9th Grade

Heredity

Imagine

- You walk into a family reunion…

Brainstorm

- What are ways that parents and siblings are alike? How are they different?

(brainstorm a list with a partner)

Alike: facial features, hair color, eye color (physical traits), genetic diseases, handedness, personality (the way they act). gender

Different: gender, hair length, (physical traits), the way they live

Driving Question

- How do boy and girl twins happen
- Why is skin color the same
- Why is it that kids are taller than the parents
- How do conjoined twins occur
- Why are babies born with different length hair
- When is gender determined
- Why are some babies born with health problems
- Why are their different eye colors in people /families
- Why are their genetics mutations that affect body parts
- If identical twins marry identical twins will ther children all be identical

- How does genetics determine who we are and what we look like

- How does genetics determine who we are and what we look like?

Write

- Challenge Statement

(write in your lab notebook)

Human children have the potential to share more genetic information with their parents than with a sibling (exclude identical twins).

(agree/disagree and explain your answer)

How does the stuff that determines our traits get from parents to kids?

Making babies!

- List the steps you went through to make gametes (sperm and eggs) and then the baby.
  - gametes need half the info; one of each pair (which one is random)
  - gametes join together to make a baby that has a pair of each chromosome

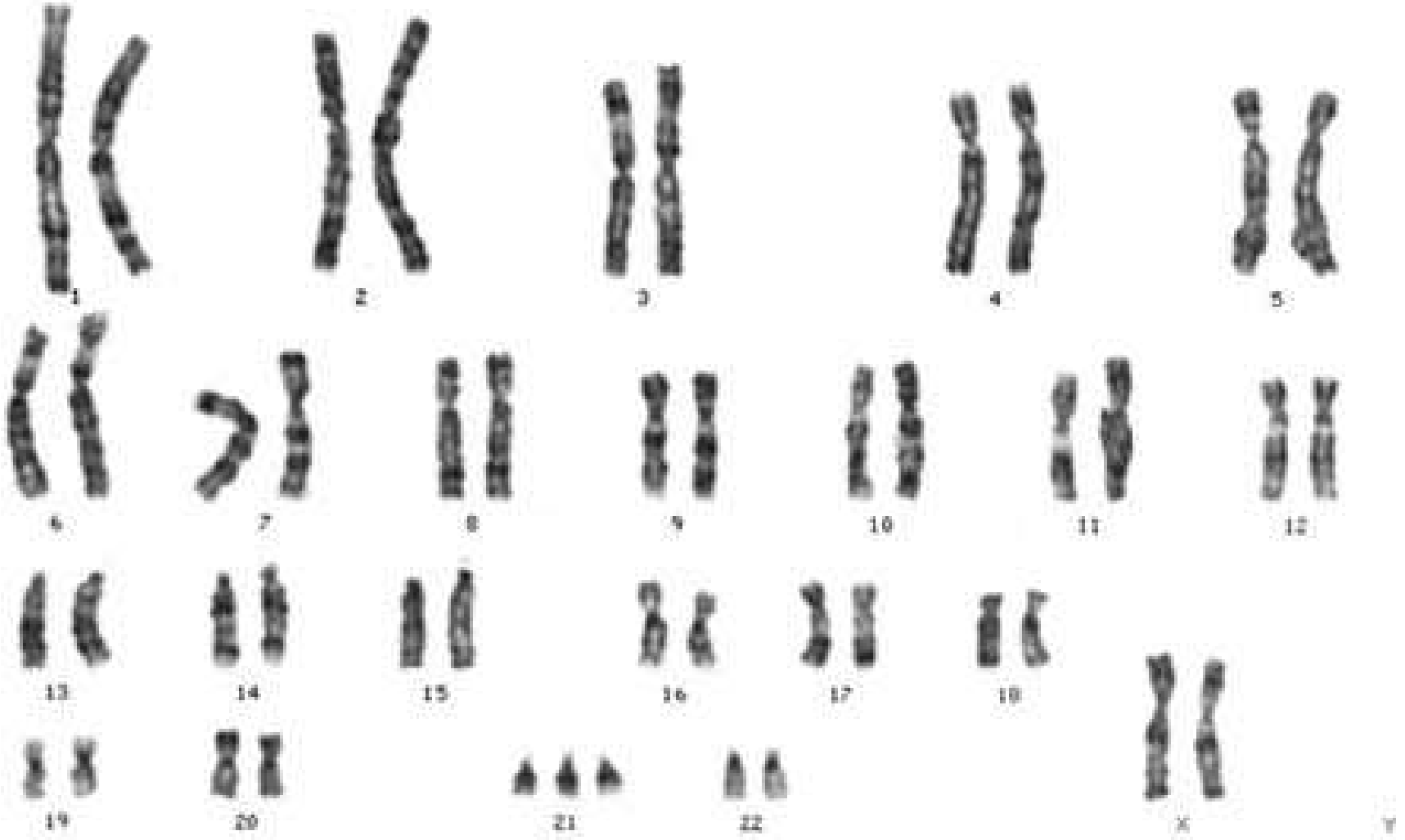
Our model of heredity so far

return to challenge statement

