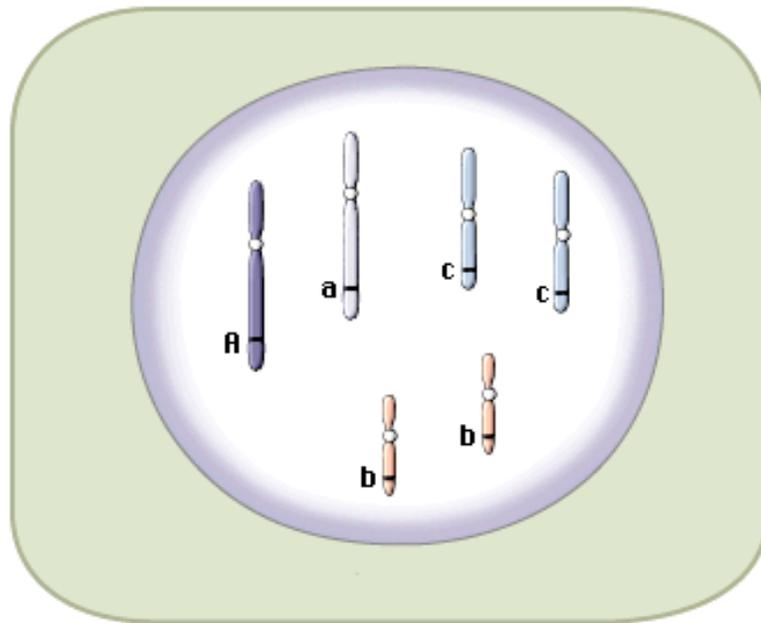
25

Another
look at
Mitosis



5/19/14

Another look at Mitosis

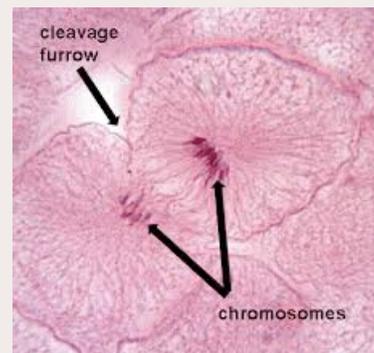


27

12. Cytokinesis -cytoplasm divides



a. Cell plate
plant

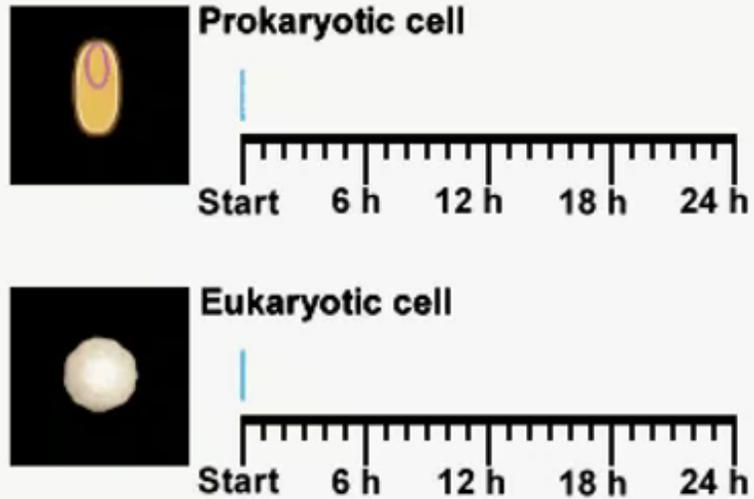


b. Cleavage furrow
animal

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28

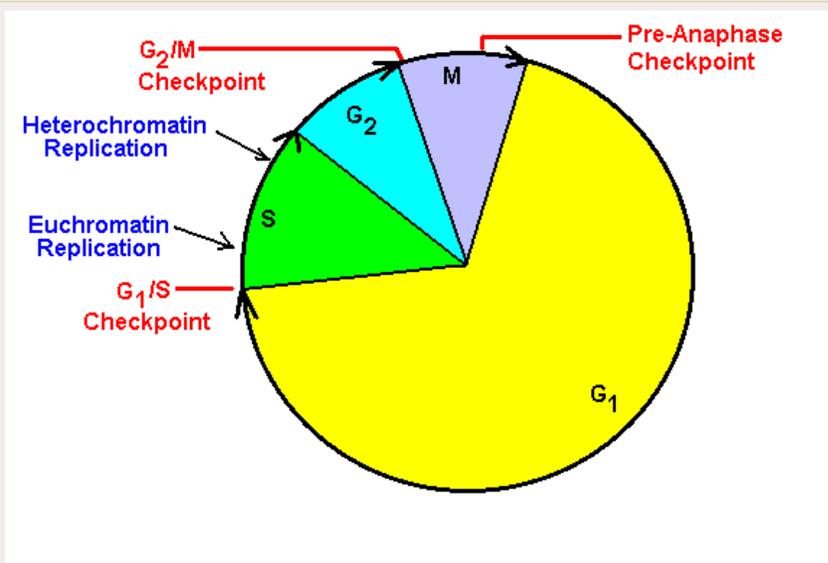
Comparing Cell Division in Prokaryotes and Eukaryotes



5/19/14

29

Cell Cycle Checkpoints



5/19/14

30

13. Environmental factors can cause mutations that promote cancer

- a. Drugs and alcohol
- b. UV light from the sun
- c. Viruses
- d. Smoking
- e. overweight



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31

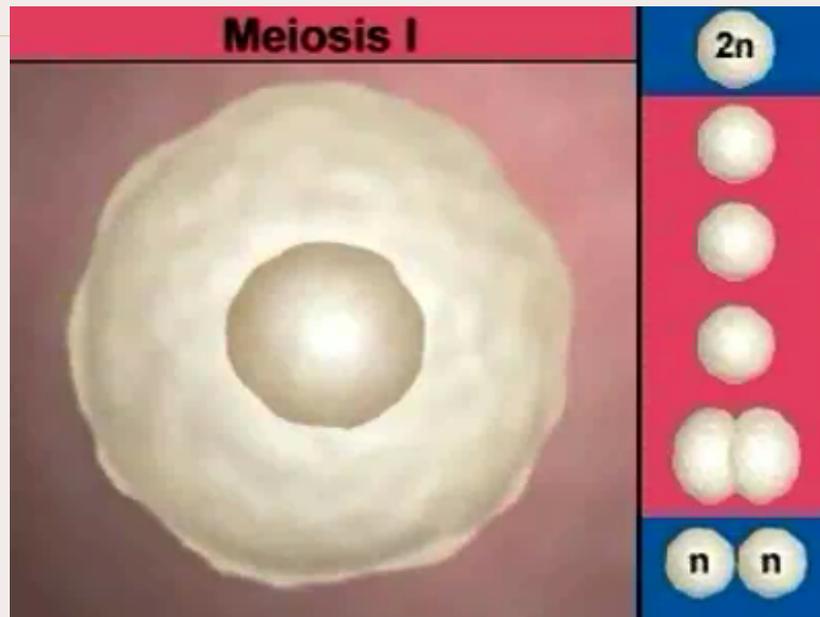
