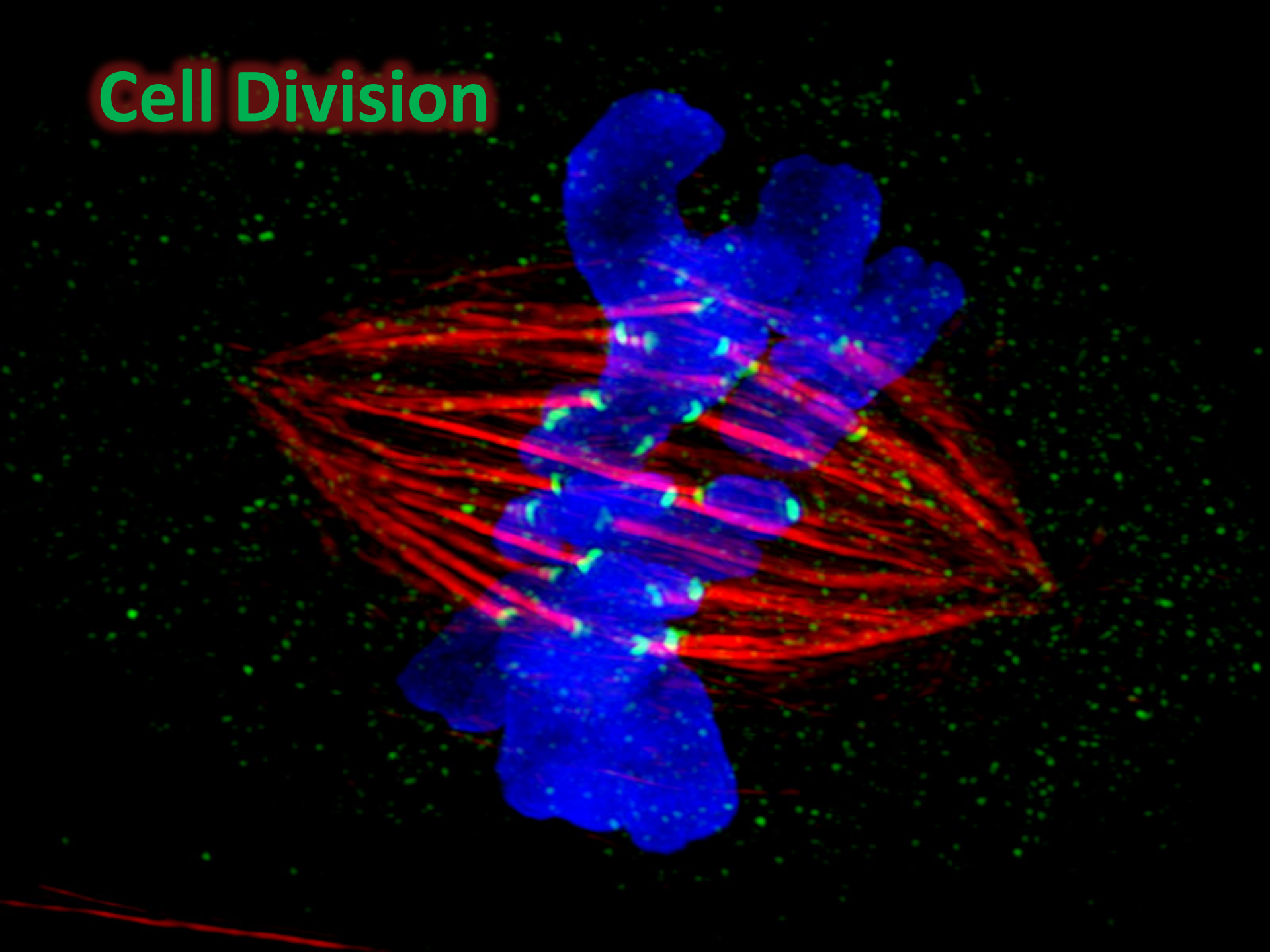
Cell Division



Introduction

- **Asexual Reproduction:** A strategy of producing offspring that are **identical** to the parent. The **advantage** in doing so is that, providing the parent is doing well, all of the offspring are also going to do well. This way an organism can produce voluminous numbers of itself and fill up the habitat. The **disadvantage** is that, if the environment changes, that could wipe out the entire population.