discuss your initial responses to the challenge statement and your thinking in light of our meiosis work.

Meiosis challenge

- What happens when something goes wrong?


1
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21
22
X
Y

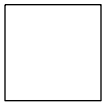
All in the Family

A Model of Inheritance

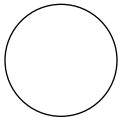
L. Coleman 2013

ALBINISM is a rare genetic trait found in many species. Organisms with albinism are unable to produce pigment proteins. In animals the protein affected is **melanin**, in plants it is **chlorophyll**.

Pedigree Basics



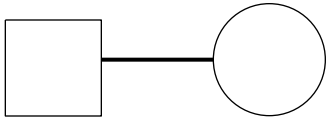
male



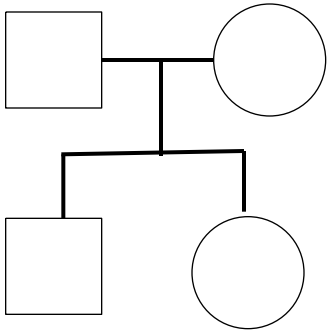
female

affected male

affected female



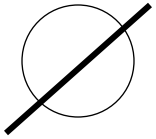
a mating



parents

offspring

siblings



deceased

Trait: **Albinism**

George

Arlene

Sandra

Tom

Sam

Wilma

Ann

Michael

Daniel

Alan

Abigail

Christopher

The Kendrick Family

A. What observations can you make about the pedigree?

B. What questions do you have about our observations?

Our driving question:

- How does genetics determine who we are and what we look like?

Model of Inheritance (so far…)

TERMS

gene

trait

RELATIONSHIPS

1. Sexually reproducing organisms have two genes that determine each trait, one from each parent.
   a. A parent passes only one of his/her two genes for a trait to each offspring.
   b. Random chance determines which of the two genes is passed to each offspring.

A look at some famous data...

Gregor Mendel's Experiments with Pea Plants

(published 1865)

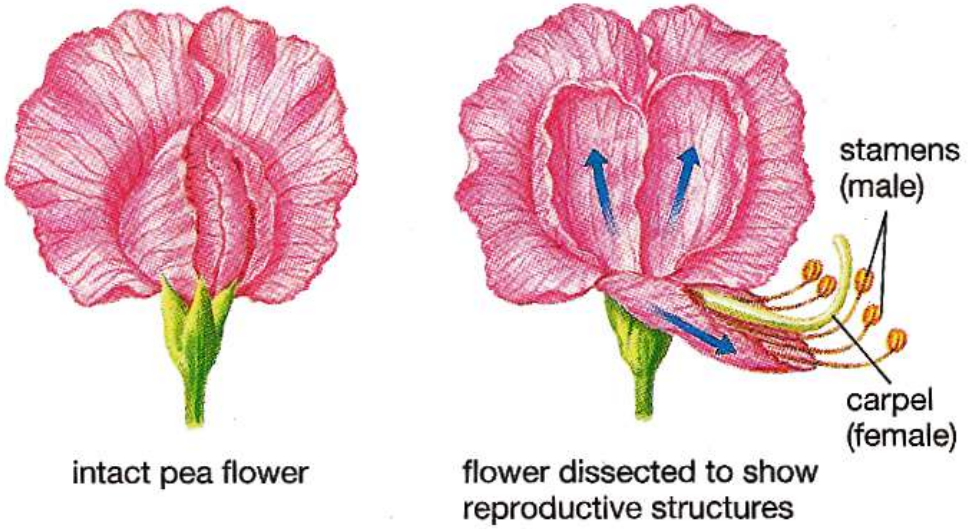
Gregor Mendel was a priest in what is now the Czech Republic. He was a high school science teacher and keeper of the monastery garden.