14. Germ cells go through a different form of division called Meiosis.

- A. Germ cells- located in the testes and ovaries.
 - B. Meiosis begins with a diploid cell ($2n$).
 - C. One replication of chromosomes, followed by 2 divisions results in 4 haploid cells (n).
 - D. This type of division occurs only in the formation of sperm and eggs (gametes).
 - E. Gametes are reproductive cells that are haploid.
- Fyi...Gametes **MUST** be haploid or else the number of chromosomes an organism contains would always double.

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32

Meiosis- the movie



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33

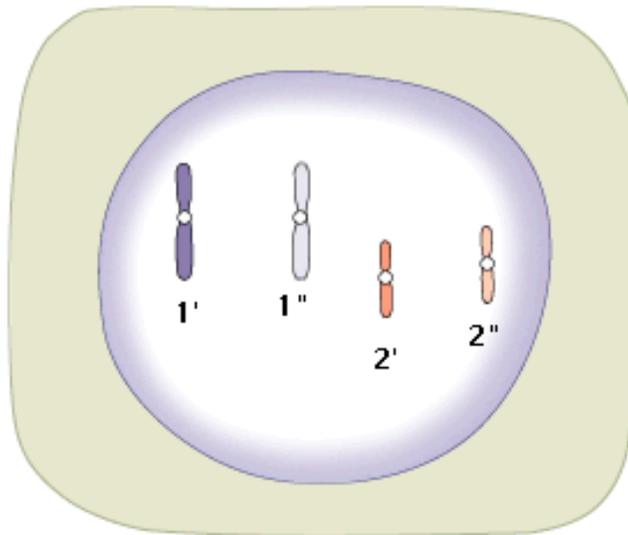
15. Meiosis I is a reduction division ($2n$ to n)