- **Sexual Reproduction:** A strategy of producing offspring that are **variables** of the parent or parents. The **advantage** is, should the environment change, maybe some will survive; insuring that that kind of organism survives. The **disadvantage** is that the organism produces fewer offspring that survive.

- **Ta-Dah, over time the winner is…Sexual Reproduction!**

Exercise 1: DNA Replication

If the cell is to undergo any type of cell division

this is an absolute necessity!

Otherwise, the cell would end up without any

instructions on how to maintain itself,

and how to undergo reproduction;

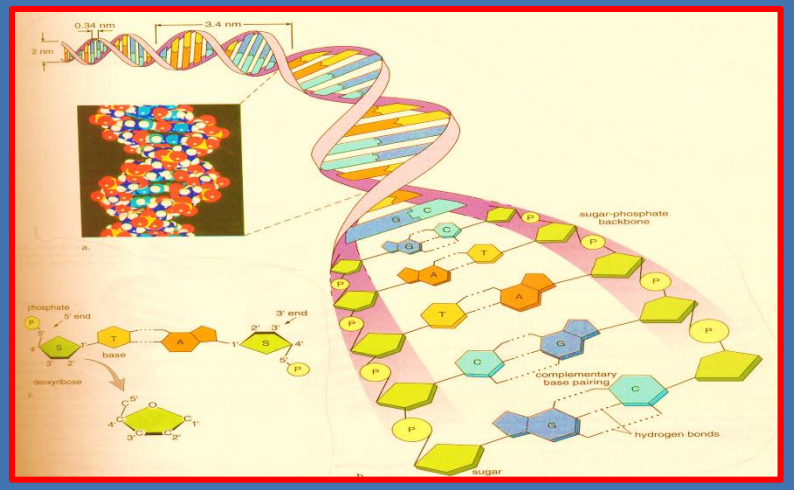
then the entire system or paradigm of maintaining organism on this planet

would break down and be shattered.

- **DNA Structure:** "Complementary base pairing."

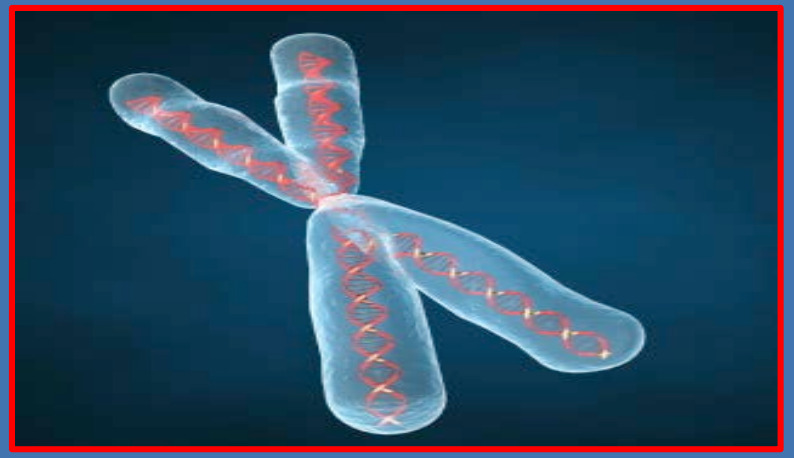
  (page 160) Answer questions 1-3 on page 160.

- **Reproduction of DNA:** by "complementary base parings." Answer a second set of questions 1-3 on page 160.



- **The Chromosome:** only forms from coiled up DNA in preparation for cell division. Once division is complete, it uncoils. After duplication the chromosome consists of two identical chromatids.

  Answer questions 1-4 page 161.



Exercise 2: Chromosome Sets

- **The One-Set Concept of Chromosomes: What is Haploid?**

  There is no duplication of items in a single set!

  At a formalized dinner there will be a place set for you, and there will be no duplication of utensils/items in that set. However there will be enough items to do the job of eating properly.

  In biology the symbol n = one set of DNA molecules, and it is always enough DNA to do the job of properly assembling the organism, maintaining the organism, and making the organism reproduce.

Answer questions 1-4 on page 162.

- **The Two-Set Concept of Chromosomes: What is Diploid?**

With two sets there is duplication of items.

At this formalized dinner, you will notice that the person sitting next to you also has one complete place set with no duplication of items in their place set. Together, the two of you represents two place sets, and you will note that for every item in your place set there is a matching item in that persons place set.

