Cellular Reproduction

Early Beliefs

- **Aristotle 384-322 BC believed that eels came from mud, that maggots came from decaying meat and horse hair in water turned into a worm**
- **Spontaneous generation* was the belief that living could come from nonliving**

What is spontaneous generation?*

Refuting Spontaneous Generation

- **Francesco Redi 1668 from Italy did experiments that proved maggots came from flies not decaying meat by showing the life cycle of a fly. This brought questions for further investigation**

*What was Redi's experiment, and how did it influence the beliefs about spontaneous generation?**

More early beliefs

- **Anton VanLeeuwenhoek 1675 discovered the world of microorganisms by using a microscope, but many people believed they spontaneously generated because microorganisms would appear in nutrient solution called infusions when air was present**

Louis Pasteur

- **Louis Pasteur (1822-1895) believed micro organisms came from spores (reproductive cells) and would develop when nutrients were available Pasteur's experiment disproved spontaneous generation**


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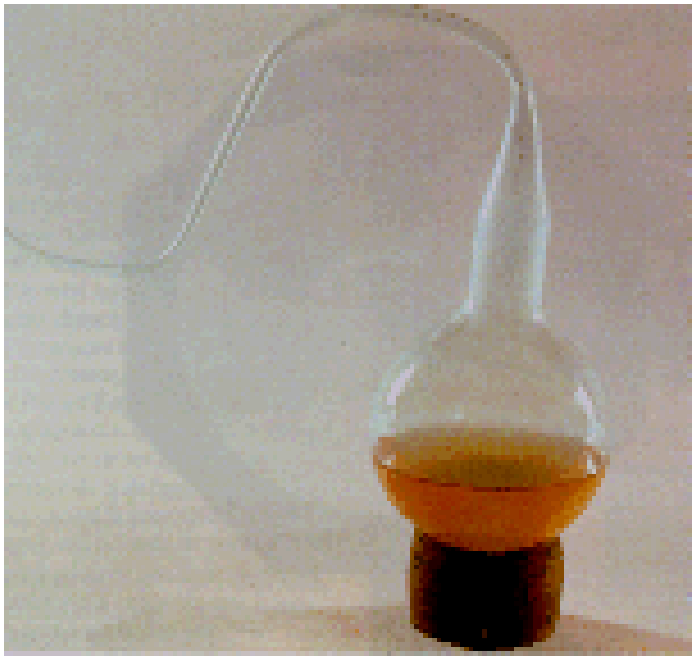
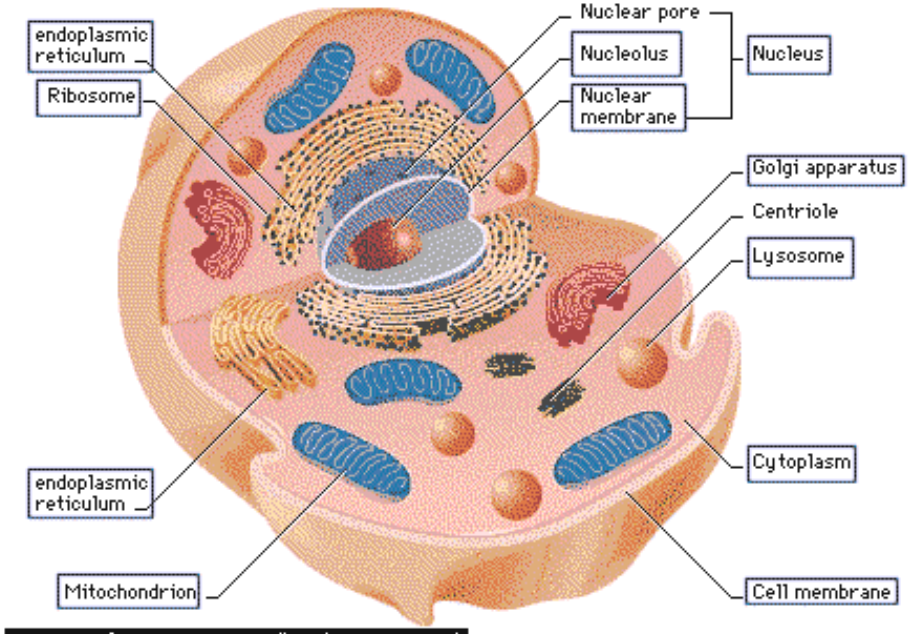


Theory of Biogenesis

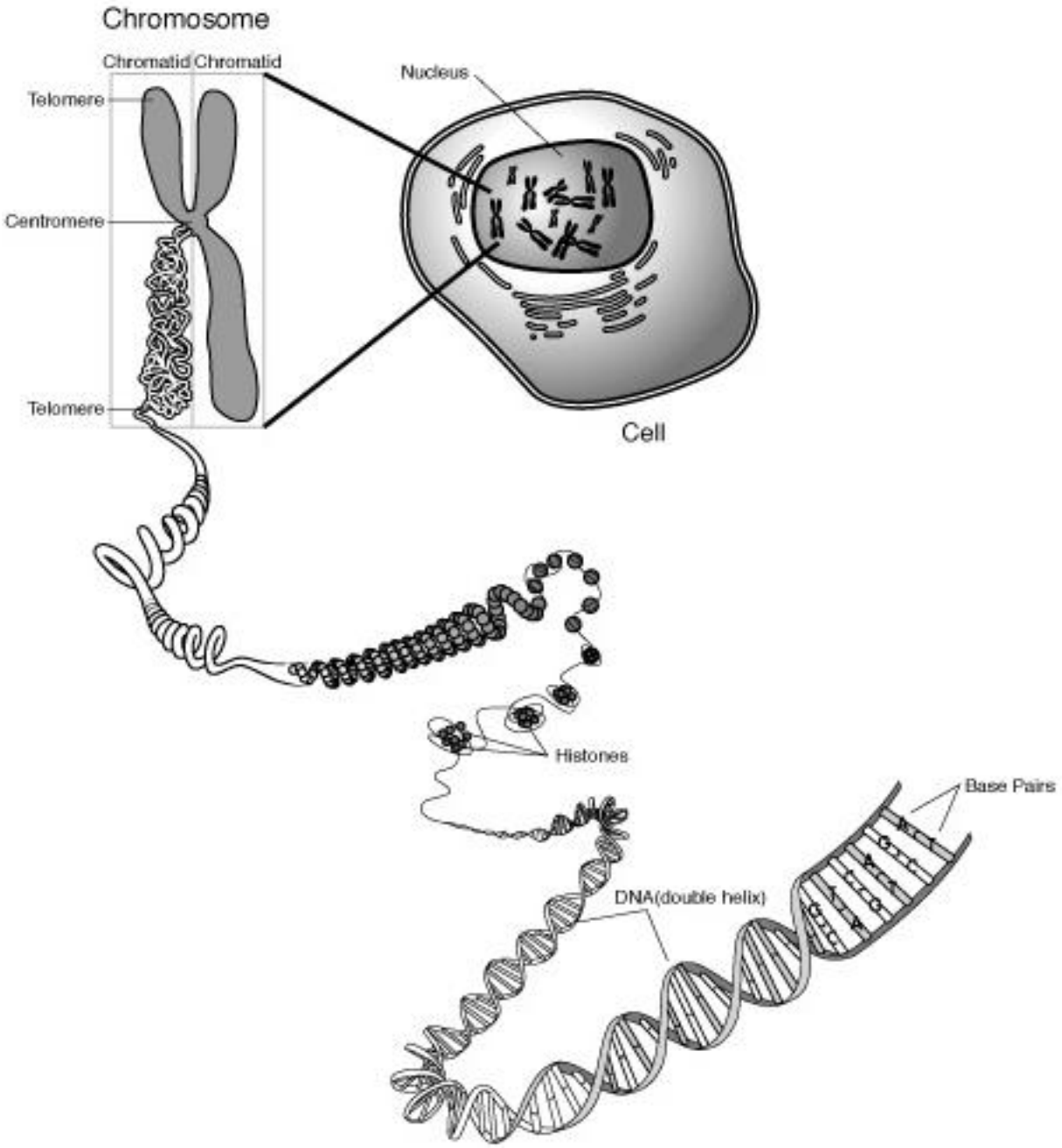
- **From Pasteur's work came the theory of biogenesis**
- **At the present time under present conditions all organisms are produced form other organisms***

Explain Louis Pasteur's experiment and how the infusions in the S-shaped flasks were used to establish the theory of biogenesis?*



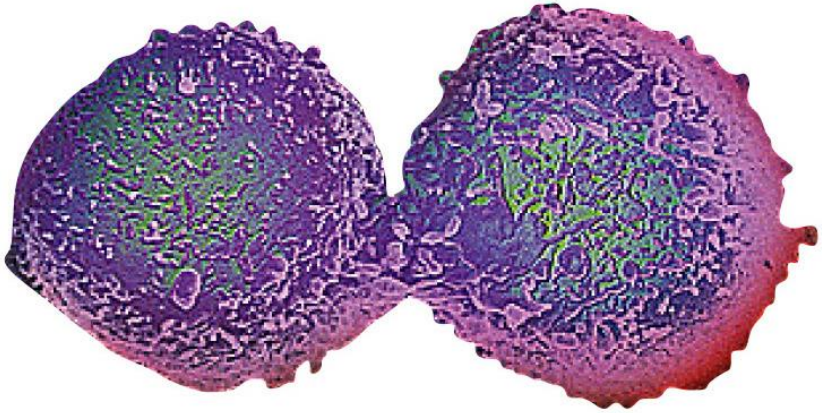
Reproduction of Body cells

- **The nucleus is the control center of the cell and is what controls the reproduction in Eukaryotes**
  - **Chromatin is the main substance located in the nucleus made of chromosomes**
  - **Chromosomes are distinct smaller bodies that are made of DNA**
  - **DNA carries life's code and the genetic code for each cell Chromatin is made of chromosomes and chromosomes are made of DNA***

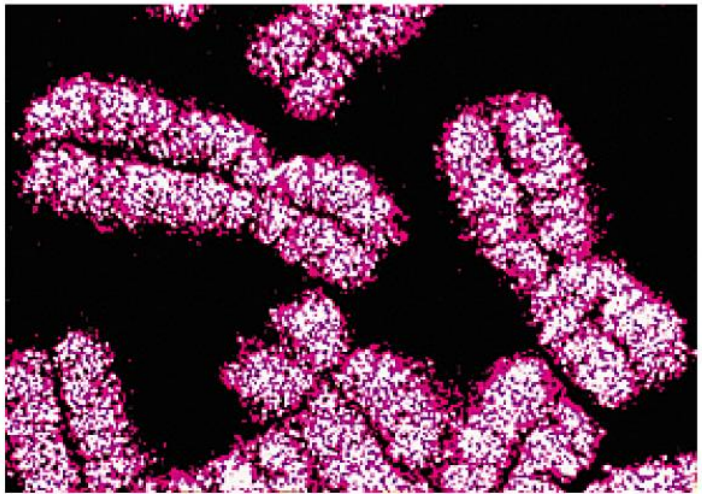

Chromosome
Chromatid
Chromatid
Telomere
Centromere
Telomere
Nucleus
Cell
Histones
Base Pairs
DNA(double helix)

- You began life as a single cell, but there are now more cells in your body than the 100,000,000,000 stars in the Milky Way

