

***Before You Begin:  
A Background Material Lesson Plan***

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**Learning Outcomes:**

Students should have basic understanding of the background information before viewing the Lectures.

**Concepts**

Meiosis

Mitosis

Sexual Reproduction

Asexual Reproduction

Homologous pair

Chromatid

Centromere

Homozygous

Heterozygous

Autosome

Sex chromosome

Sex-linked gene

Bipotential gonad

Gamete

Zygote

Clone

Testosterone

Estrogen

Secondary Sex Characteristics

Karyotype

Mutation

Parthenogenesis

SR Y-sex-determining region of the Y chromosome

**Scientists**

Discuss how each of these scientists contributed to the beginning of Genetic Research.

*Photos courtesy of The Archives, California Institute of Technology*

Gregor Mendel



Theodor Boveri

Alfred Sturtevant



Walter Sutton



Thomas Hunt Morgan



**Discussion Questions Prior to Viewing the Lecture Series**

1. When did genetic investigations begin?
2. What tools and technology were available for scientists at that time?
3. How did people believe the sex of an organism was determined?
4. How is the sex of a baby determined?

**Karyotype Activity**

Define and discuss Karyotyping before proceeding with the activity.

Karyotype is a photomicrograph of the entire metaphase chromosome component of a cell. In a non-dividing cell the chromosomes are not easily visible because they are spread throughout the nucleus as chromatin. During the metaphase stage of mitosis the chromatin organizes itself and duplicates into sister chromatids, attached at the centromere. The chromosomes can be colored with special dyes that cause them to become striped, or banded, at specific points. Since each chromosome has a “twin” [review Haploid (N) and Diploid (2N)], the homologous pairs can be identified and grouped.

Cut out the chromosomes, match homologous pairs, and prepare a karyotype of the individual.

Extra: Males and females of many pet birds (parrots, macaws, etc.) look identical so karyotyping is used by breeders and pet owners to find out the gender of their birds.

**Shuffling the Deck- The Card Game of Life**

Explain and discuss how this activity simulates gene swapping in sexual reproduction. Include concepts of randomness, contribution of two parents, and the shuffling of traits.

1. Procure enough decks of cards for each student to participate in the activity. One deck is sufficient for 4 teams of 2. (Select deck with different designs or colors patterns for ease of sorting later.)
2. Sort cards by number.
3. Setting up student hands: Give each student six cards:

**Example Setup**

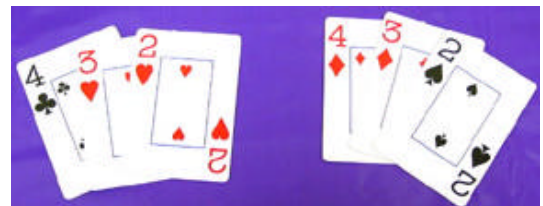
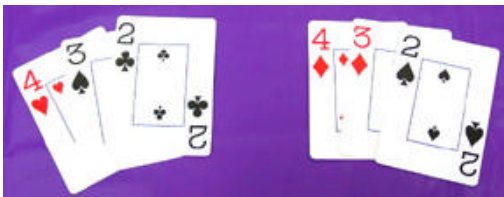
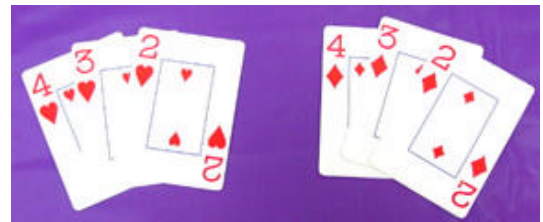
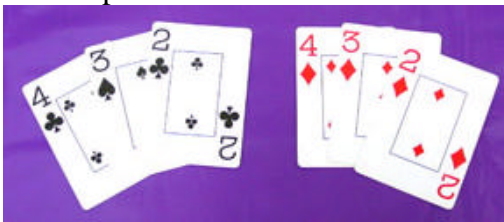


<b><i>Student 1</i></b>	2?	2?
	3?	3?
	4?	4?
<b><i>Student 2</i></b>	2?	2?
	3?	3?
	4?	4?

4. Student 1 selects one card from a pair to put into the **“Genetic Pot.”** Student 2 must play a card of equal value, regardless of suit, against the card that was lead.
5. Students record what was played into the **“Genetic Pot”** to determine traits of their offspring.  
 Red is dominant; black is recessive  
 Red and black is the heterozygous condition, dominant trait is expressed.

Dominant Trait	Recessive Trait	Playing Cards			
Roll Tongue	Non roller	2	5	8	Jack
Free Ear lobes	Attached Ear Lobes	3	6	9	Queen
Dimples Present	No Dimples	4	7	10	King

Examples of Possible Combinations:



6. Switch partners with others that have the same numbers. Student 1 can use the “Genetic Pot,” and Student 2 can use the unselected traits.
7. Point out that sexual reproduction aids in variation.
8. You can occasionally use the Joker and Aces to represent mutations that occur and are passed along.

**References:**

1. Evolution- a series with a useful website produced and maintained by WGBH <http://www.pbs.org/wgbh/evolution/sex/index.html>
2. PBS Teacher Source – <http://www.pbs.org/teachersource/>
3. Scientific American Frontiers – Gene Hunters <http://www.pbs.org/saf/1202/>
4. Nova- Cracking the Code of Life <http://www.pbs.org/wgbh/nova/genome/>
5. Nova on-line resource <http://www.pbs.org/wgbh/nova/teachers/>