His curiosity about heredity led him do numerous experiments on pea plants. His results and conclusions written in 1865 are the foundation of modern genetics.

Mendel's monastery today.

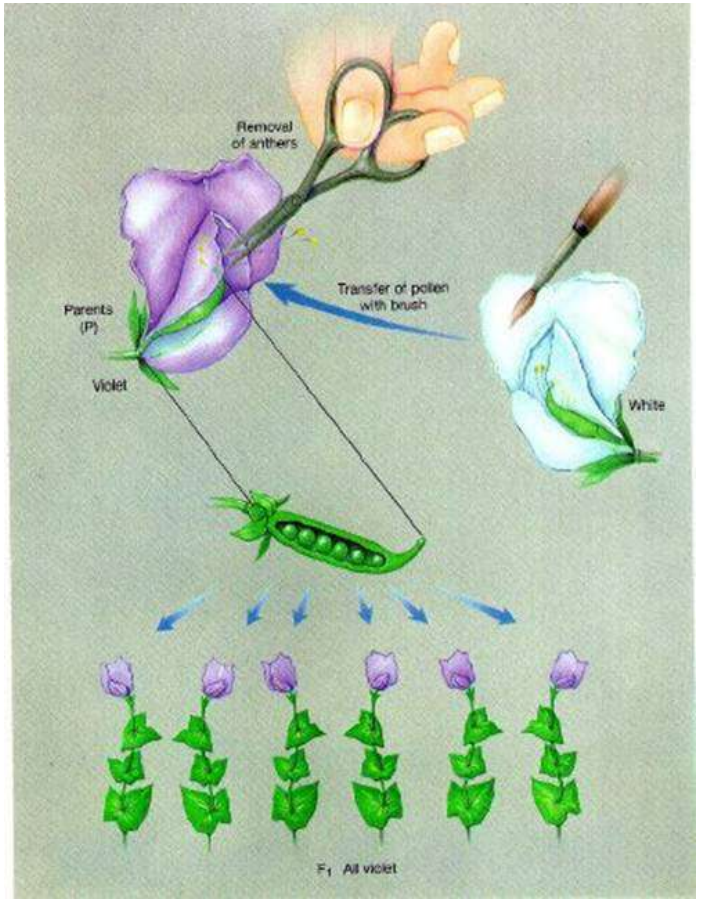
Mendel's garden.

He chose pea plants because of the structure of their flowers. Male and female reproductive parts are enclosed by petals.



He saw that this would allow him to control the parent plants in a cross.

He meticulously clipped off the stamens of a plant's flowers to prevent self-pollination…



He tested more than 70,000 pea plants!!

… then with a small brush moved pollen from the stamen of the desired parent to the stigma of the first plant.

Mendel observed the following kinds of pea plants in his garden:

G. ***What controls flower color in these pea plants?***

Since there are two <u>different</u> colors what does this tell us about the gene controlling the color trait?

We call these different forms of genes **“alleles”.**
We can now add to our model:

Model of Inheritance (so far…)

TERMS

gene

trait

alleles

RELATIONSHIPS

1. Sexually reproducing organisms have two genes that determine each trait, one from each parent.
   a. A parent passes only one of his/her two genes for a trait to each offspring.
   b. Random chance determines which of the two genes is passed to each offspring.

2. Genes for a trait can occur in different forms called alleles.

• So for pea flowers, there are two alleles for color: **purple** and _____. We will represent the purple allele with a **1** and the white allele with a **2**.

