

## Meiosis Lab I: Objectives and Directions

1. Objectives for Meiosis Lab:
  - A. Observe the **different phases of Meiosis** by forming clay models of **MEIOSIS**
  - B. Observe how **INDEPENDENT ASSORTMENT (RANDOM ALIGNMENT)** of the **chromosome pairs** occurs during **METAPHASE I of MEIOSIS** without the influence of **crossing-over**.
  - C. Observe how the **segregation of alleles** occurs during **MEIOSIS** as a result of the separation of the **2 chromosomes** of each **homologous pair of chromosomes (homologs)** in **ANAPHASE I**.
  - D. Observe the effect of the **segregation of alleles** on **genetic diversity**.
  - E. Observe why **genes** are inherited together due to **linkage** (all **genes** on the same **chromosome** are **linked**)
  - F. Observe why the **new cells** formed **differ genetically** from the **original cell**
  - G. Develop knowledge of **what happens to the chromosomes during MEIOSIS**
  
2. Materials: (per group)
  - A. One large sheet of brown paper or a paper-covered tabletop
  - B. **2 colors** of clay for **chromosomes** and **4 colors** of clay (small amounts) for **alleles**
  - C. Pen or pencil, mm scale, and razor blade.
  - D. Several sheets of the letter-size white paper for the models.
  
3. Methods: (form groups of no less than 4 but no more than 6 students)
  - A. Spend 10 minutes studying **MEIOSIS** (this should include crossing-over to be done for “Exercise B”) **NO BOOKS or NOTES when making the models**.
  - B. Obtain the required materials
  - C. Roll out the clay **ONLY** on the brown paper.
  
4. Note: ***Only those who participate in model making will receive points.***
  - A. Each person should examine each model for correctness and consistency.
  - B. Everyone in the group will receive the same points of evaluation, so be sure to agree on the correctness of the models (**NO dissenting opinion points**).
  - C. Have the instructor evaluate your models after **EACH** exercise.
  - D. **DO NOT** compare models between groups before evaluation.
  - E. Zero points if a group’s work area is not left properly cleaned-up.

## Meiosis Lab II: Clay Models of Meiosis 1

4. Exercise A: Meiosis and Random alignment WITHOUT CROSSING-OVER
  - A. Construct **10 models of MEIOSIS** for a cell with a nucleus that is  $2n=4$ , (assume that the chromosomes are always condensed and the same size in all models):
    1. **Interphase in G2** (except show the chromosomes condensed even though in reality, they are NOT CONDENSED in **interphase**)
    2. **Prophase I**
    3. **Metaphase I** (make two models to show **random alignment**)
    4. **Anaphase I**
    5. **Telophase I**
    6. **Metaphase II**
    7. **Anaphase II**
    8. **Telophase II** (make two models to show **independent assortment** which is due to **random alignment** of **chromosome pairs** that occurs during **metaphase I**)
  - B. Chromosome models:
    1. Use **red** and **blue** modeling clay to form the **chromosomes**
    2. Use one color for **each set of parental chromosomes**
    3. Assume there is **1 long chromosome** and **1 short chromosome** per set (make the **long chromosomes** about **6 cm long** and the **short chromosomes** about **4 cm long**; make the **diameter** of both types of **chromosomes** about **3 - 5 mm**)
  - C. Gene models for 2 heterozygous gene loci
    1. **Gene locus A**: construct **small clay beads** of one color to represent **1 allele at heterozygous gene locus A** and **small clay beads** of another color to represent a second **allele at heterozygous gene locus A**.
    2. **Gene locus B**: construct **small clay beads** of one color to represent **1 allele at heterozygous gene locus B** and **small clay beads** of another color to represent a second **allele at heterozygous gene locus B**.
    3. Place the **gene locus B** clay bead **alleles** at the **END** of the **long pair of chromosomes** and the **gene locus A** clay bead **alleles** about **2 cm above gene locus B** on each of the **2 chromatids** of the **replicated chromosomes**.
  - D. Use pen or pencil to indicate the nuclear envelope, nucleoli, and the spindle apparatus (the out edge of the paper will represent the cell wall).
5. **SAVE ALL** of these **MEIOSIS MODELS** for “Exercise B” on the next page.

## Meiosis Lab 3: Clay Models of Meiosis 2

### 6. Exercise B: Meiosis and the Effect of Crossing-Over

- A. Use the **10 clay models of MEIOSIS** previously constructed including the clay beads that represent the **2 different alleles at heterozygous gene locus A** and the **2 different alleles at heterozygous gene locus B**.
- B. Change the models to demonstrate what happens to the arrangement of the **4 alleles** on the **long chromosome** in the **new cells** formed if **crossing-over** occurs between the **2 gene loci** constructed in “**Exercise A**”
- C. Show **crossing-over ONLY** on these models:
  1. **Prophase I**
  2. **Metaphase I (both models)**
  3. **Telophase I**
  4. **Metaphase II**
  5. **Telophase II (both models)**