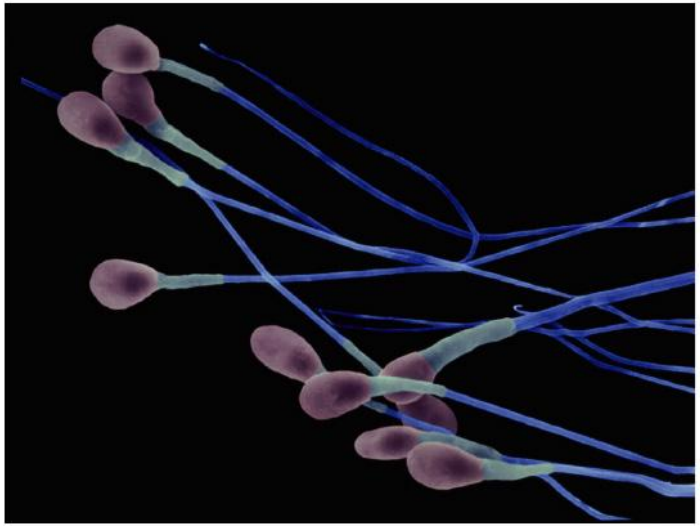
- Just in the past second, millions of your cells have divided in two



- The Replication of the chromosomes in a dividing cell is so precise that only one error occurs in 100,000 cell divisions



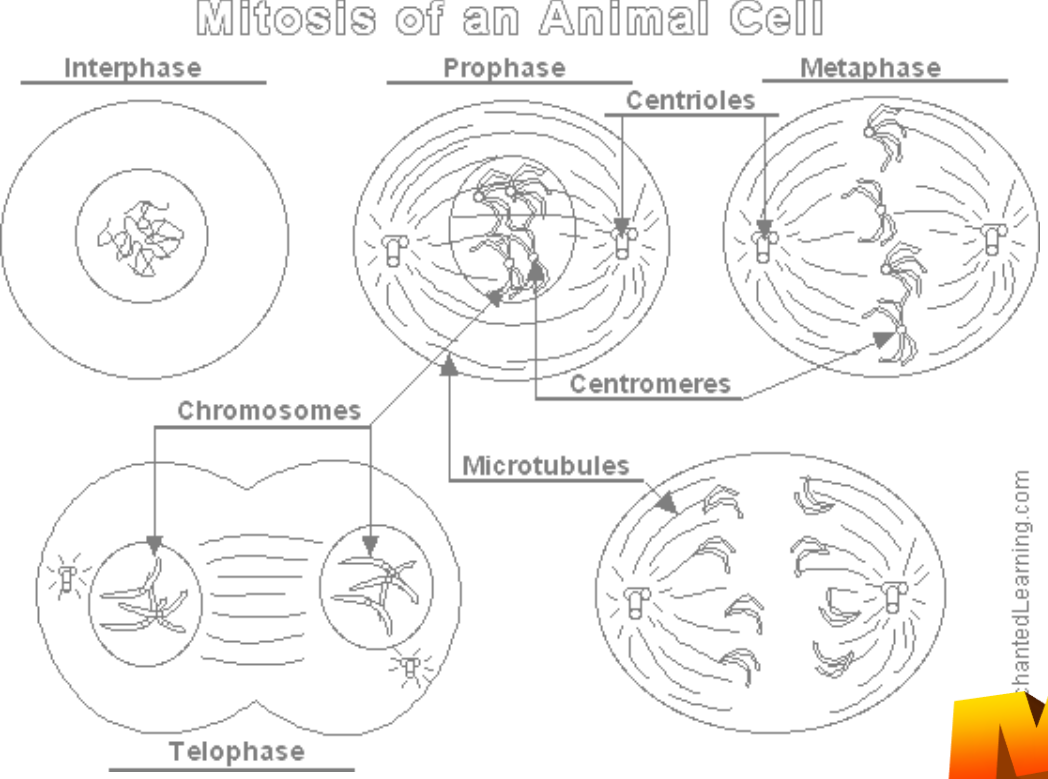
- Each sperm or egg produced in your reproductive organs carries one of over 8 million possible combinations of parental chromosomes



Genetics in the News

A $50,000 EGG!

- A few years ago a sterile couple was willing to pay $50,000 to a woman willing to donate her eggs
  - They ran an advertisement in several Ivy League college newspapers with the title: Egg Donor Needed- Large Financial Incentive
    - The ad sought a woman:
      - b/w the ages of 21-32
      - Who was tall, athletic, healthy, and
      - Who had scored over 1400 on the SATs



Mitosis

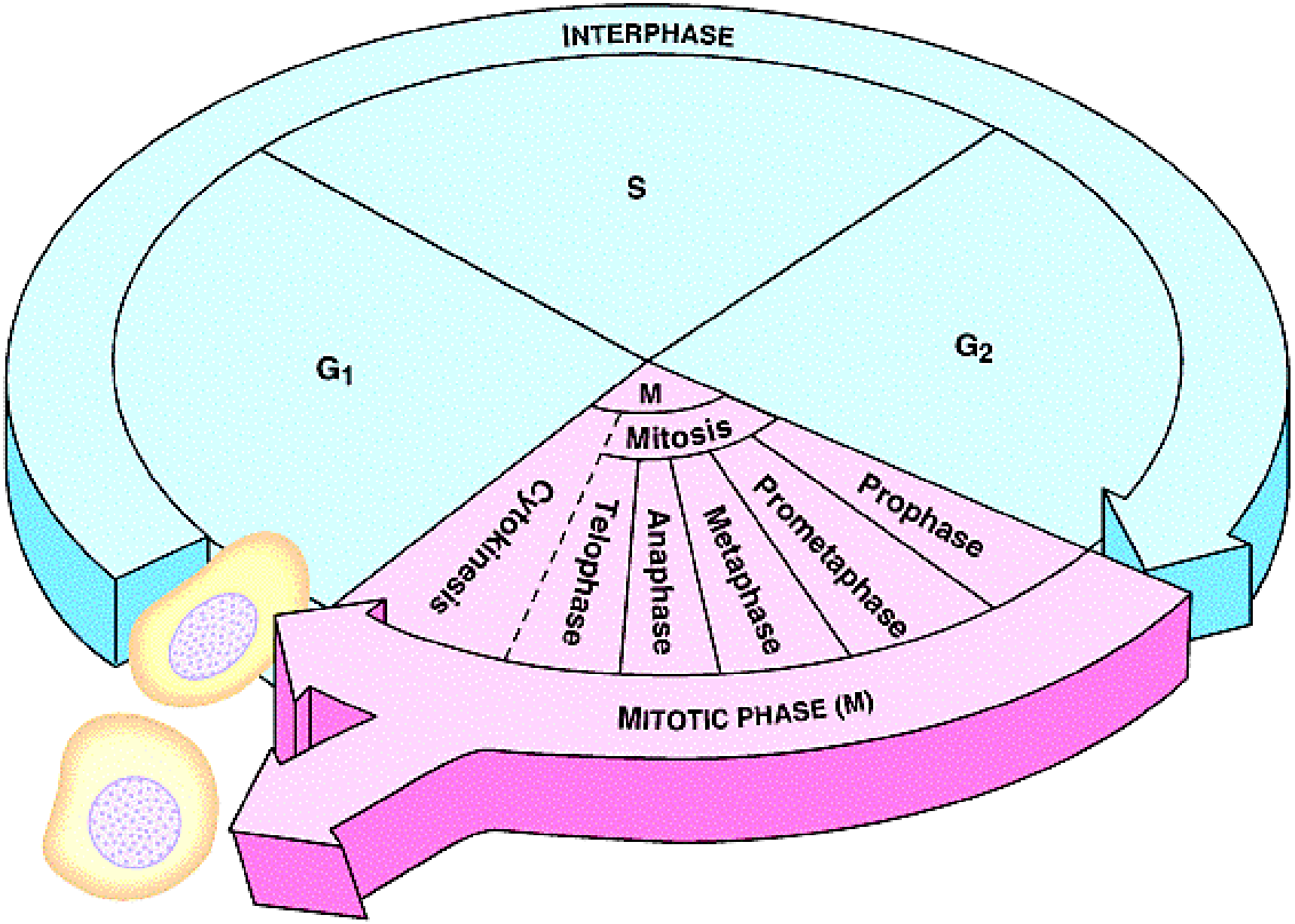
- **is the process in which the chromosomes replicate themselves and separate to form two new nuclei (mitosis refers only to the division and replication of nuclear material)**

Interphase

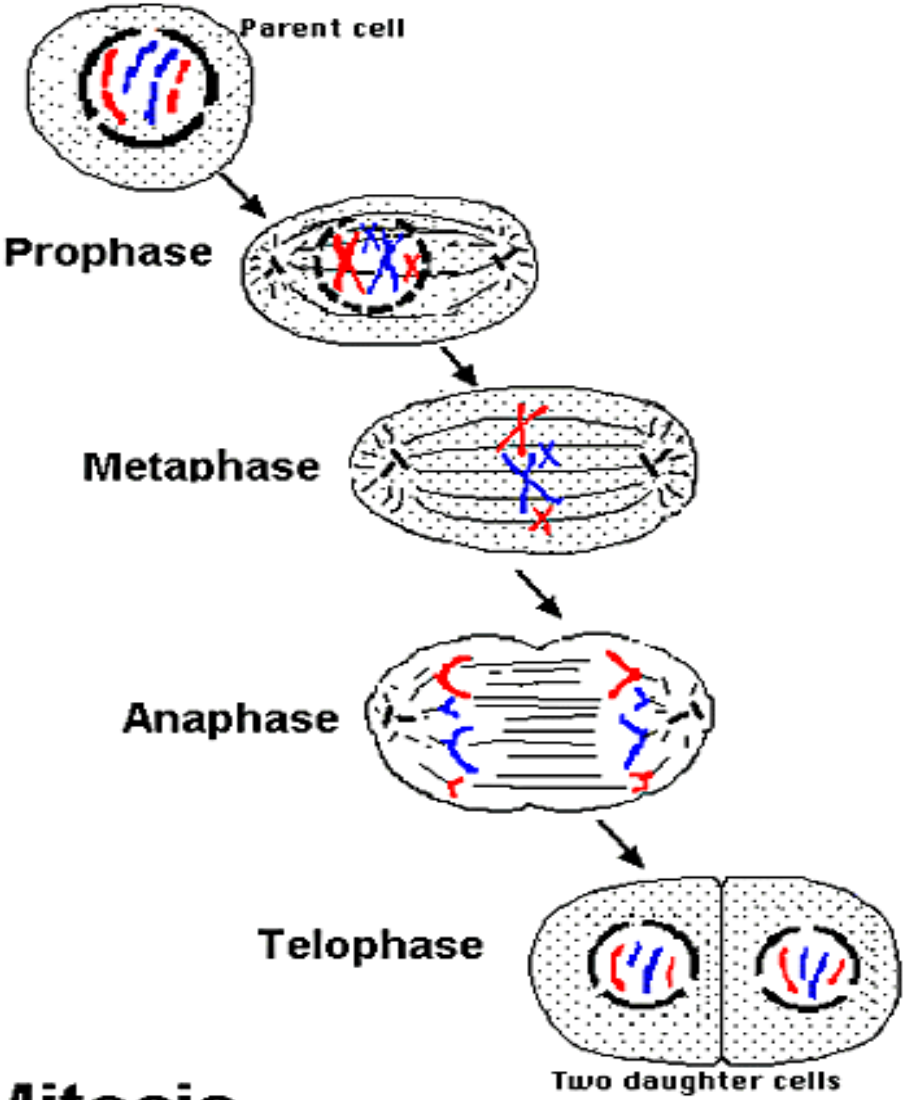
- **phase of relatively little nuclear activity and makes up about 2/3 of the life of the cell***
  - **The nuclear membrane is clearly visible**
  - **Nucleoli is clearly visible**
  - **Chromosomes replicate during this phase**