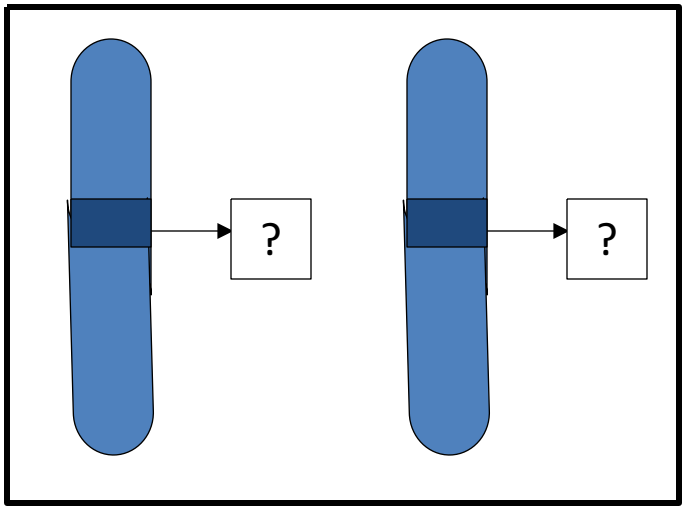
1 = purple allele

Mendel began by creating lines of plants that were **pure-breeding** for purple flowers and **pure-breeding** for white flowers.

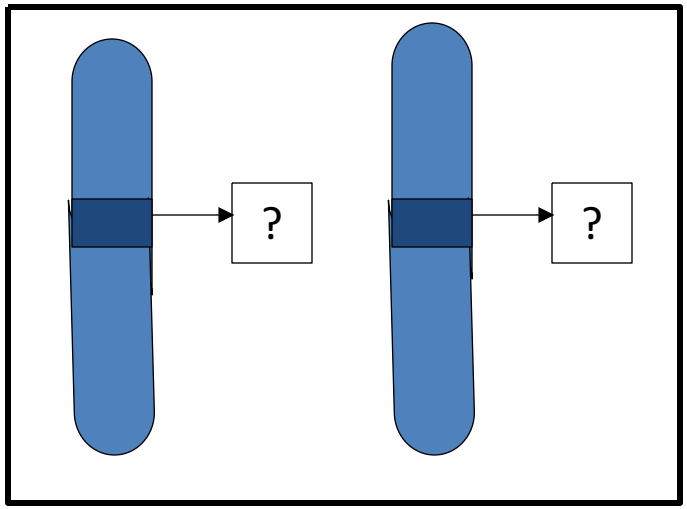
What do you think "pure-breeding" means?

H. Since we know each plant has two alleles for color, ***what two alleles do you think a pure-breeding purple plant has? What two alleles do you think a pure-breeding white plant has?*** (Remember 1= purple allele, 2 = white allele)

Purple:



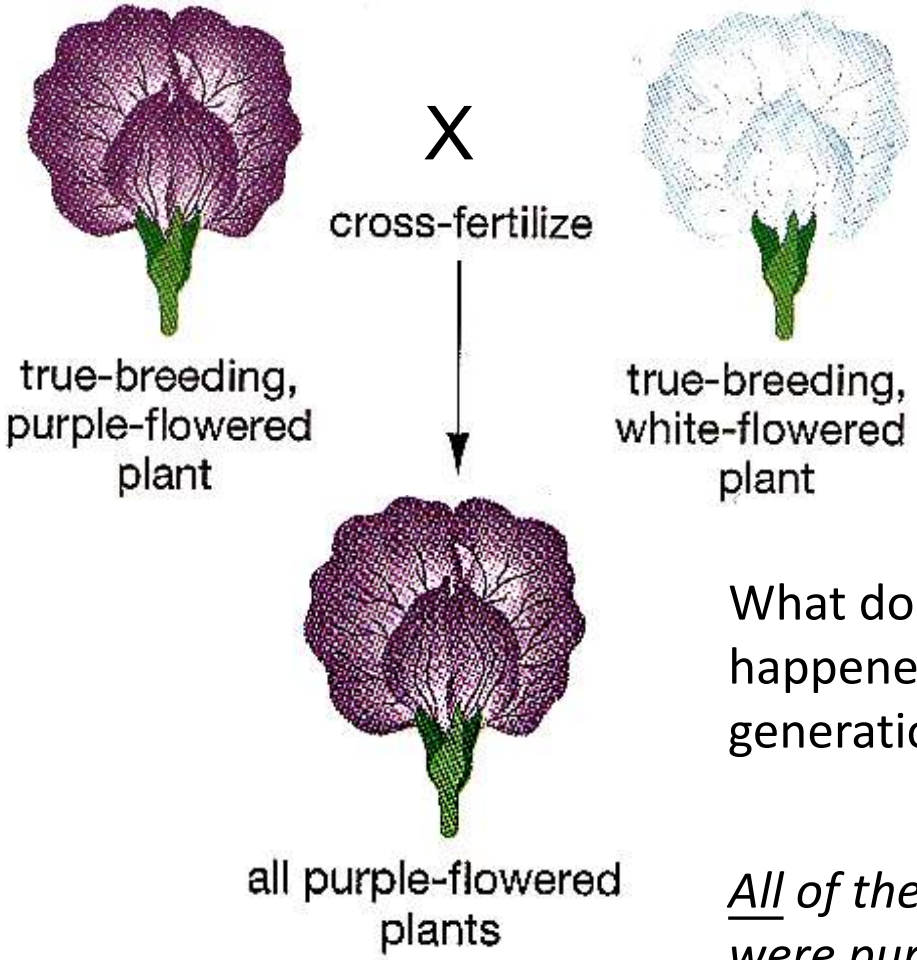
White:



