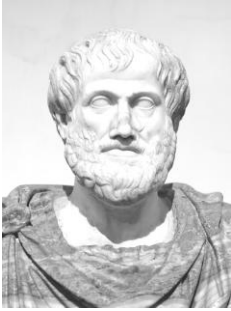


## Cellular Reproduction



### I. Early Beliefs

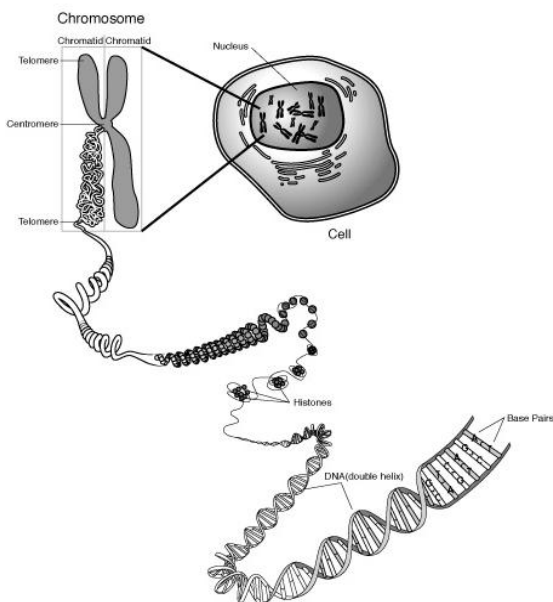
- A. Aristotle 384-322 BC believed that eels came from mud, that maggots came from decaying meat and horse hair in water turned into a worm
- B. Spontaneous generation was the belief that living could come from nonliving
- C. Francesco Redi 1668 from Italy did experiments that proved maggots came from flies not decaying meat by showing the life cycle of a fly. This brought questions for further investigation
- D. 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
- E. Louis Pasteur (1822-1895) believed micro organisms came from spores (reproductive cells) and would develop when nutrients were available
  1. Pasteur's experiment disproved spontaneous generation

### II. From Pasteur's work came the theory of biogenesis

- A. At the present time under present conditions all organisms are produced from other organisms

### III. Reproduction of Body cells

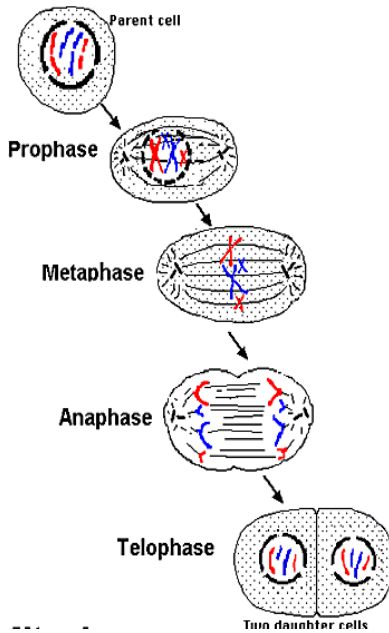
- A. The nucleus is the control center of the cell and is what controls the reproduction in Eukaryotes
  1. Chromatin is the main substance located in the nucleus made of chromosomes
  2. Chromosomes are distinct smaller bodies that are made of DNA
  3. DNA carries life's code and the genetic code for each cell
- B. 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)
- C. Interphase – phase of relatively little nuclear activity and makes up about 2/3 of the life of the cell
  1. The nuclear membrane is clearly visible
  2. Nucleoli is clearly visible



**3. Chromosomes replicate during this phase**  
**D. Mitosis is made up of four main stages**

**1. Prophase – First phase**

- a. Nucleolus disintegrates
- b. Chromosomes become visible
- c. Nuclear membrane dissolves
- d. Centrioles separate and migrate to opposite ends of the cell
- e. Nuclear membrane disappears by late prophase
- f. Chromosomes appear double stranded
  - 1) Each chromosome in the double strand is a chromatid
  - 2) The two chromatids are attached by a centromere
  - 3) The centrioles at opposite ends have spindle fibers (microtubules) that radiate toward the chromosomes
  - 4) The spindle fibers and the centrioles together make up the asters



**2. Metaphase – middle phase or after phase**

- a. Chromosomes move toward and line up all on the equator of the cell
- b. Each centromere attaches to a spindle fiber