What happens in interphase just before mitosis?*

Figure 11.5 The cell cycle



Mitosis is made up of four main stages

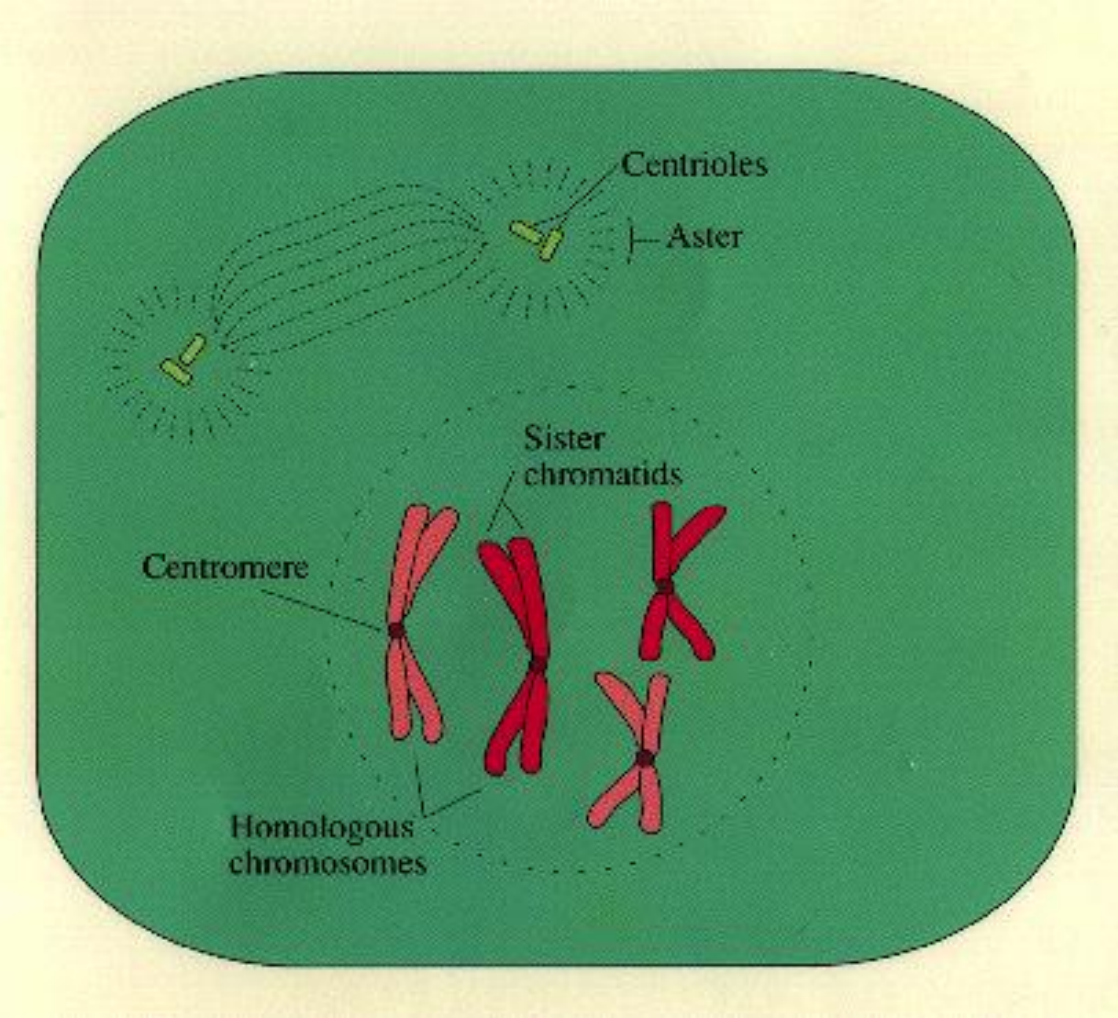


Mitosis

Be able to draw and label the stages of mitosis.*

Prophase First phase

- Nucleolus disintegrates
- Chromosomes become visible
- Nuclear membrane dissolves
- Centrioles separate and migrate to opposite ends of the cell
- Nuclear membrane disappears by late prophase
- Chromosomes are double stranded



Prophase

- Each chromosome in the double strand is a chromatid
- The two chromatids are attached by a centromere
- The centrioles at opposite ends have spindle fibers (microtubules) that radiate toward the chromosomes
- The spindle fibers and the centrioles together make up the asters

*What are chromosomes, chromatids, centrioles, spindle fibers, and centromeres?**

Metaphase

- middle phase or after phase
- Chromosomes move toward and line up all on the equator of the cell
- Each centromere attaches to a spindle fiber

Anaphase

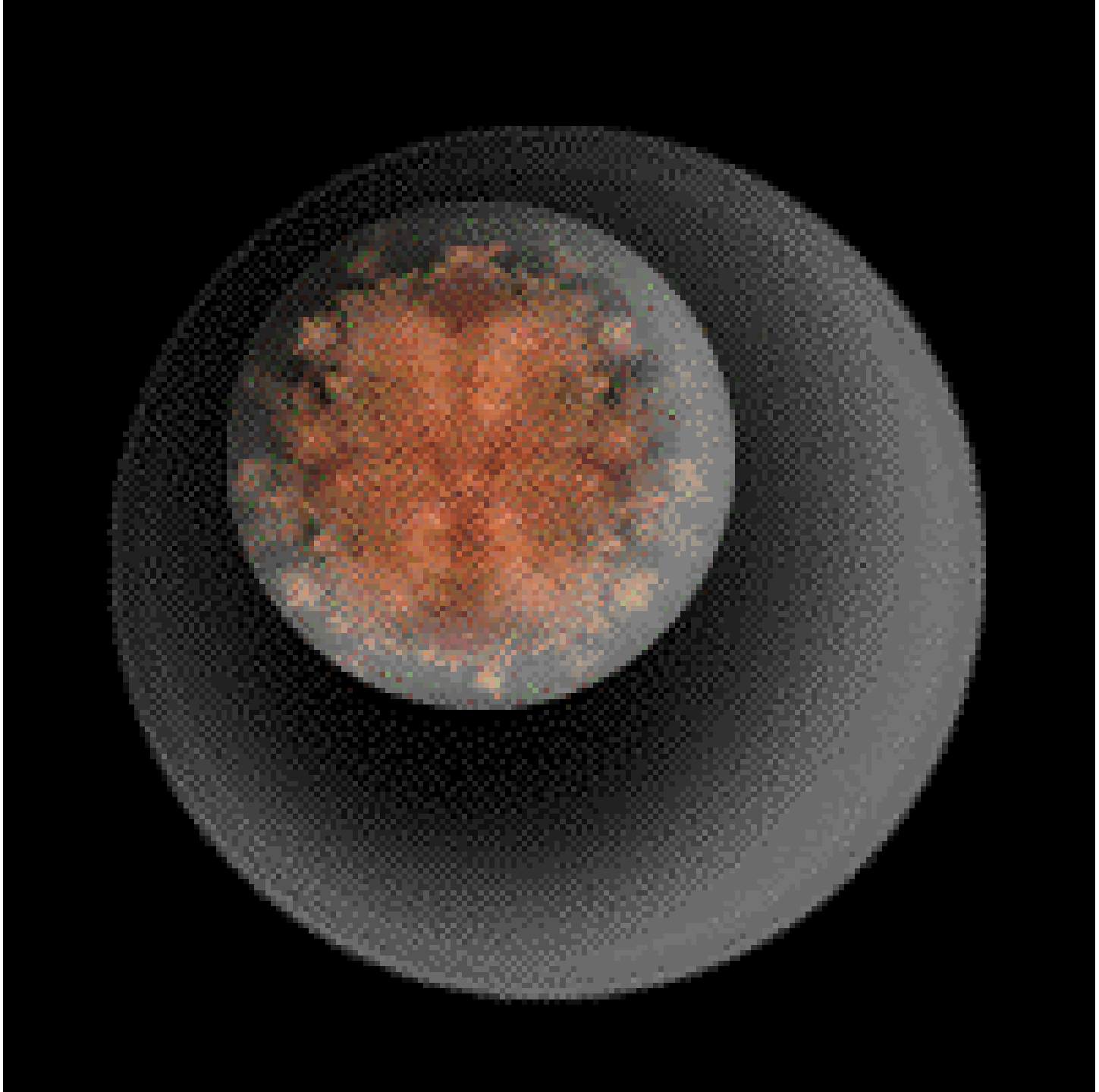
- Chromatids are separated into single strand chromosomes
- The pull that separates these is not completely understood
- By the end of anaphase there is one set of single strand chromosomes at each end of the cell
- Cell membrane begins to pinch at center
- In plants the cell plate begins to form

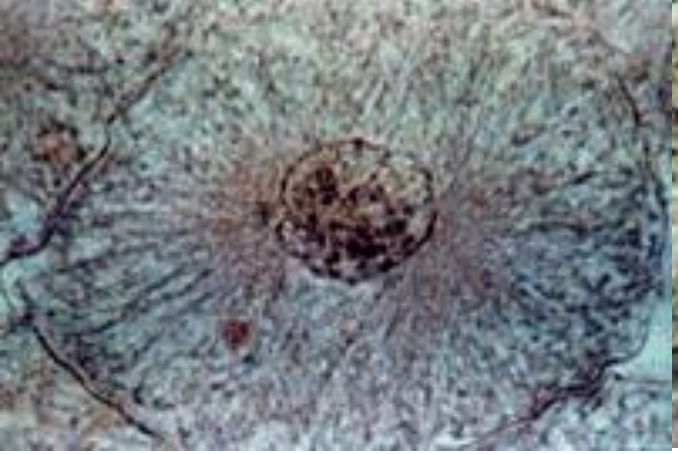
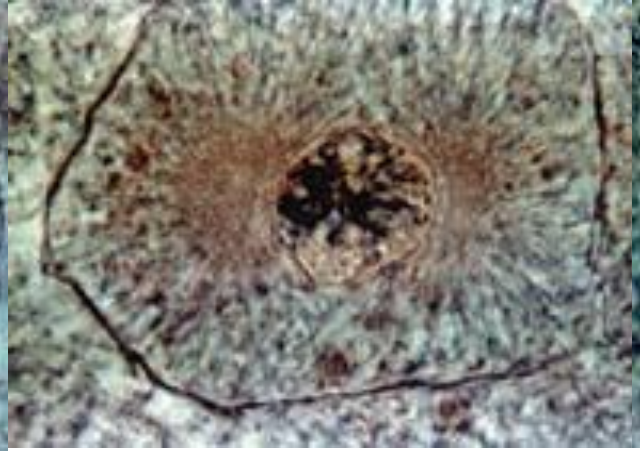
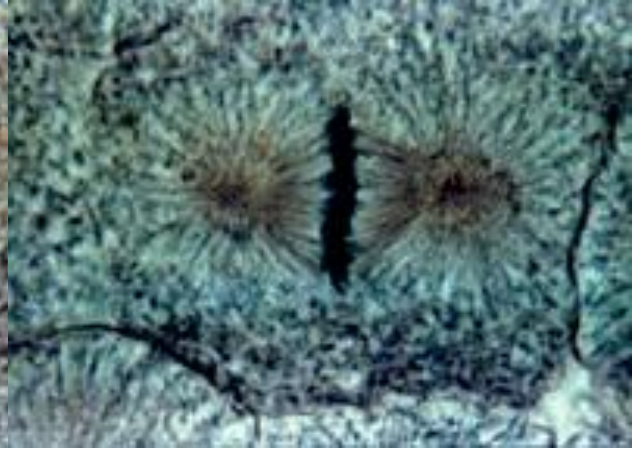
Telephase