endel then crossed (*mated - symbolize by "X"*) **pure-breeding purple flowers** with . He called this a "**Parental Cross**" (*symbolized by* "**P**") and he called their offspring the "**F1**" generation (*from Latin "Filia", meaning daughter*).

P

(parental cross)



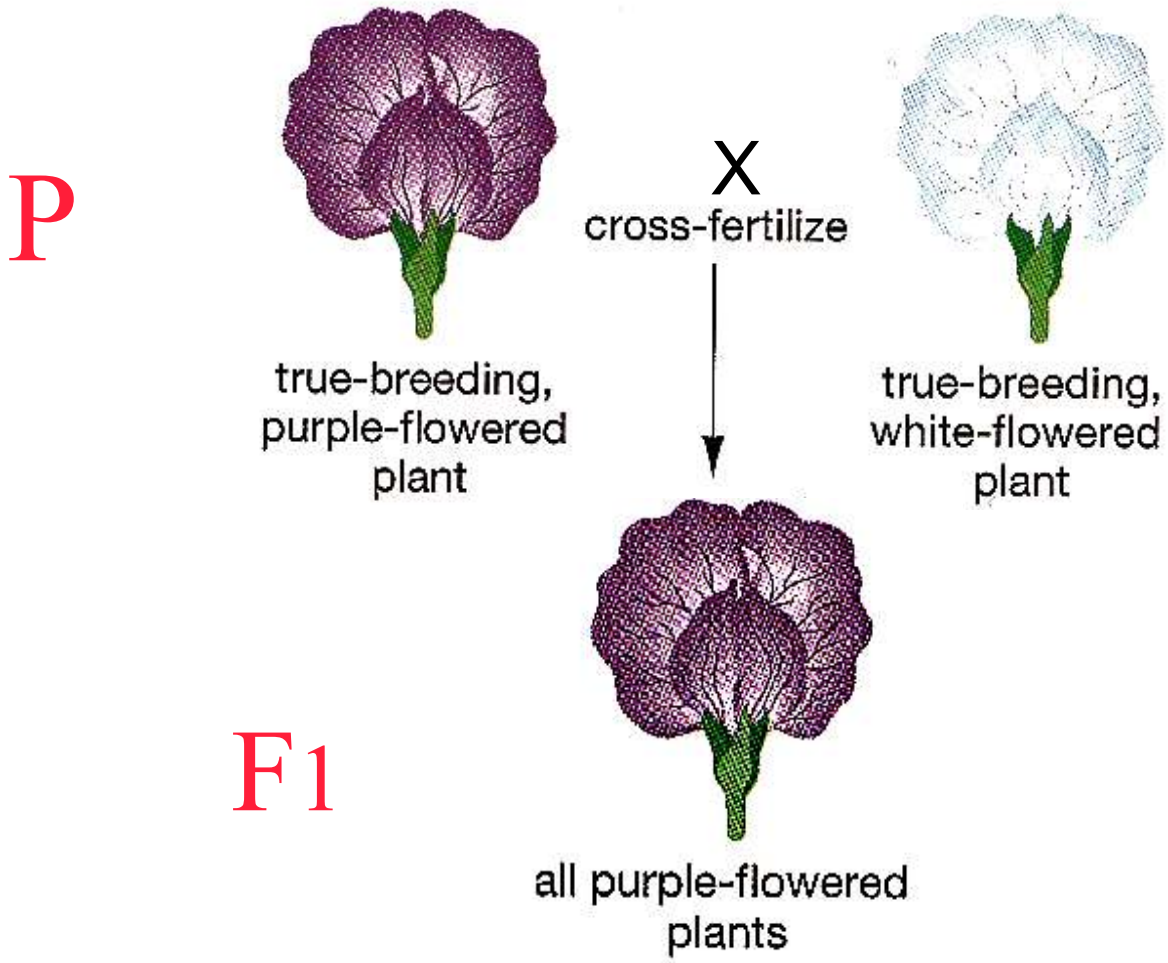
F1

(offspring of parental cross)

What do you think happened in the F1 generation?