In biology 2n = two sets of DNA molecules. There are two sets of blue-prints to build two houses (organisms), but only one house (organism) is going to be built from the two copies.

Answer questions 1-4 on page 163.

- **Homologous Chromosomes:** only occurs in a diploid (two set = 2n) organism.

Homologous chromosomes are two chromosomes that look alike, but are not identical, even though they look the same.

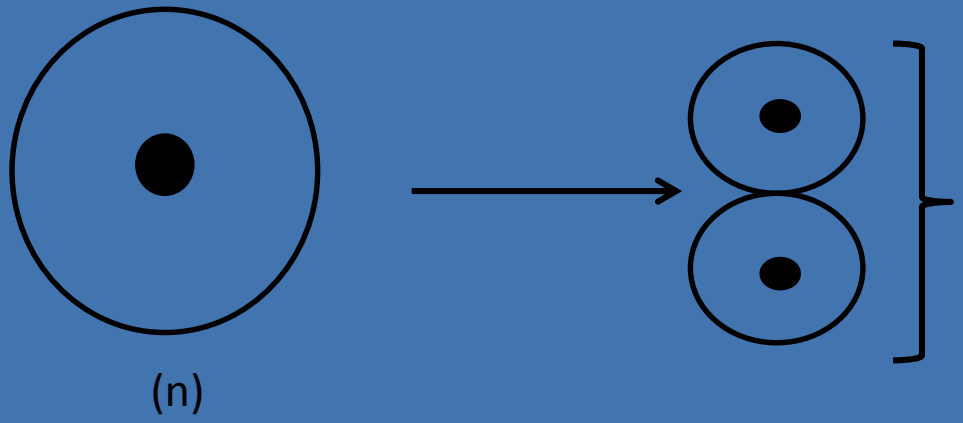
The reason chromosomes occur in non-identical pairs in a diploid organism is because the sperm contributes one full set in its nucleus, and the egg also contributes one full in its nucleus. So when they fuse, the resulting cell will contain two full sets.

For every chromosome in one set, there will be a matching (but not identical) complementary chromosome in the other set. These two chromosomes are called homologs.

Answer questions 1-4 on page 164.

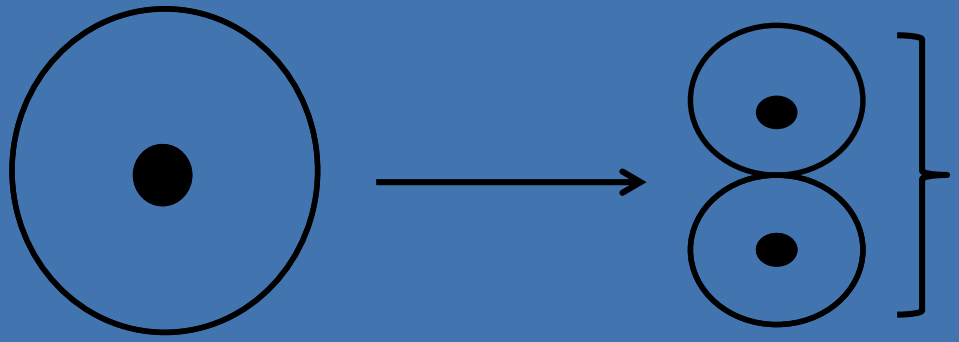
Exercise 3: Asexual Reproduction of Cells

Mitosis (Maintains Set Number)



(n)

Both n and genetically identical to one-another, and to the precursor cell.



(2n)

Both 2n and genetically identical to one-another, and to the precursor cell.