- A. Homologous chromosomes are separated instead of sister chromatids.
- B. 2 cells are formed, each with one copy of each chromosome type (n).
- C. The chromosomes in these n cells, are still attached to their sister chromatid.
- D. It is during Meiosis II that the sister chromatids are separated.

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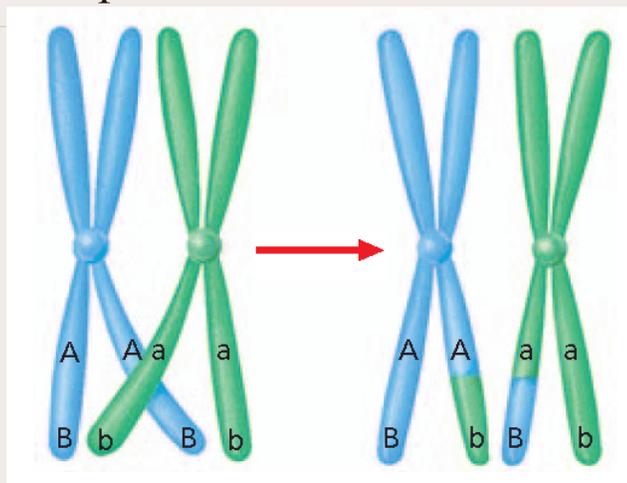
34