- last phase
- Nuclear membrane reappears around each set of chromosomes by the ER
- Chromosomes lose distinct form and become a mass of chromatin
- Cell membrane completely pinches off resulting in two daughter cells
- In plant cells a cell plate forms between the poles of plant cells.*
- The division of the cell other than the nucleus is called cytokinesis
- If something goes wrong during this cycle death occurs

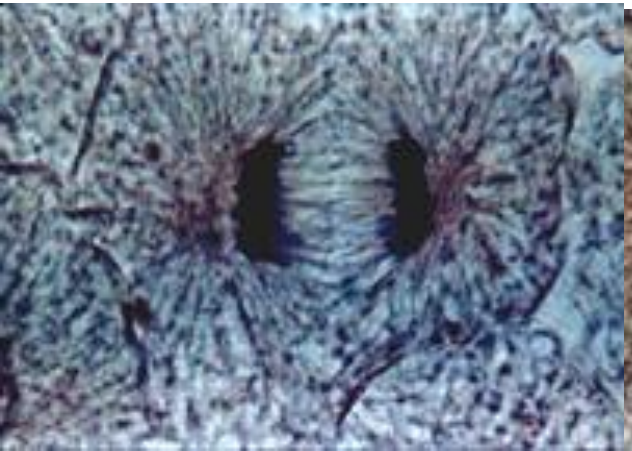
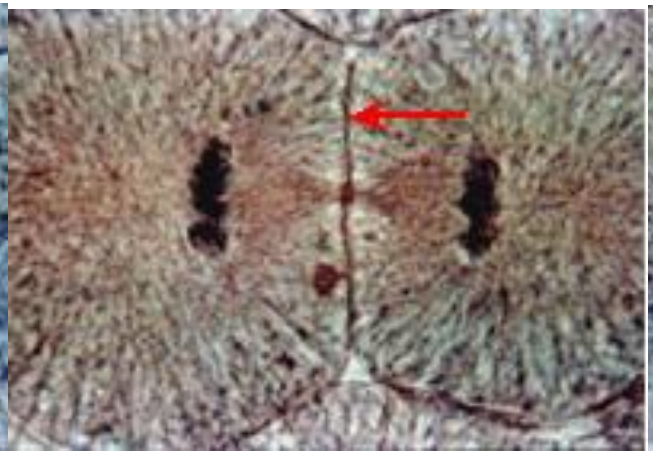
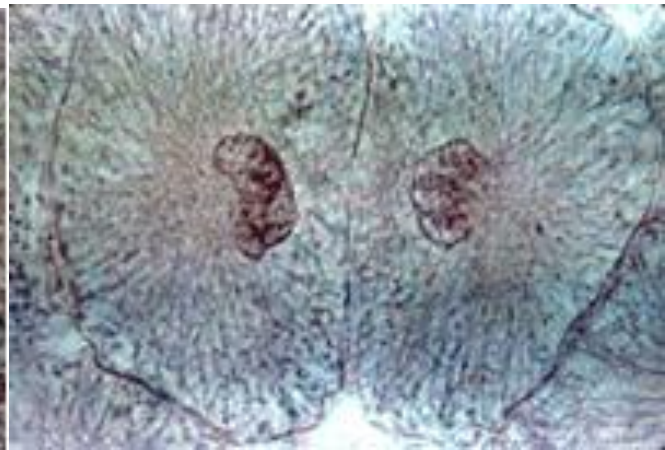
Genetic Continuity*

- Mitosis is a process that insures genetic continuity in which the daughter cells have the same information and # of chromosomes as the mother cell



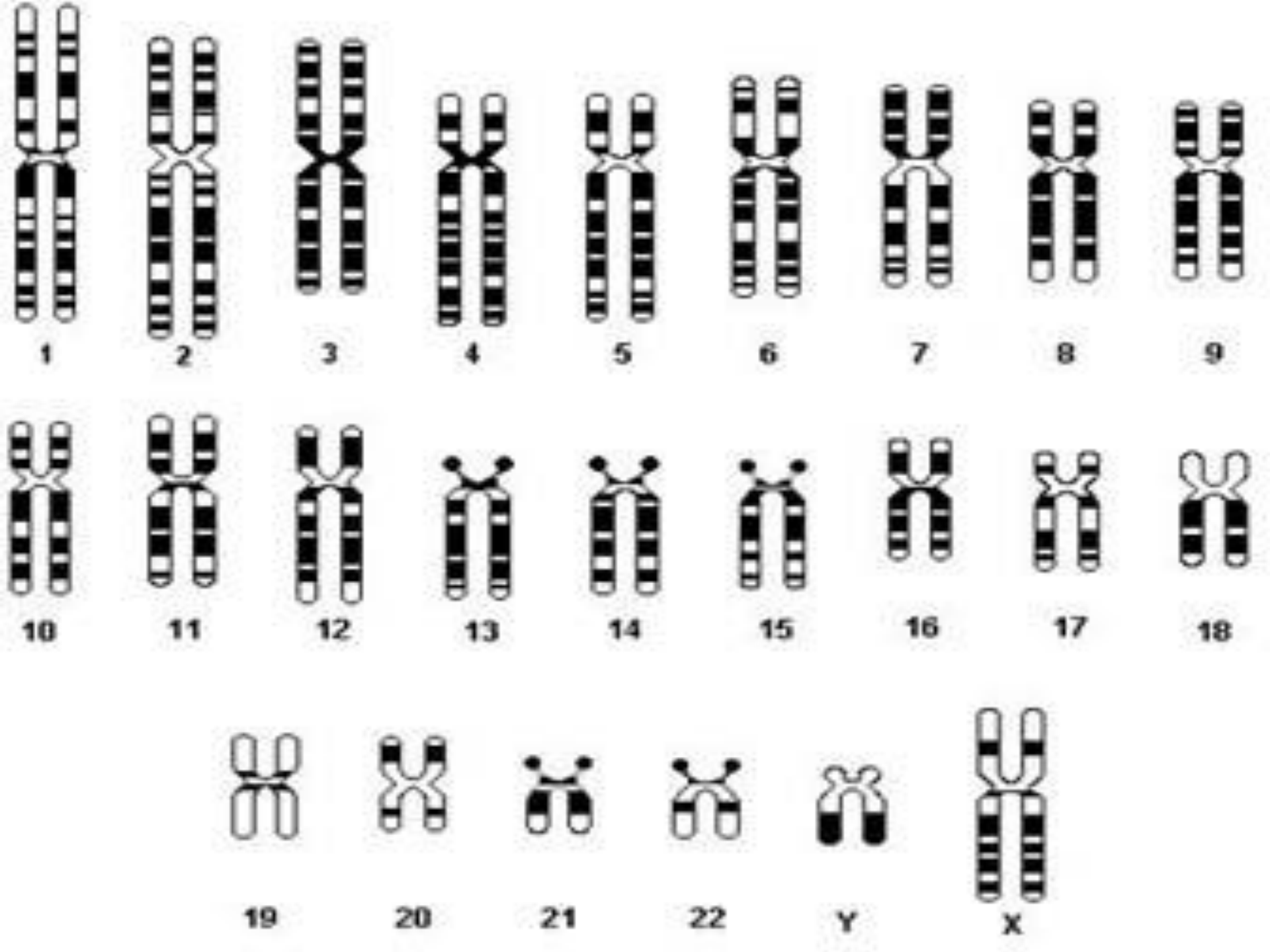
Stages of Mitosis

Chromosomes and Chromosome

- **Chromosome varies from one kind of an organism to another**
  Humans have 46 chromosomes*
- **Karyotype - show the cells # and type of chromosomes (quiz)**

How many Chromosomes does a normal human have?*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Review

1. What is mitosis?
2. What is the difference between chromosomes and chromatin?
3. What happens in interphase just before mitosis begins?
4. Know the stages of mitosis using 4 chromosomes. (Be able to name each stage)

Biology Quiz

Instructions: Answer the following questions as completely as possible in the space provided.

1. What is mitosis?
2. What is the difference between chromosomes and chromatin?
3. What happens in interphase just before mitosis begins?
4. How would you identify metaphase in mitosis?
5. Draw and label the stages of mitosis using 4 chromosomes. (Name each stage)

Matching Chromosomes

- **For each chromosome there is a matching chromosome**
- **Has the same type of information**
- **One set of 23 chromosomes came from your dad and one set of 23 came from your mom**
- **Each chromosome carries the same type of information as its mate**
- **When a chromosome is paired each pair is called homologous chromosomes**
- **Homologous chromosomes carry the same type of information for the same genes**

What are homologous chromosomes? How are they the same? How are they different?*

Human Chromosome Numbers

- **Humans have 23 homologous chromosomes, 46 individual chromosomes**
- **A homolog* is one chromosome from the homologous pair**
- **When a complete set of chromosomes are present it is said to be the diploid* number of chromosomes or the 2n # (46 in humans)**
- **When there is only ½ of a set present as in gametes it is called haploid* or referred to as the n # of chromosomes. (23 in humans)**

What is the difference between the haploid and diploid # of chromosomes?