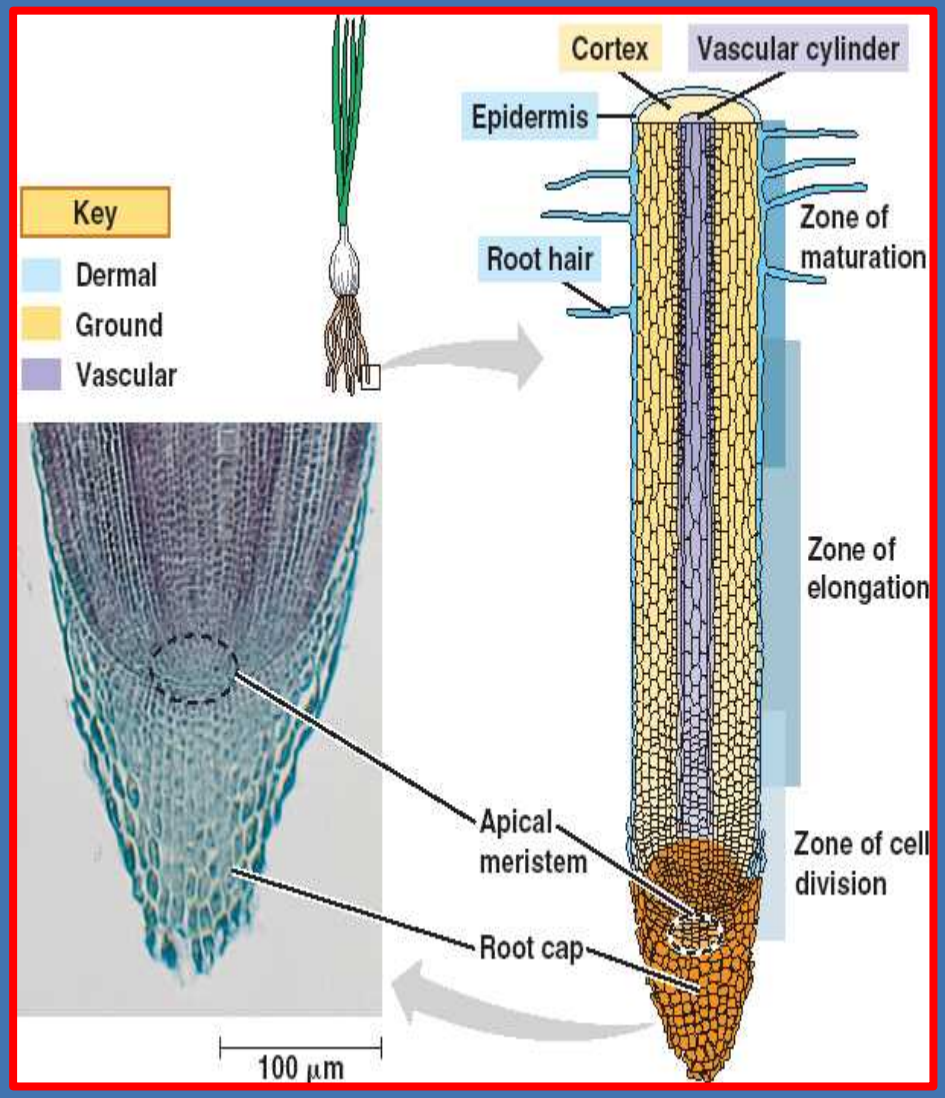
Answer questions 1-2 page 165, and questions 1-6 page 166.

Exercise 4

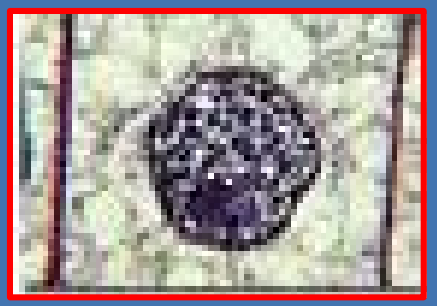
- **Chromosome Movement During Mitosis:** **This is carefully choreographed. Note the "click-it" beads exercise included on the disk.**

- **Phases of Mitosis:** **Answer questions 1-7 on page 168.**

Exercise 5: Onion Root Tip - Every cell in the root tip is in one of the following phases...