Meiosis



35

16. Crossing over (Prophase I) recombines the organism's parents chromosomes

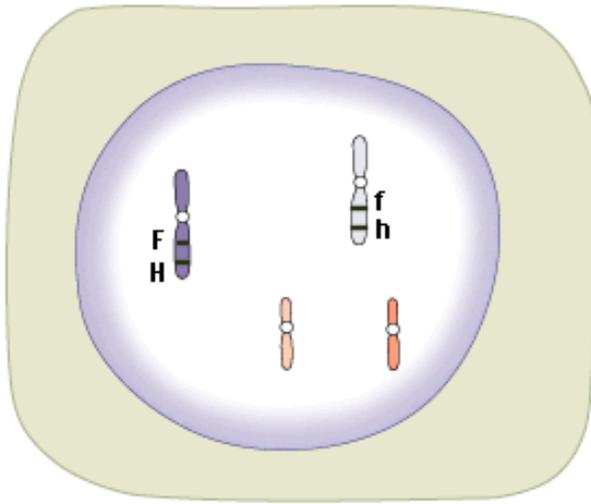


Visual Concept

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36

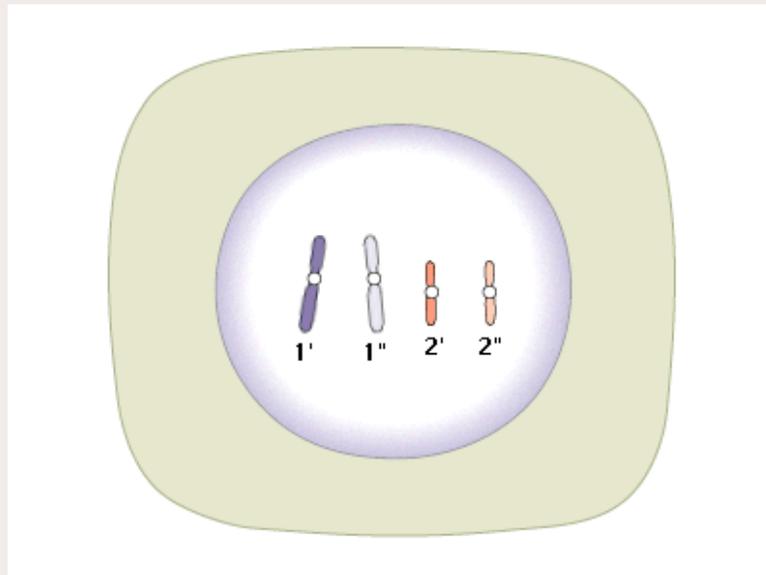
Crossing over - movie



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37

17. Nondisjunction- failure of chromosomes to separate when they should

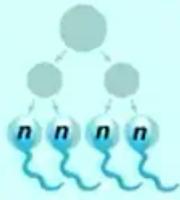


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38

Results of meiosis

Spermatogenesis



Oogenesis



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Visual Concept

39

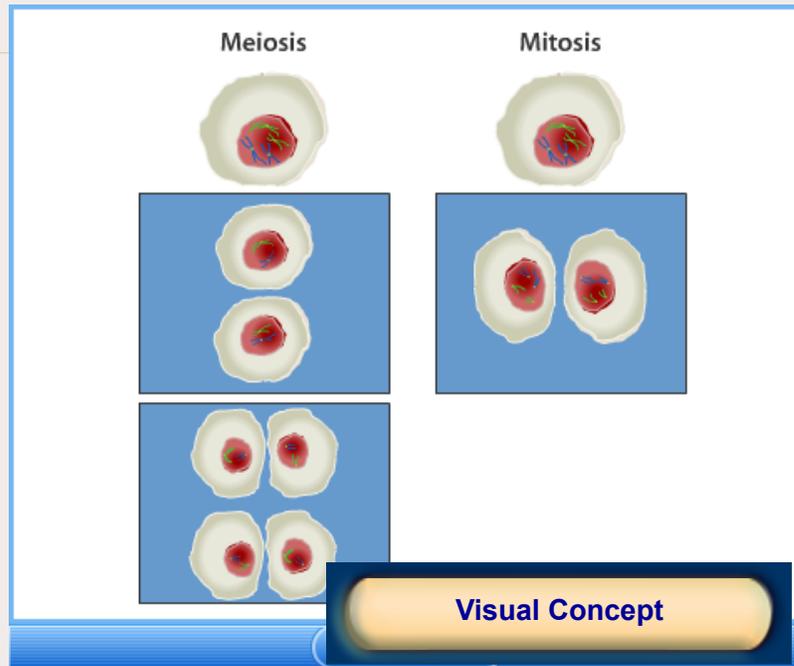
18. Results

- A. Spermatogenesis- formation of sperm cells
- B. Oogenesis- formation of 1 egg and 3 polar bodies
- C. Zygote=sperm + egg, this restores the diploid number

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40

Comparing mitosis and meiosis

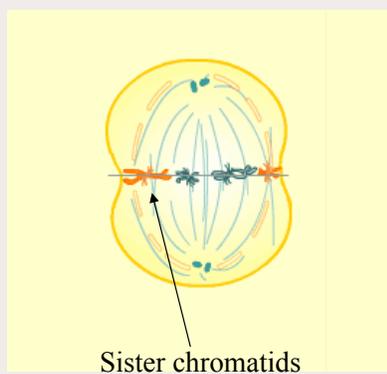


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41

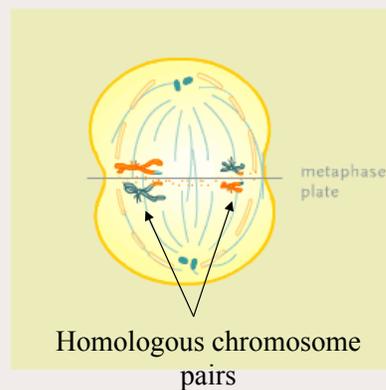
Metaphase (Mitosis) vs. Metaphase I (Meiosis)

Mitosis



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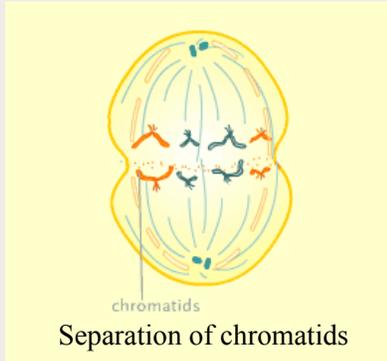
Meiosis