What is a homolog and what are homologous chrosomes
What is the difference between the n and 2n number of chromosomes?*

Mitosis vs Meiosis

- **Mitosis was the process of getting a complete replication of chromosomes to produce two genetically identical 2n cells**
- **Meiosis is the process of making sex cells with ½ the # (haploid #) of chromosomes and shuffle the genetic information**
- **Meiosis is the process of making egg and sperm called gametes***

Clearly know the difference between mitosis and meiosis.*

Meiosis in males (Spermatogenesis)

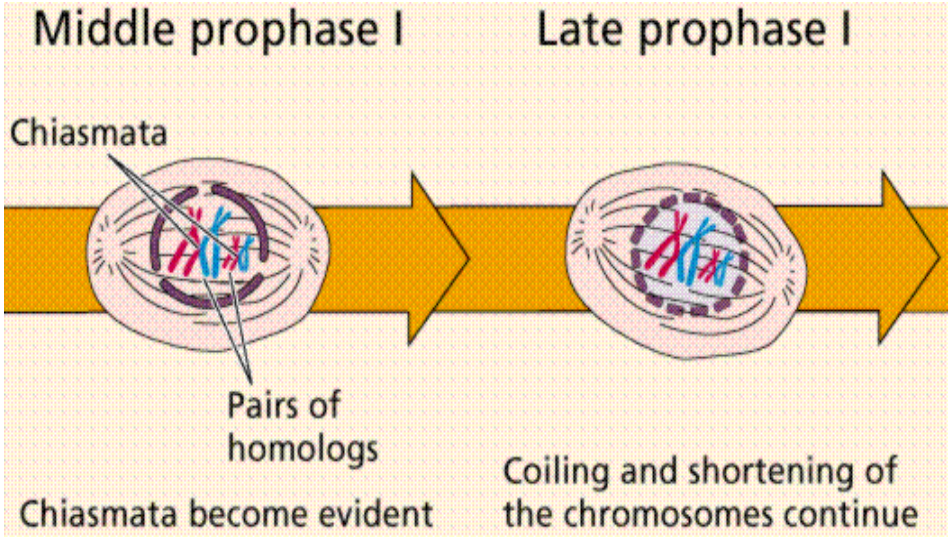
- **First we are going to look at meiosis in males**
- **Meiosis involves two divisions called meiosis I and meiosis II**
- **Meiosis in males is also called spermatogenesis**
- **Meiosis starts in diploid spermatogonial cells in the testicles (interphase)**

What is spermatogenesis?*

Be able to draw and label spermatogenesis.*

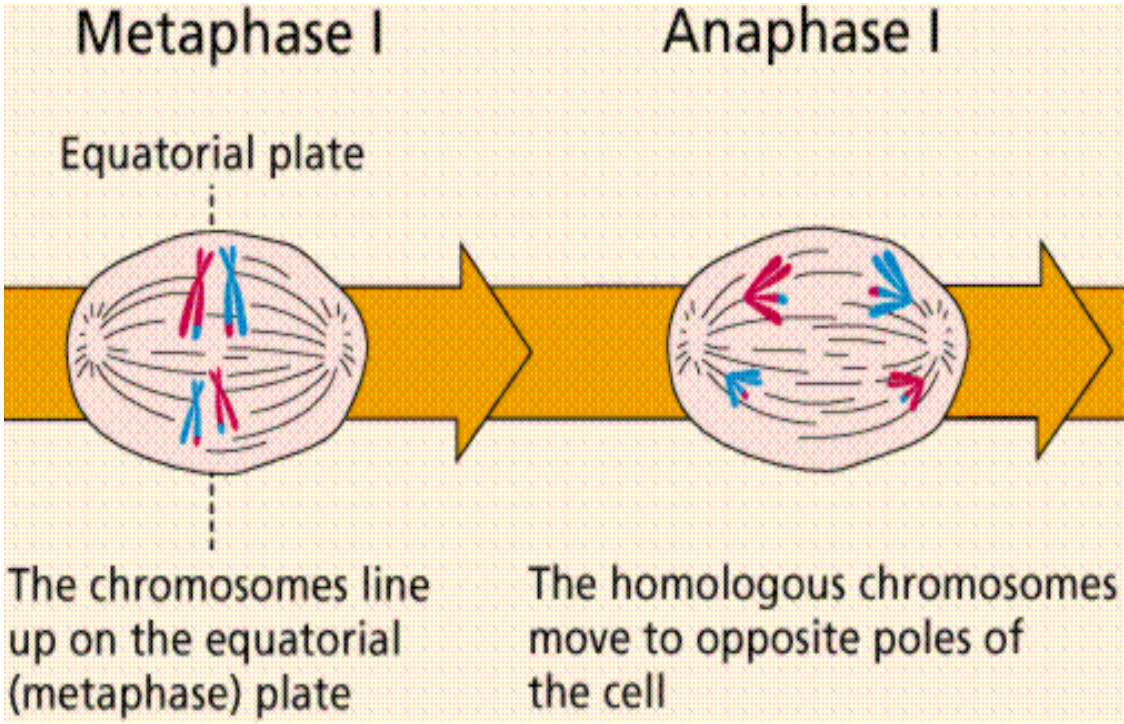
Meiosis I

- **Prophase I – Primary spermatocyte**
  - **Chromosomes move close together by a process called synapsis (finding its homolog) becoming a homologous pair**
  - **Each chromosome duplicates itself becoming a double strand chromosome**
  - **When two double stranded chromosome pairs are side by side they are called a tetrads**



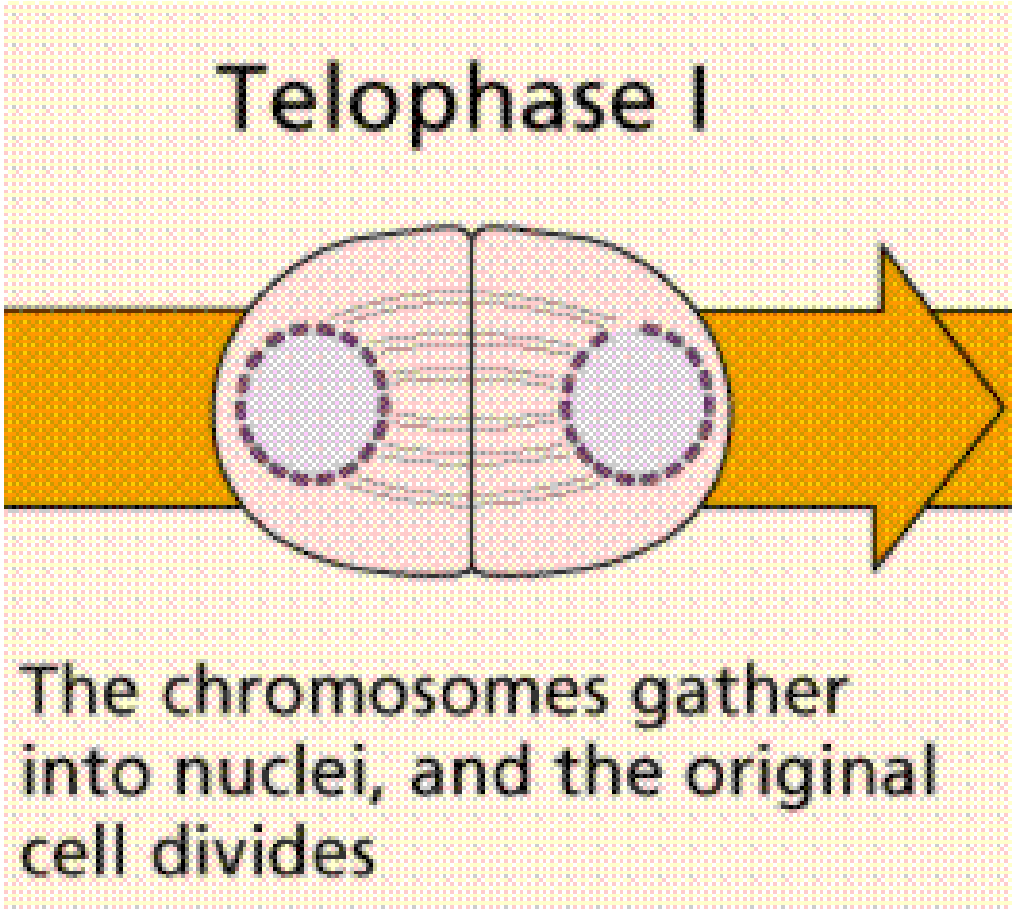
Meiosis continued

- **Metaphase I**
  - **each tetrad attaches to separate spindle fibers from opposite poles**
- **Anaphase I**
  - **the tetrads are separated to opposite ends separating the homologous chromosomes**