<u>All</u> of the F1 offspring were purple!

I. Based on this data, our model, and the alleles of the two pure-breeding parents, ***what two alleles do the purple flowers in the F1 generation have?***



We can now add to our model:

Model of Inheritance (so far…)

TERMS

gene

trait

alleles

variations

RELATIONSHIPS

1. Sexually reproducing organisms have two genes that determine each trait, one from each parent.
   a. A parent passes only one of his/her two genes for a trait to each offspring.
   b. Random chance determines which of the two genes is passed to each offspring.

2. Genes for a trait can occur in different forms called alleles.

3. When there are two variations of a trait in a population then there are two alleles (1 and 2) and three combinations of alleles that individuals can have: (1,1) or (2,2) or (1,2).

There are **3** combinations of alleles but only **2** variations of the trait: purple and white. ***How is this possible?***

COMBINATIONS OF ALLELES

PURE-BREEDING PURPLE PARENT		PURE-BREEDING WHITE PARENT	F_1 OFFSPRING
(1,1)	X	(2,2)	(1,2)

Model of Inheritance (so far…)

TERMS

gene

trait

alleles

variation

dominant

recessive

RELATIONSHIPS

1. Sexually reproducing organisms have two genes that determine each trait, one from each parent.
   a. A parent passes only one of his/her two genes for a trait to each offspring.
   b. Random chance determines which of the two genes is passed to each offspring.
2. Genes for a trait can occur in different forms called alleles.
3. When there are two variations of a trait in a population then there are two alleles (1 and 2) and three possible combinations of alleles that individuals can have: (1,1) or (2,2) or (1,2).

a. If (1,1) and (1,2) appear as one variation of the trait and (2,2) appears as the other then 1 is called the dominant allele.

b. 2 is called the recessive allele. It will only show if no dominant allele is present.

In further experiments Mendel allowed the F1 purple flowers to self-pollinate.

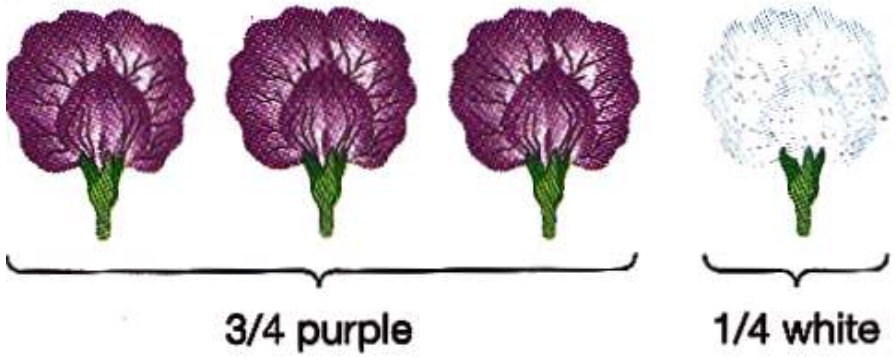
F1

What do you think happened?

self-fertilize

F2

(2nd generation offspring)



Both purple and white offspring resulted - but ***3 times more purple than white***. In other words, the ratio of purple to white was 3:1.

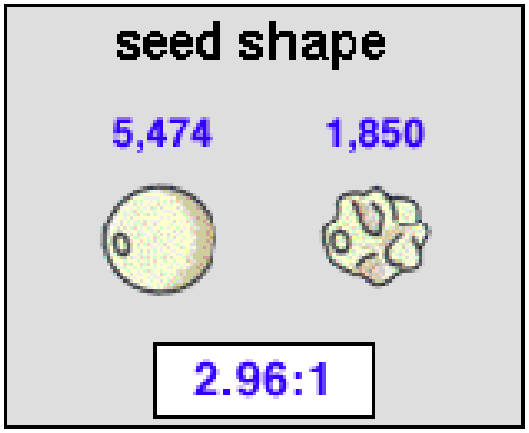
J. Using the model, ***explain how white flowers came from the two purple F_1 parents.***