Interphase

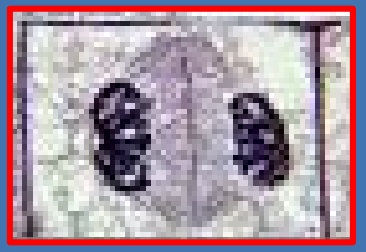


Early Prophase

Late Prophase

Metaphase

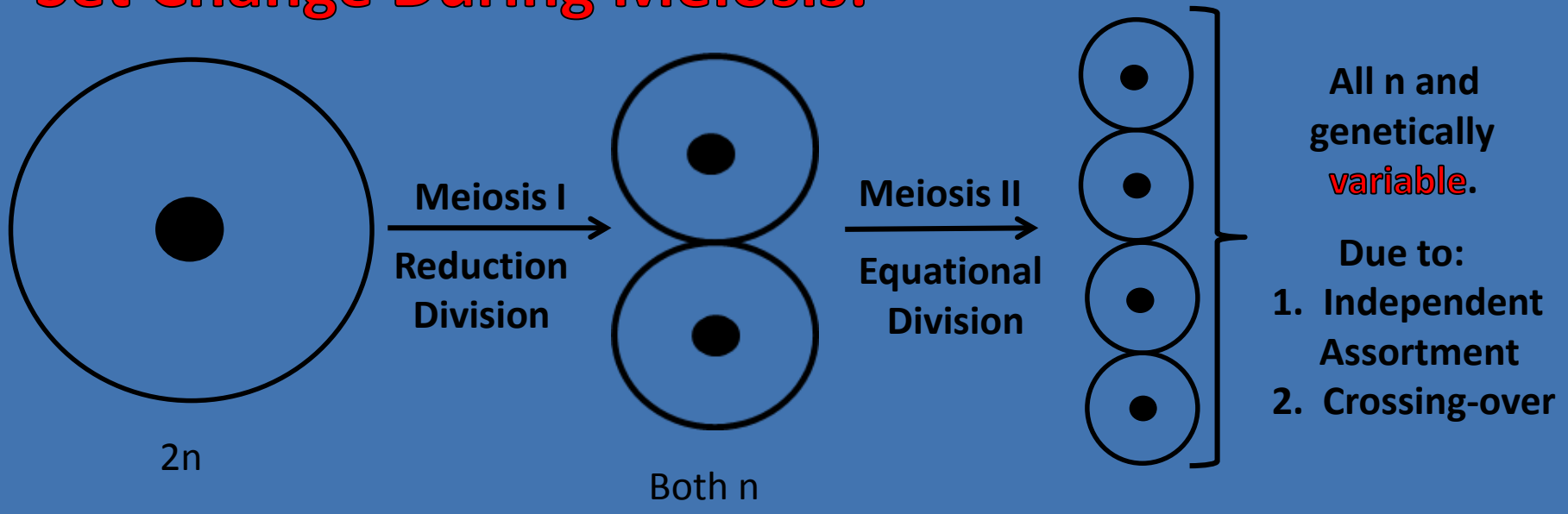
Anaphase



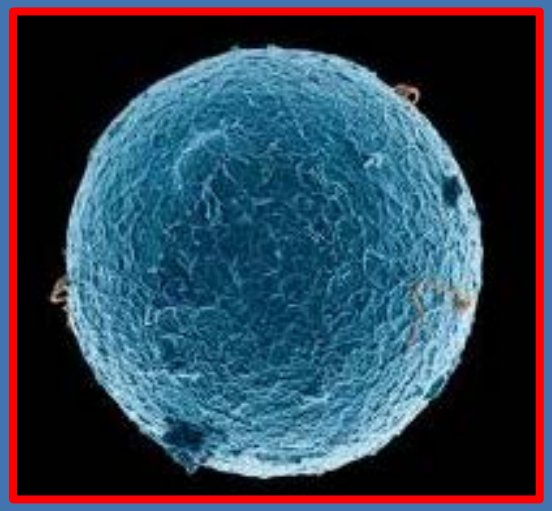
Telophase

Exercise 6

- **Sexual Reproduction:** **Meiosis and Fertilization are complementary process; they are always tied together. Since fertilization increases set number, it is necessary for it to be preceded by meiosis which first reduces set number before it can be increased with fertilization.**
  Answer questions 1-2 on page 170.
- **Set Change During Meiosis:**