**3. Anaphase**

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

**4. Telephase – last phase**

- a. Nuclear membrane reappears around each set of chromosomes by the ER
- b. Chromosomes lose distinct form and become a mass of chromatin
- c. Cell membrane completely pinches off resulting in two daughter cells

- d. The division of the cell other than the nucleus is called cytokinesis
    - e. If something goes wrong during this cycle death occurs
  - E. Mitosis is a process that insures genetic continuity in which the daughter cells have the same information and # of chromosomes as the mother cell
  - F. Chromosome varies from one kind of an organism to another
  - G. Humans have 46 chromosomes
  - H. Karyotype - show the cells # and type of chromosomes
  - I. For each chromosome there is a matching chromosome
    - 1. Has the same type of information
    - 2. One set of 23 chromosomes came from your dad and one set of 23 came from your mom
    - 3. Each chromosome carries the same type of information as its mate
    - 4. When a chromosome is paired each pair is called homologous chromosomes
      - a. Homologous chromosomes carry the same type of information for the same genes
      - b. Humans have 23 homologous chromosomes, 46 individual chromosomes
      - c. A homolog is one chromosome from the homologous pair
    - 5. When a complete set of chromosomes are present it is said to be the diploid number of chromosomes or the  $2n$  # (46 in humans)
    - 6. When there is only  $\frac{1}{2}$  of a set present as in gametes it is called haploid or referred to as the  $n$  # of chromosomes. (23 in humans)
  - J. Mitosis was the process of getting a complete replication of chromosomes to produce two genetically identical  $2n$  cells
- IV. Meiosis is the process of making sex cells with  $\frac{1}{2}$  the # (haploid #) of chromosomes and shuffle the genetic information
- A. Meiosis is the process of making egg and sperm
  - B. First we are going to look at meiosis in males
    - 1. Meiosis involves two divisions called meiosis I and meiosis II
    - 2. Meiosis I in males is also called spermatogenesis
      - a. Meiosis starts in diploid spermatogonial cells in the testicles (interphase)
      - b. Prophase I – Primary spermatocyte

- 1) **Chromosomes move close together by a process called synapsis (finding its homolog) becoming a homologous pair**
  - 2) **Each chromosome duplicates itself becoming a double strand chromosome**
  - 3) **When two double stranded chromosome pairs are side by side they are called a tetrads**
  - c. **Metaphase I – each tetrad attaches to separate spindle fibers from opposite poles**
  - d. **Anaphase I – the tetrads are separated to opposite ends separating the homologous chromosomes**
  - e. **Telephase I – When the membrane pinches off**
  - f. **The result of division of meiosis I is haploid secondary spermatocytes**
  3. **Meiosis II separates the double stranded chromosomes (separates the chromatids)**
    - a. **Prophase II is a short phase**
    - b. **Metaphase II – chromosomes are lined up along the equator and attach to a spindle fiber**
    - c. **Anaphase II – the chromatids are separated to opposite ends**
    - d. **Telephase II – the cells pinch off resulting in four haploid spermatids that will get flagella and develop into sperm cells**
- C. Meiosis in females (Oogenesis)**
1. **Meiosis I begins in females before birth and is dormant until puberty or sexual maturity in other animals**
    - a. **Chromosomes are replicated before birth in the primary Oocyte**
    - b. **Before birth the early phases of prophase take place**
    - c. **At puberty tetrads form (replicated homologous chromosomes side by side)**
    - d. **Metaphase I each chromosome from tetrad attaches to the poles by spindle fiber**
    - e. **Anaphase I – Tetrads are separated and an uneven division of cytoplasm takes place**
    - f. **Telephase I – cytoplasm is pinched off**

- g. Results in a secondary Oocyte and first polar body which dies
- 2. Meiosis II division of secondary oocyte
  - a. Prophase II is very short
  - b. Metaphase II where double stranded chromosome attaches to spindle fiber
  - c. Anaphase II chromatid pulled to poles
  - d. Telephase II the cytoplasm is pinched off
    - 1) Results in an Ootid that will develop into a mature ovum and a second polar body that dies
  - e. The reason only one ovum is produced is to conserve cytoplasm
- D. Meiosis provides wide genetic variation in sperm and eggs translating into even greater variety among offspring
- E. Meiosis is the process of shuffling the deck so to speak