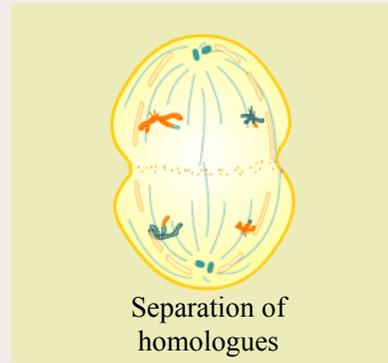
42

Anaphase (Mitosis) vs. Anaphase I (Meiosis)

Mitosis



Meiosis

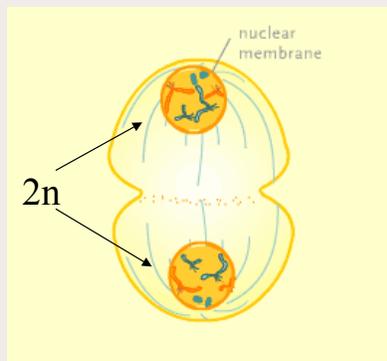


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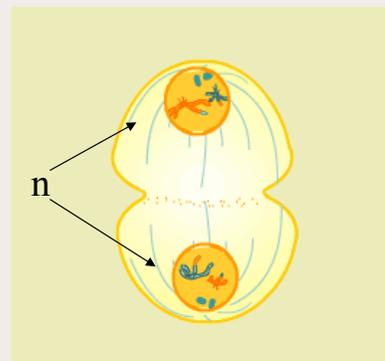
43

Telophase (Mitosis) vs. Telophase I (Meiosis)

Mitosis



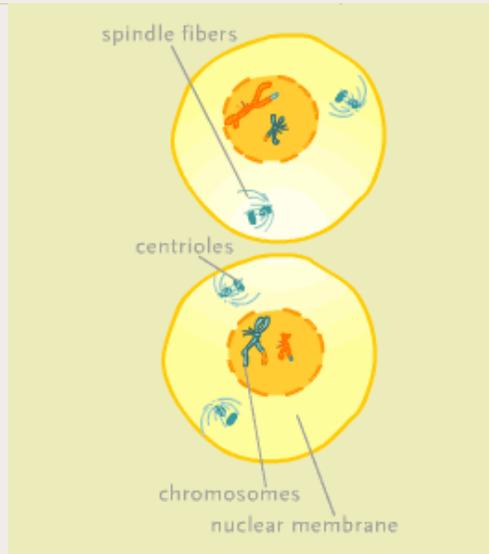
Meiosis



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44

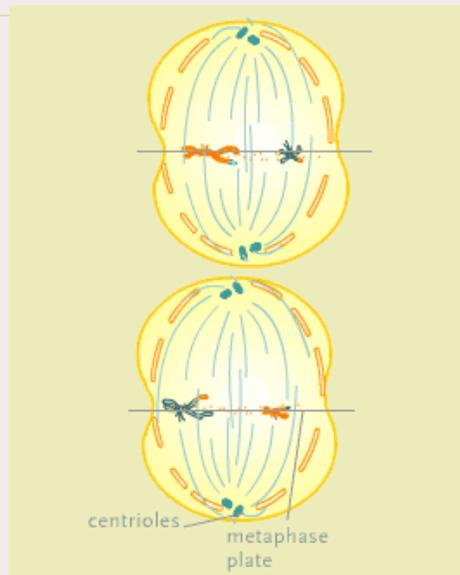
Prophase II (Meiosis)



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45

Metaphase II (Meiosis)

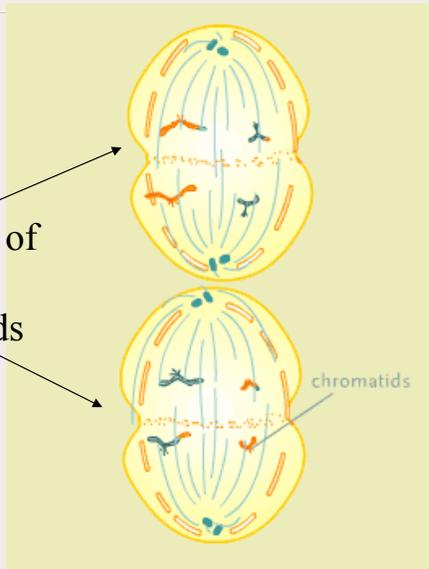


5/19/14

46

Anaphase II (Meiosis)