- **Set Change During Fertilization:**



+

Fusion →

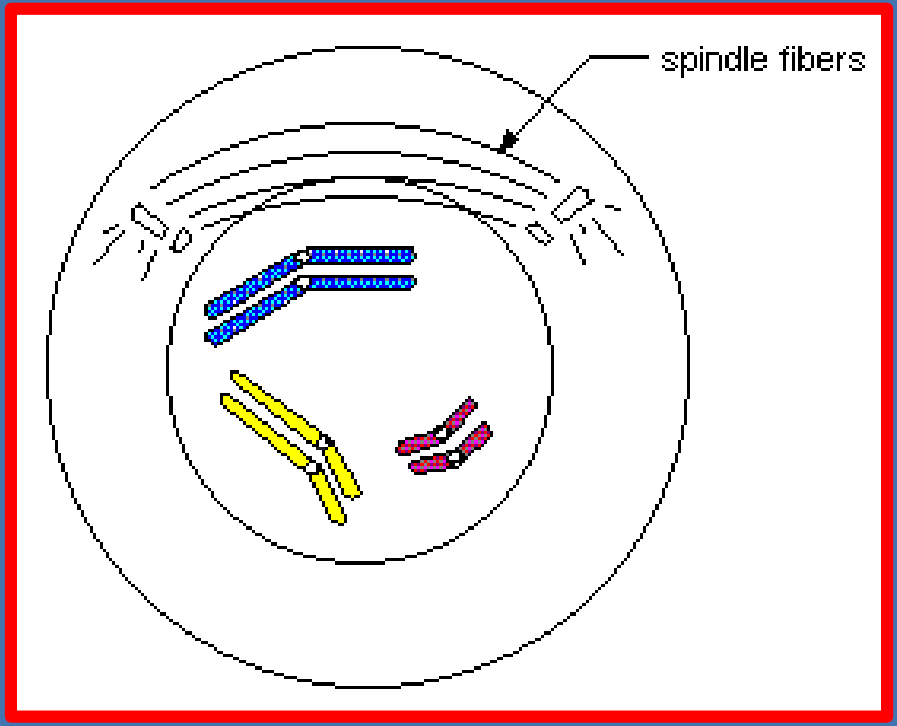
Egg (n) **Sperm (n)** ***Zygote (2n)**

***Note fusion of two nuclei within circle inside zygote.**

Answer questions 1-8 on page 171

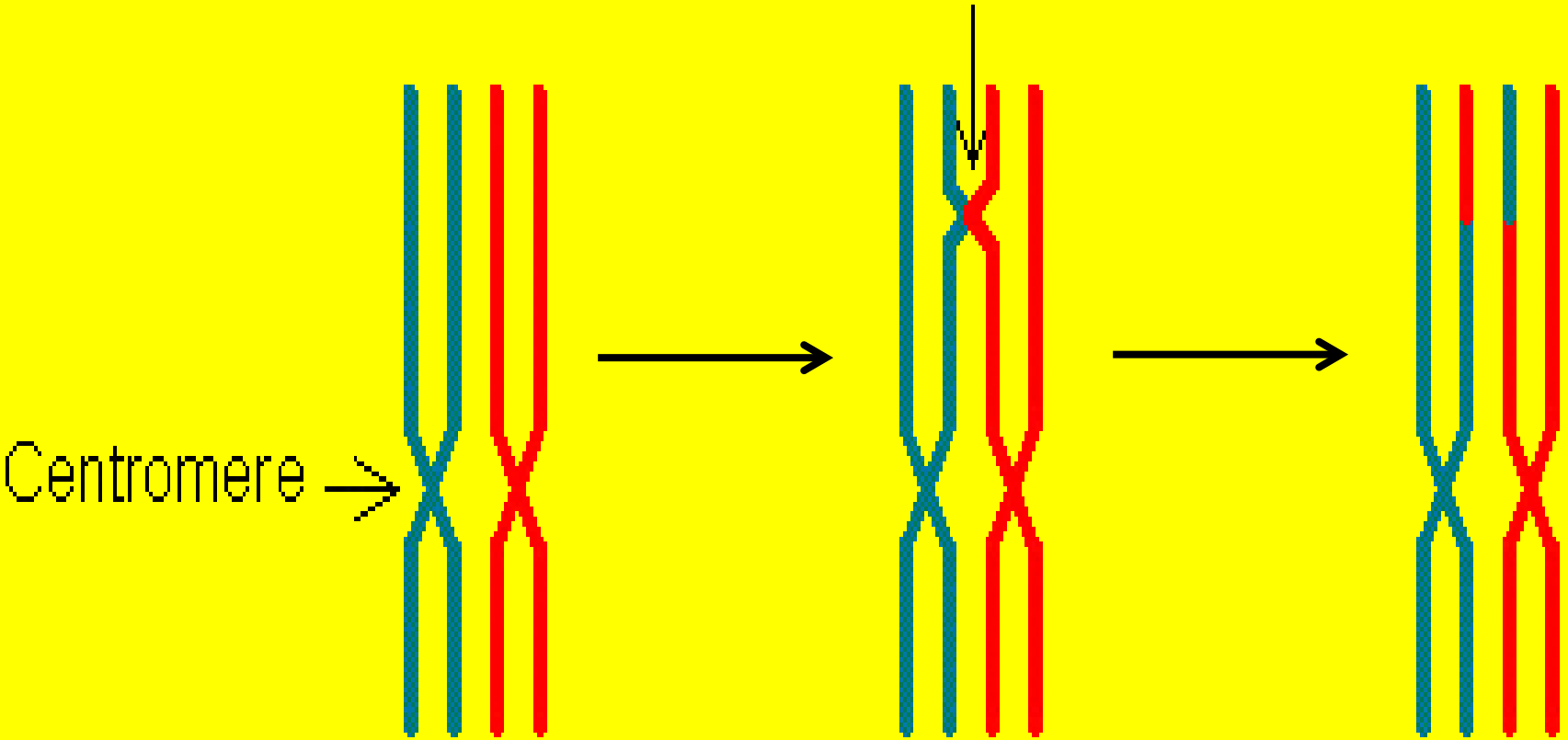
Exercise 7: Events that Create Variety

- **Synapsis: The pairing up of homologous chromosomes (homologs) which makes possible the independent assortment and crossing-over of homologs. Only occurs in meiosis!**



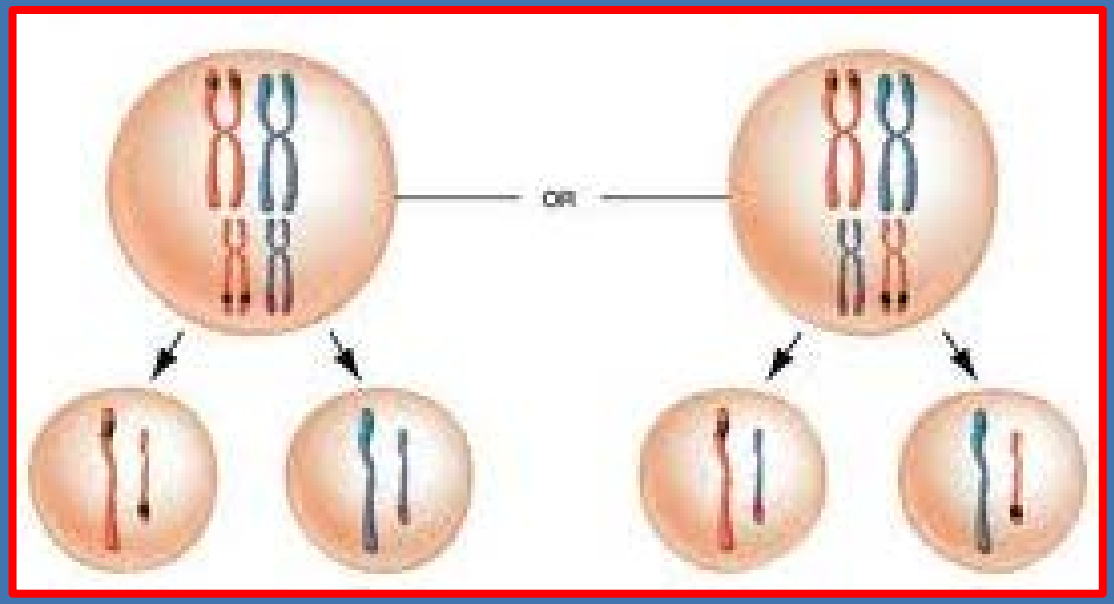
Answer questions 1-5 on page 172

- **Crossing-Over:** **The exchange of genetic material between chromatids of homologous chromosomes.**



Answer questions 1-2 on page 173

- **Independent Assortment:** **The homologs (pairs) move to the equatorial plane together and independently of any other pair; meaning there are a variety of ways of lining up pairs relative to other pairs.**



The amount of variety gained from "independent assortment" of homologs = 2^n (n = number of homologs).

Answer questions 1-2 on page 174

- **Random Fusion of Gametes (Fertilization):** **This is providing you are not fertilizing yourself, but are fertilized by a separate individual. That because each individual has a separate, and accidental, mutational history: containing unique genes that are only within their family linage.**

Answer questions 1-7 on page 174.