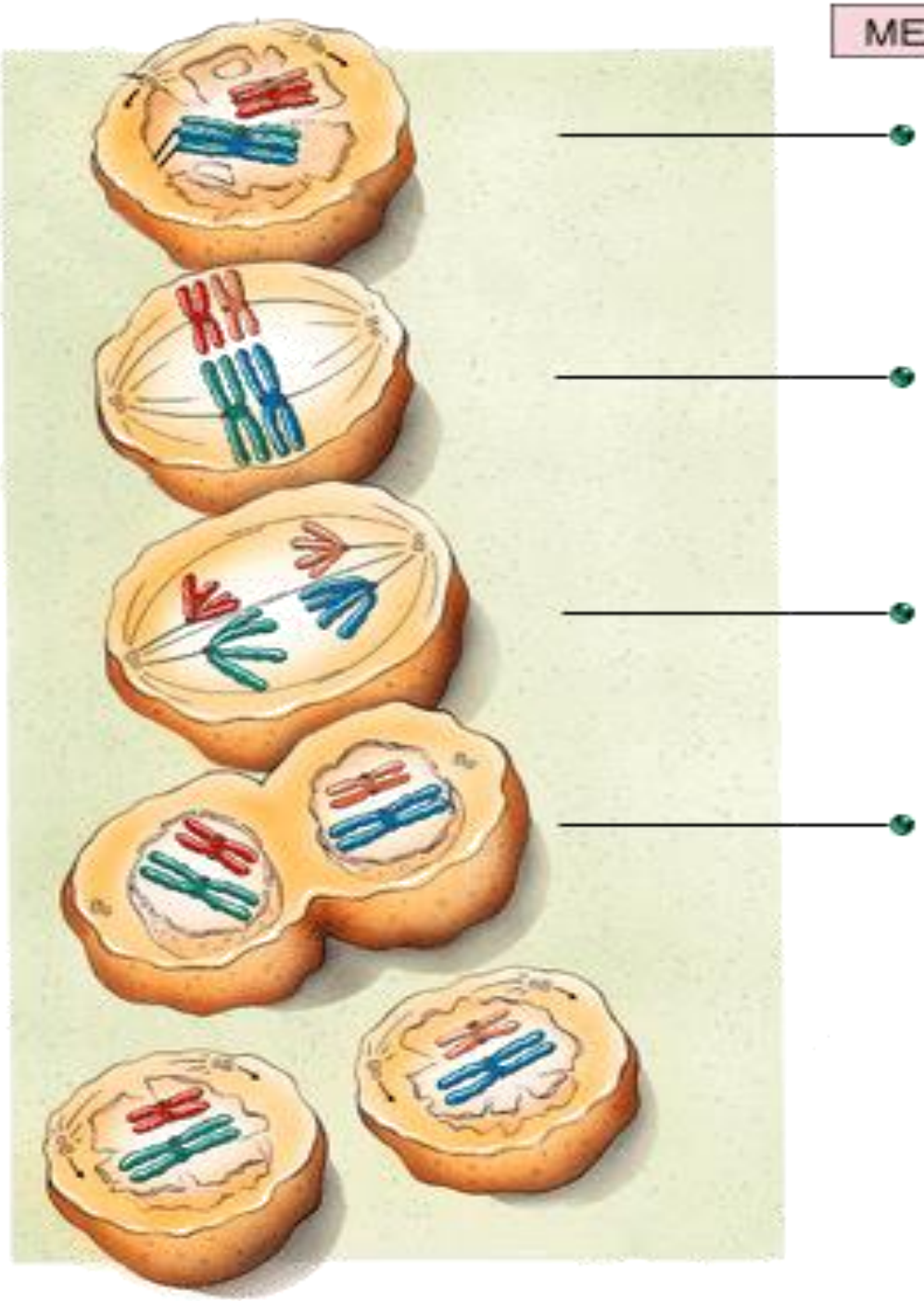


Telephase I

- **When the membrane pinches off**



MEIOSIS I

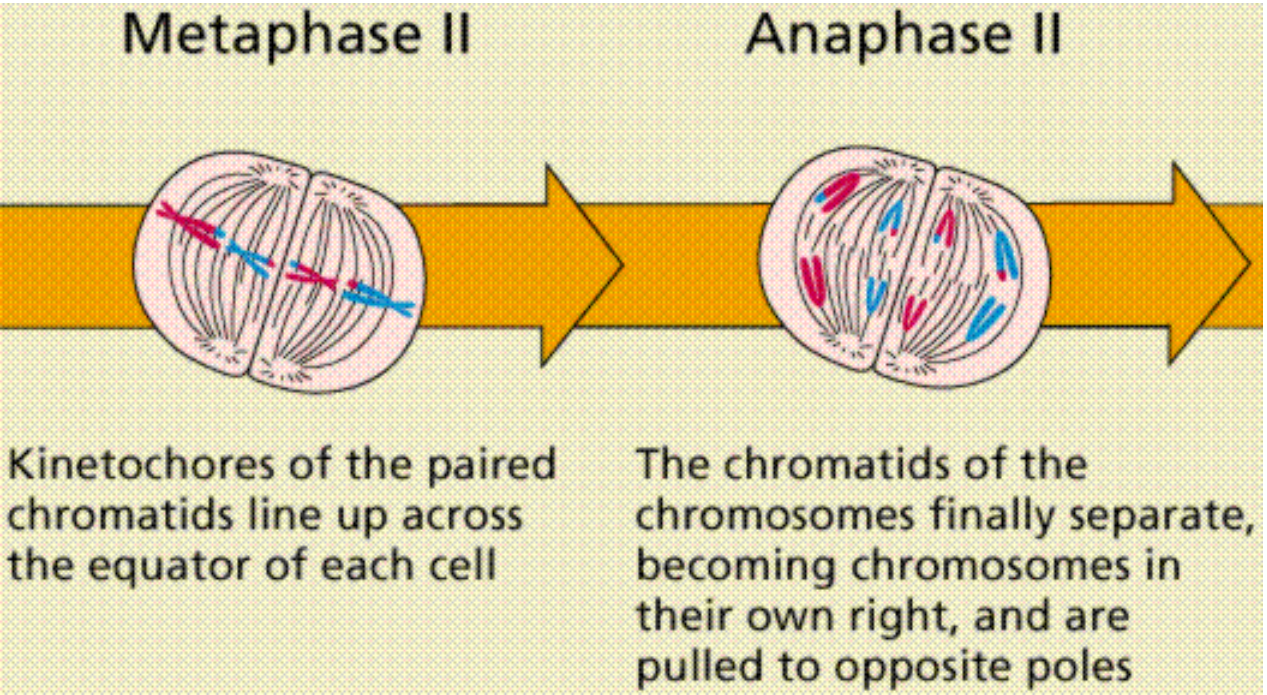


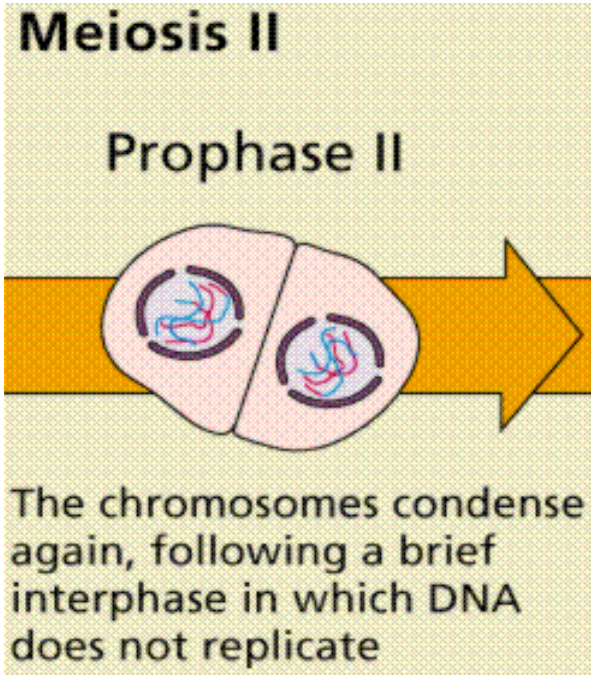
The Result of Meiosis I

- **The result of division of meiosis I is haploid secondary spermatocytes**
- **Meiosis II separates the double stranded chromosomes (separates the chromatids)**

Meiosis II

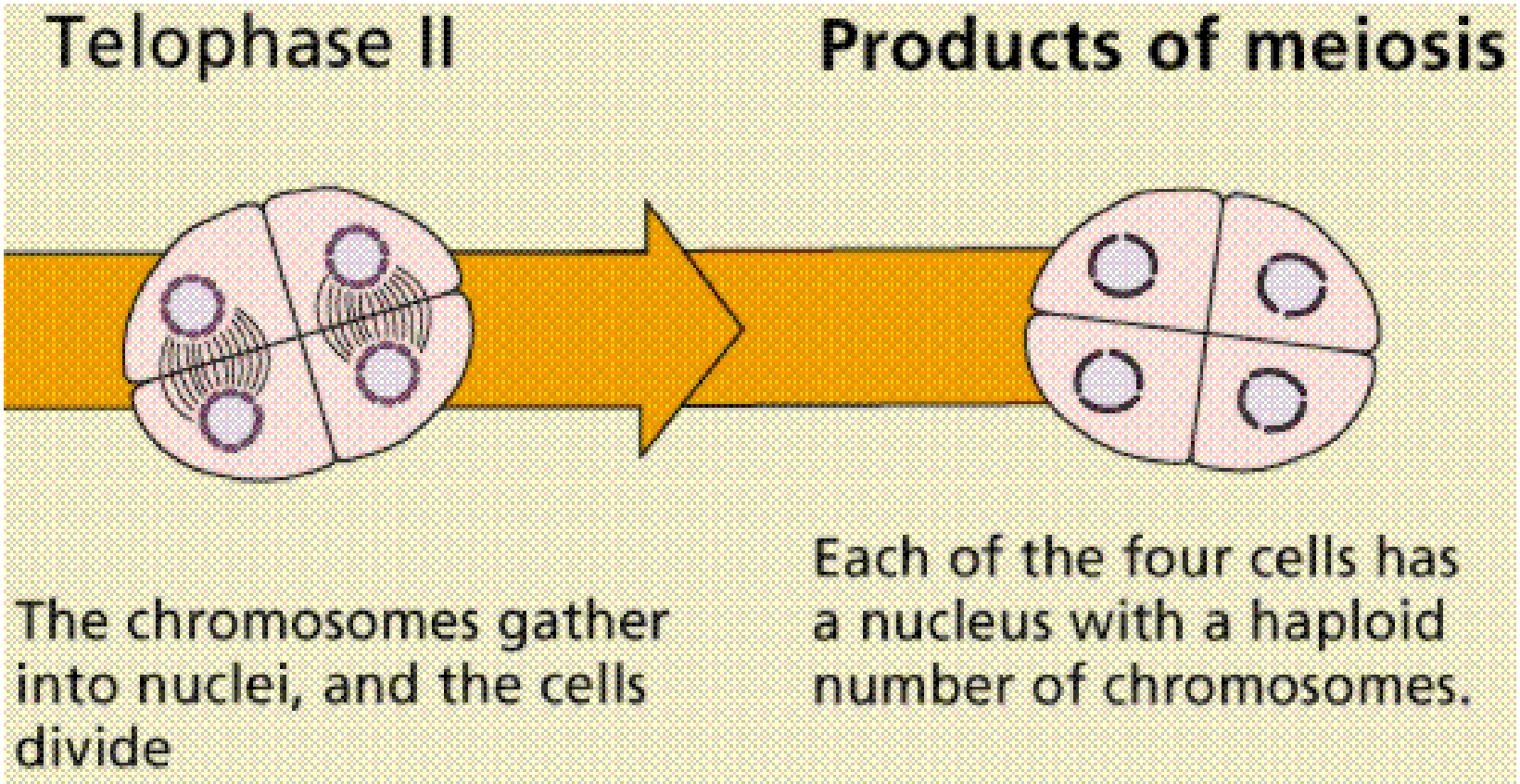
- **Prophase II is a short phase**
- **Metaphase II – chromosomes are lined up along the equator and attach to a spindle fiber**
- **Anaphase II – the chromatids are separated to opposite ends**