Separation of
Sister
Chromatids

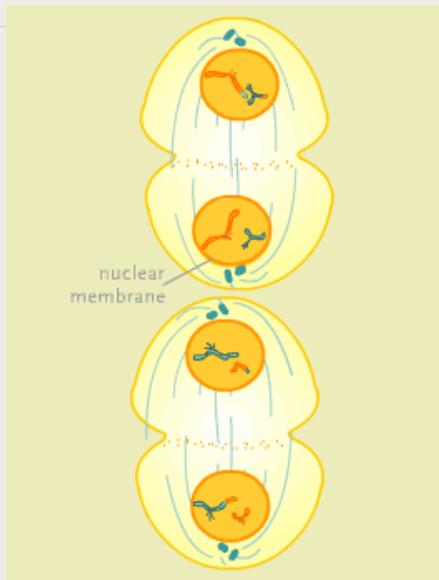


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47

Telophase II (Meiosis)

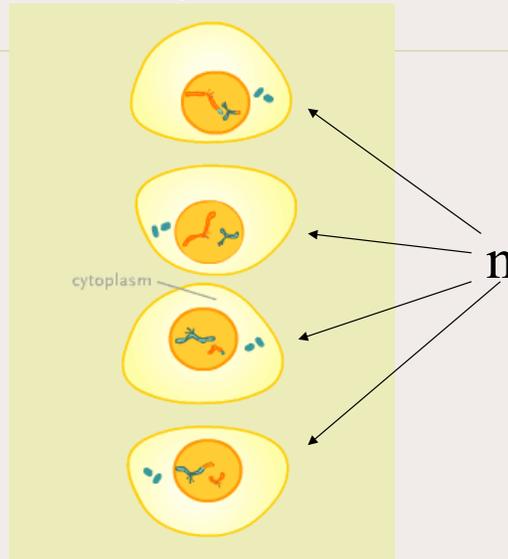
nuclear
membrane



5/19/14

48

The results of Cytokinesis II (Meiosis)

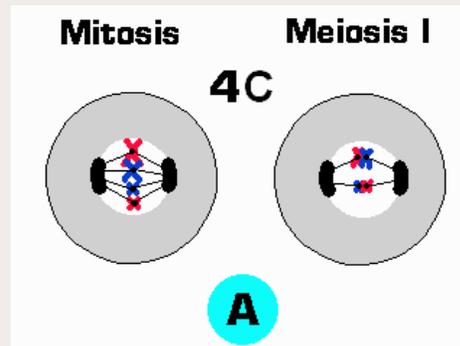


5/19/14

49

Q. What is the difference between Metaphase of mitosis and Metaphase I (I implies meiosis).

A. In Metaphase, chromatids are aligned single file, while in Metaphase I, chromatids are paired with their homologues.



5/19/14

50



5/19/14

51

Fully Colored Picture- Graphic Organizer

Sister Chromatids

Parrot book pg.280

Black book pg: 163

Draw and label, also label the centromere

Homologous Pair

Draw 2 pairs

Parrot book pg.282,each picture shows 2 pairs- one large pair and one small pair

Black book pg 163 shows one pair

Haploid

Draw 2 cells: $n=3$ and $n=4$

Parrot book page 326,Each telophase side shows $n=2$ (chromosomes still replicated). 4 haploid cells at bottom shows non replicated haploid cells

Black book: page 161 middle two meiosis pics

Diploid

Draw 2 cells

$2n=4$ and $2n=6$

Think of $2n$ as 2 "shoes" or one pair) Parrot book page 326, see mitosis prophase picture. The 2 large chromosomes are a homologous pair, the 2 small chromosomes are a homologous pair. Compare this to the haploid pictures of meiosis beginning with Telophase 1

Black book page 161

5/19/14

52