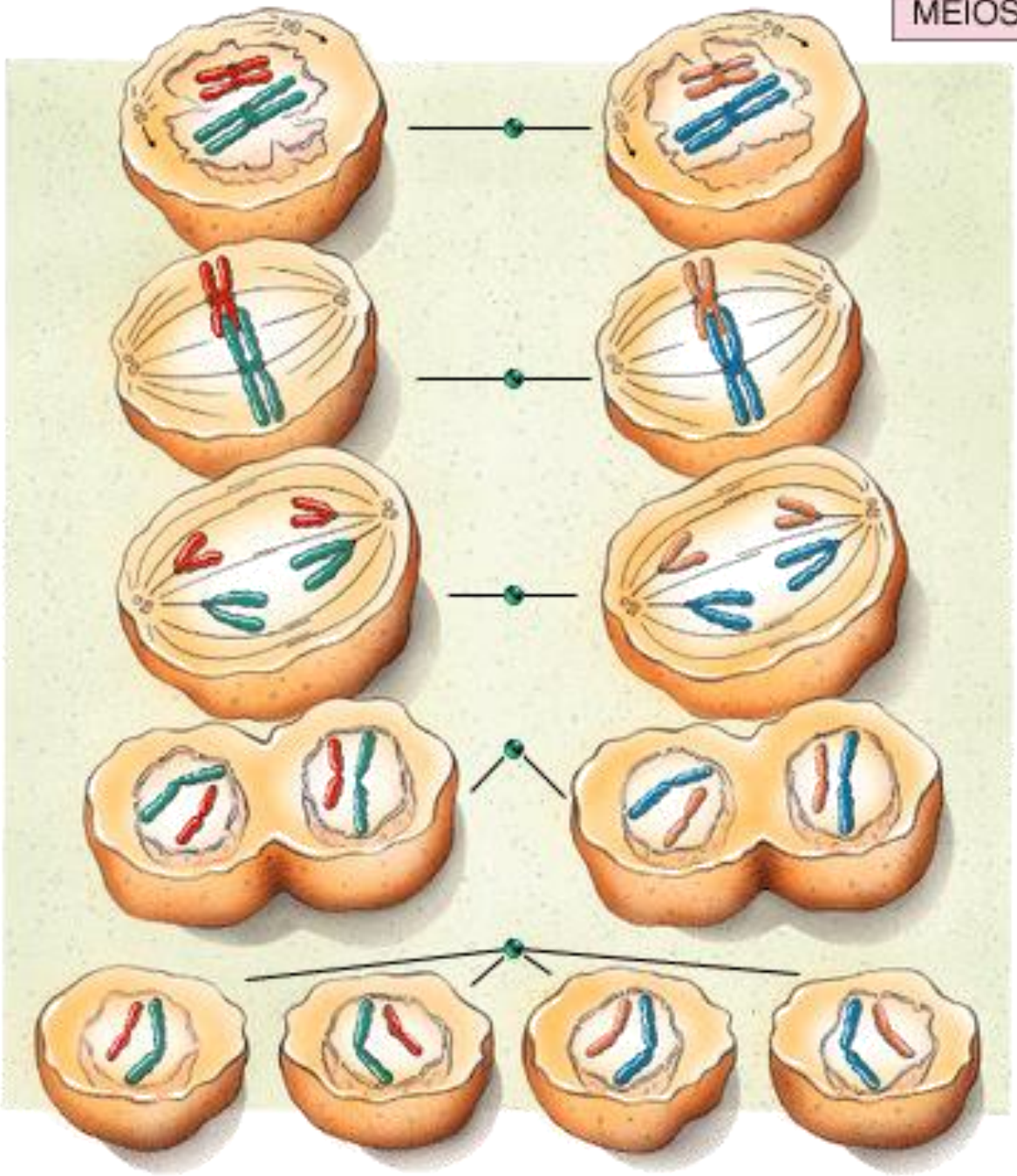


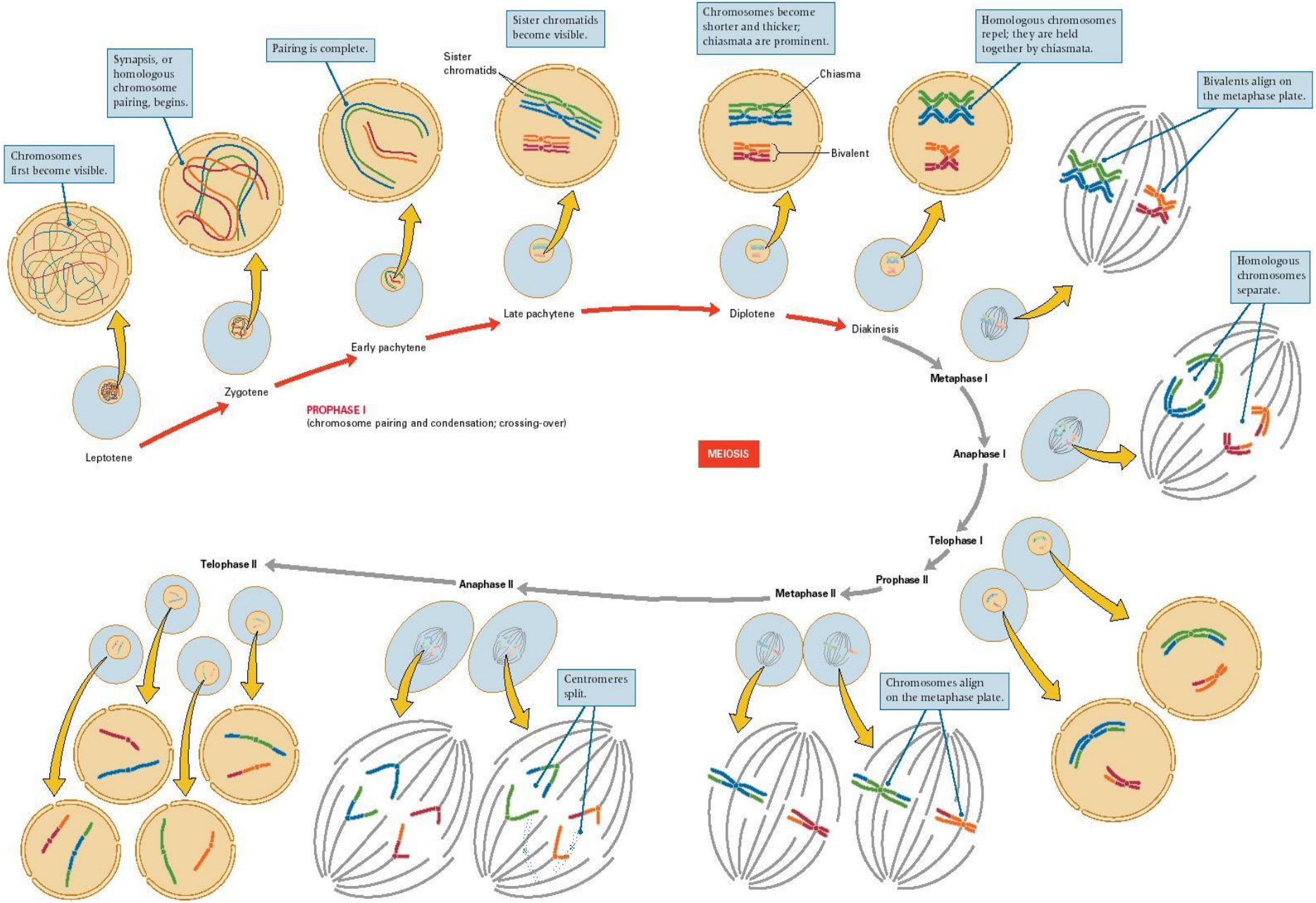
Telephase II

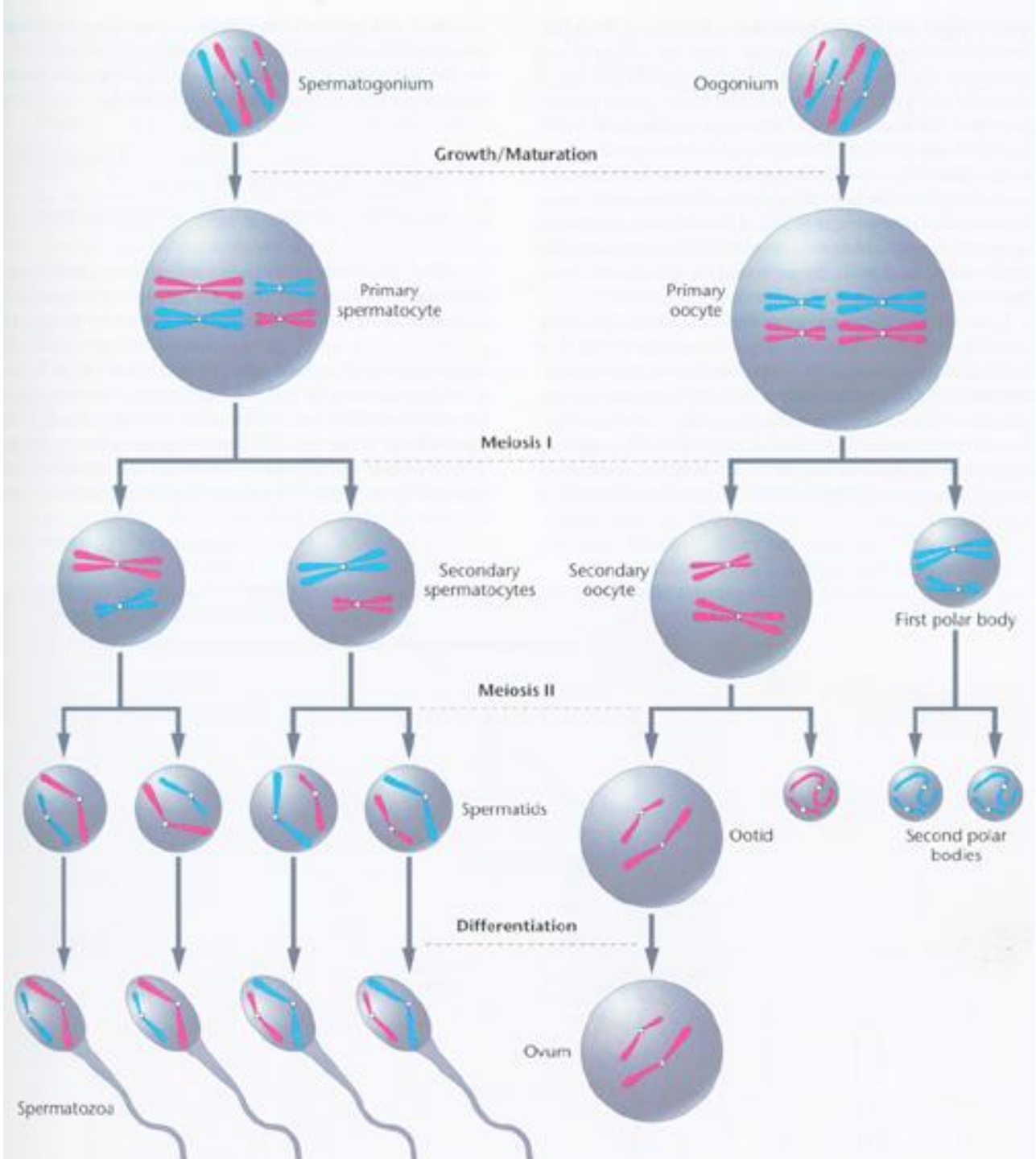
- **the cells pinch off resulting in four haploid spermatids that will get flagella and develop into sperm cells**



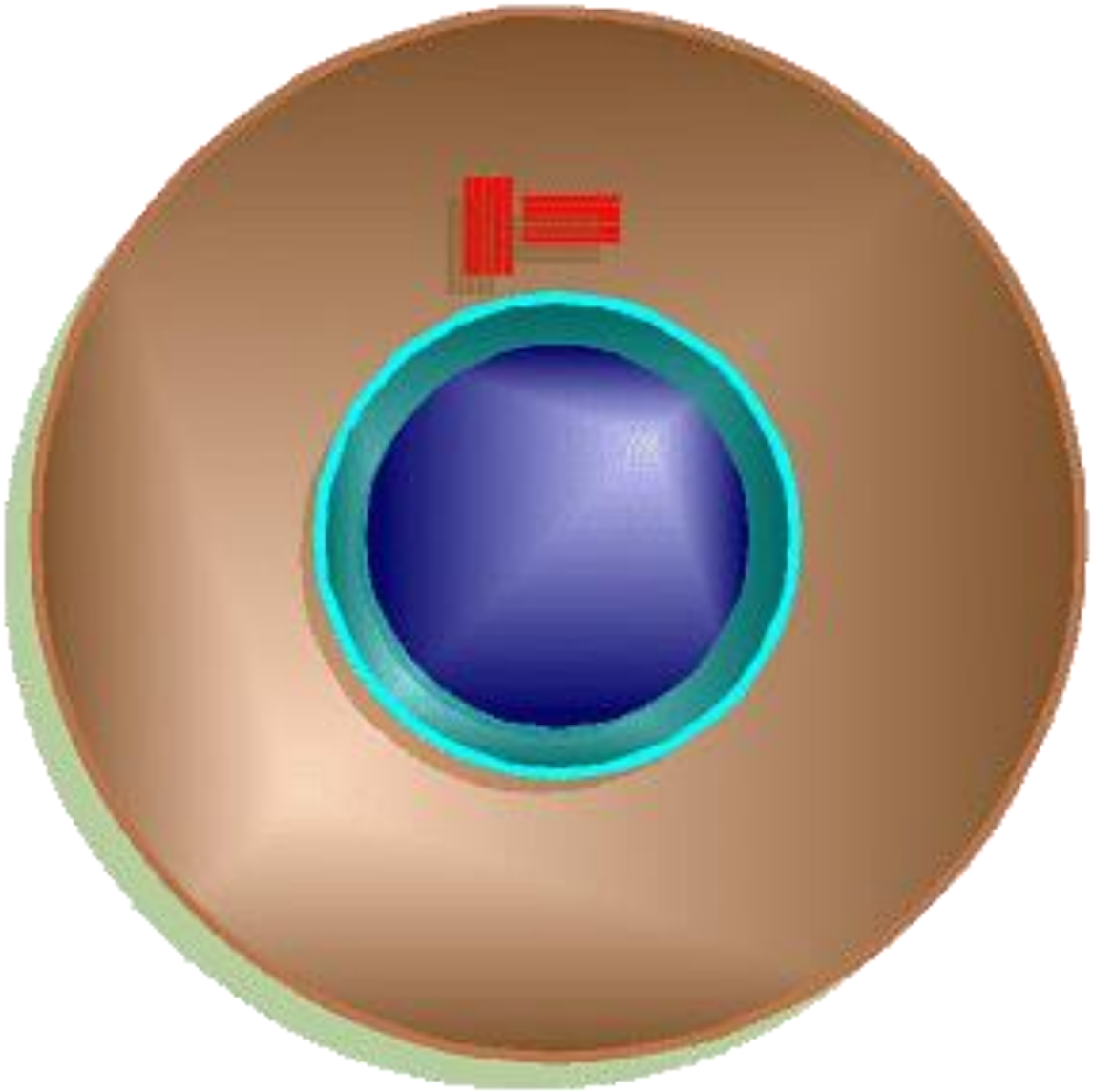
MEIOSIS II




Chromosomes first become visible.
Synapsis, or homologous chromosome pairing, begins.
Pairing is complete.
Sister chromatids become visible.
Sister chromatids
Chromosomes become shorter and thicker; chiasmata are prominent.
Chiasma
Bivalent
Homologous chromosomes repel; they are held together by chiasmata.
Bivalents align on the metaphase plate.
Homologous chromosomes separate.
Leptotene
Zygotene
Early pachytene
Late pachytene
Diplotene
Diakinesis
Metaphase I
Anaphase I
Telophase I
Prophase II
Metaphase II
Anaphase II
Telophase II
PROPHASE I
(chromosome pairing and condensation; crossing-over)
MEIOSIS
Centromeres split.
Chromosomes align on the metaphase plate.


Spermatogonium
Oogonium
Growth/Maturation
Primary spermatocyte
Primary oocyte
Meiosis I
Secondary spermatocytes
Secondary oocyte
First polar body
Meiosis II
Spermatids
Ootid
Second polar bodies
Differentiation
Ovum
Spermatozoa

Meiosis Movie



Meiosis In Females

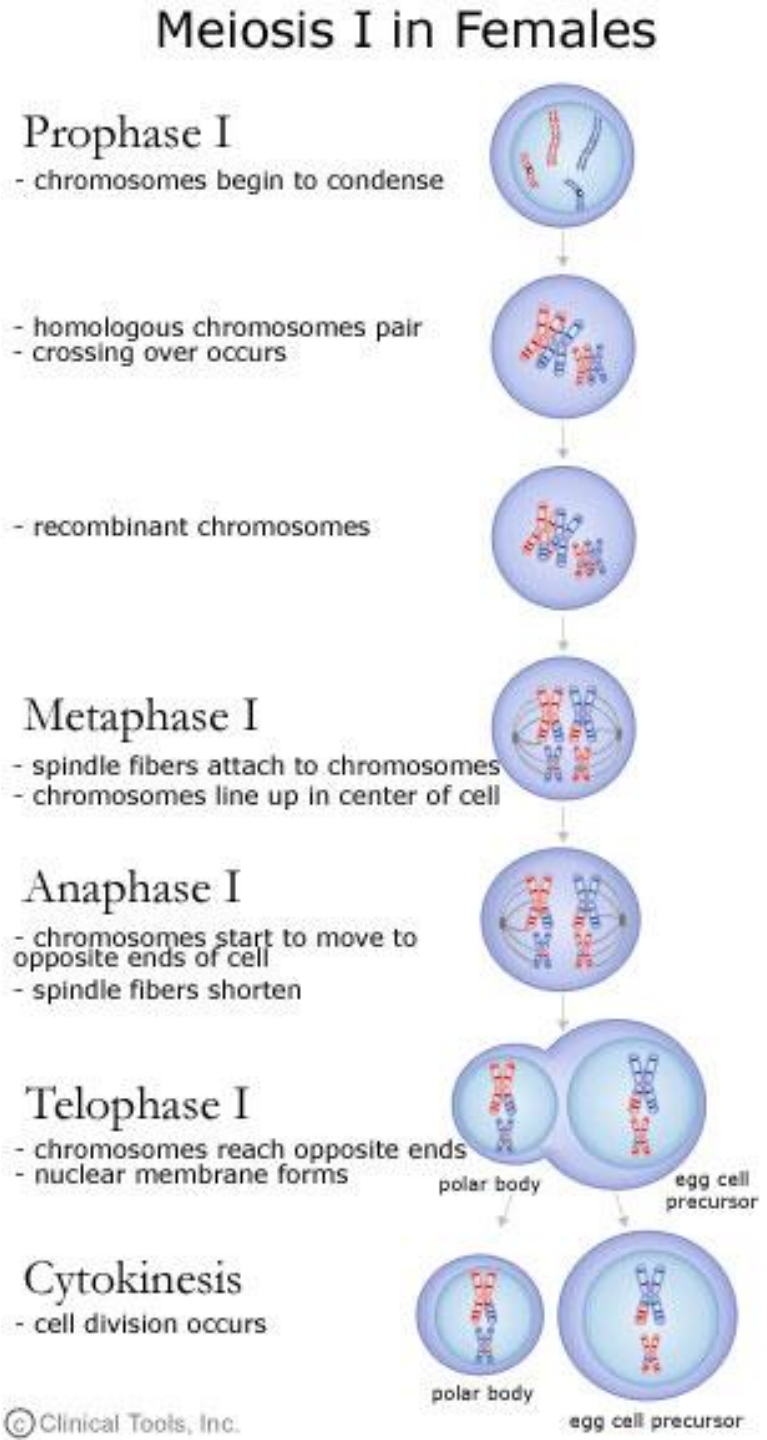
- **Meiosis in females (Oogenesis)**
- **Meiosis I begins in females before birth and is dormant until puberty or sexual maturity in other animals**
- **Chromosomes are replicated before birth in the primary Oocyte**
- **Before birth the early phases of prophase take place**
- **At puberty tetrads form (replicated homologous chromosomes side by side**
- **Metaphase I each chromosome from tetrad attaches to the poles by spindle fiber**

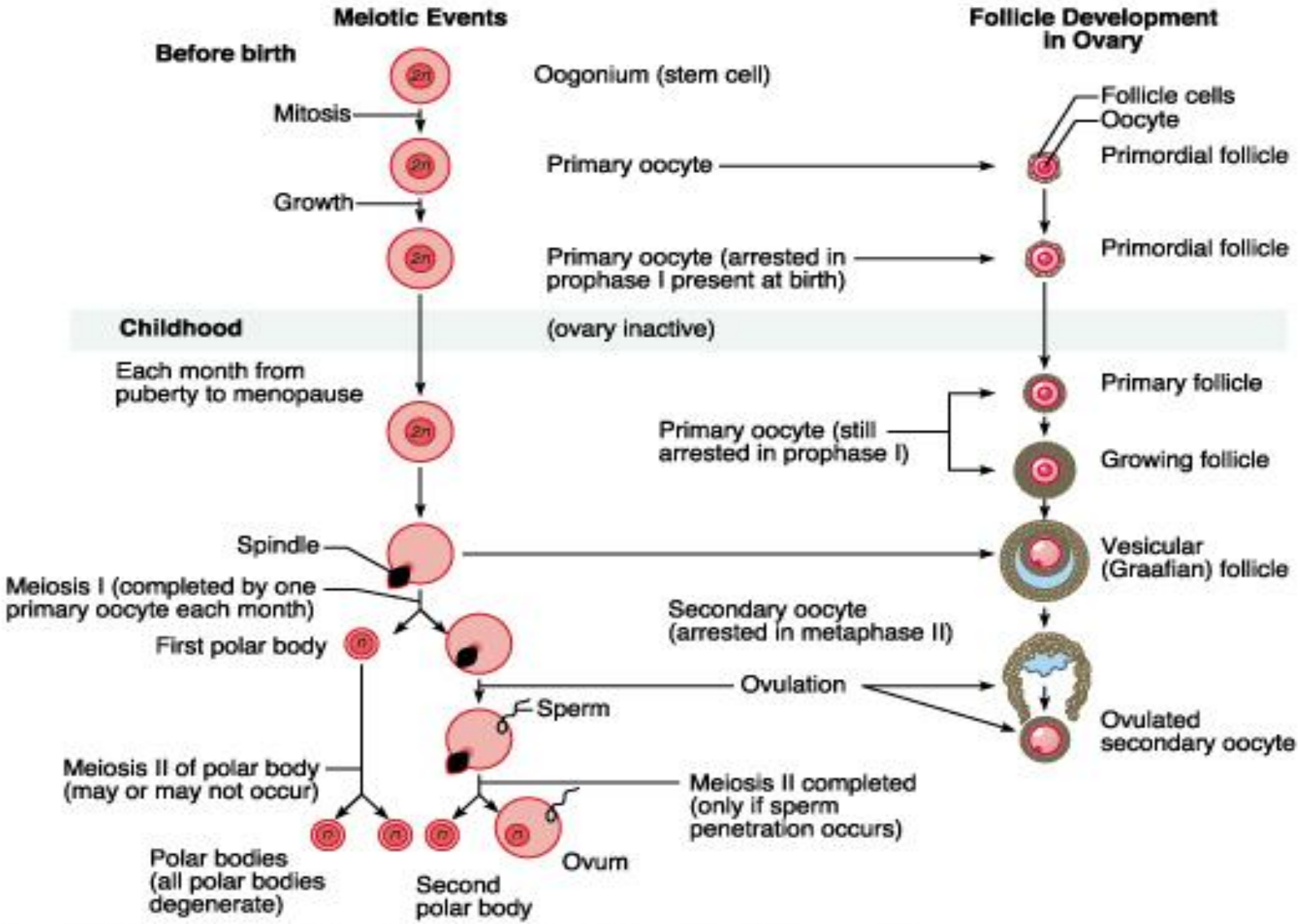
What is Oogenesis?

Be able to draw and label the stages of 0ogenesis.*

Anaphase

- **Tetrads are separated and an uneven division of cytoplasm takes place**
- **Telephase I – cytoplasm is pinched off**
  - **Results in a secondary Oocyte and first polar body which dies**





Meiosis II

- **division of secondary oocyte**
- **Prophase II is very short**
- **Metaphase II where double stranded chromosome attaches to spindle fiber**
- **Anaphase II chromatid pulled to poles**
- **Telephase II the cytoplasm is pinched off**

Meiosis II in Female

- **Results in an Ootid that will develop into a mature ovum and a second polar body that dies**
- **The reason only one ovum is produced is to conserve cytoplasm**

Meiosis

- **provides wide genetic variation in sperm and eggs translating into even greater variety among offspring**
- **Meiosis is the process of shuffling the deck so to speak**

Review

- What is spermatogenesis?
- What is oogenesis?
- **Know** the meiosis of spermatogenesis.
- **Know** oogenisis.

Biology Quiz

Name _____

1. What is spermatogenesis?
2. What is oogenesis?
3. **Draw** and **label** the meiosis of spermatogenesis.
4. **Draw** and **label** oogenisis.