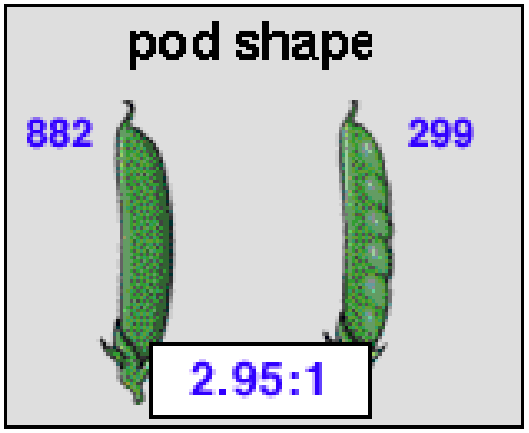
Explain why there are three times more purple offspring than white.

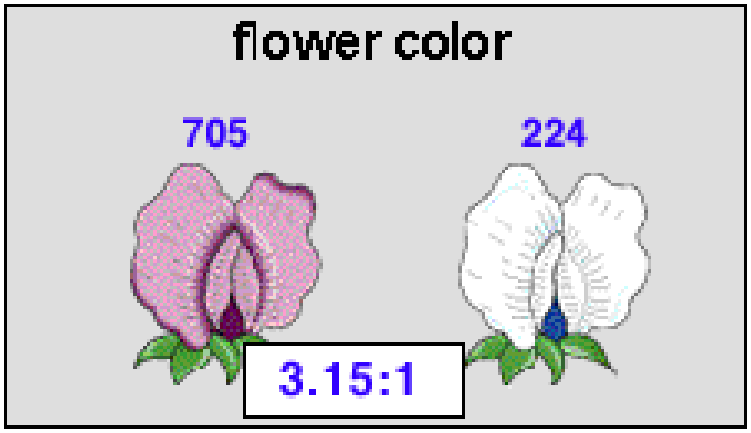
Mendel did the same experiments with several other traits in pea plants. All produced the same result:

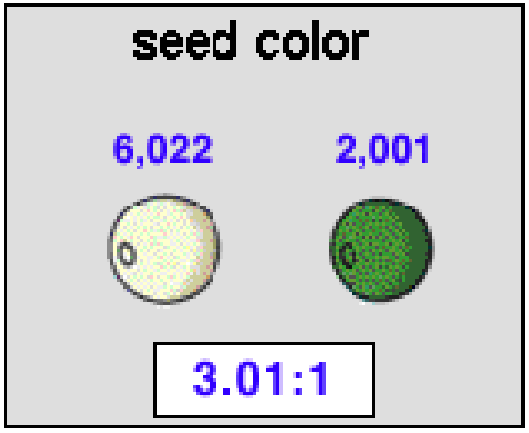
One variation of the trait disappeared in the 1st generation then reappeared in the 2nd. The ratio was always 3:1.

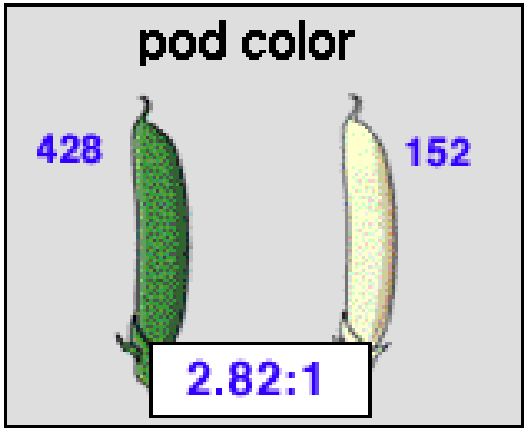
2nd generation data for various traits:

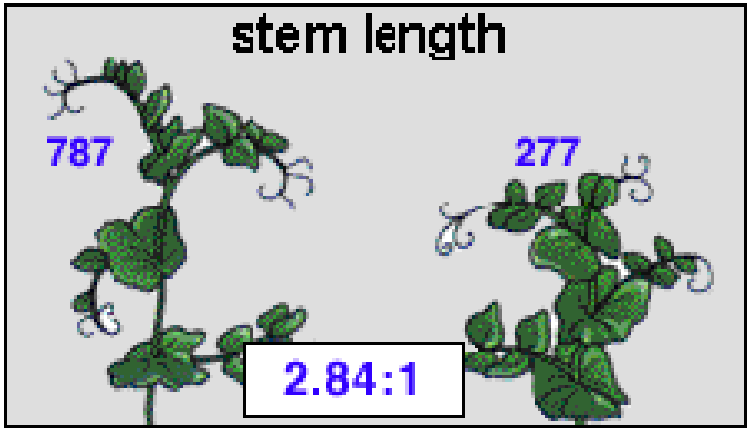






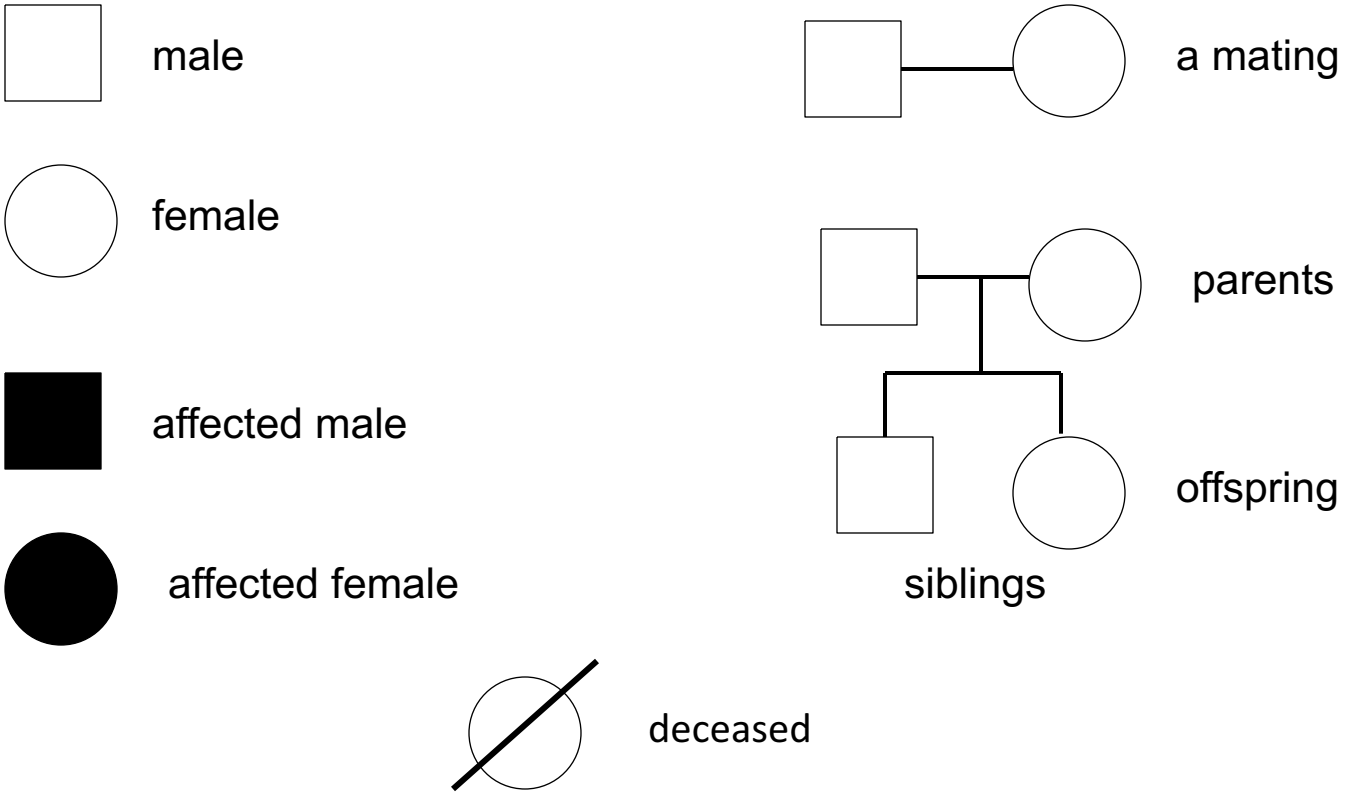






Now we're ready to return to the Kendrick family.

Quick review:



The Kendrick Family

Trait: **Albinism**

George

Arlene

Sandra

Tom

Sam

Wilma

Ann

Michael

Daniel

Alan

Abigail

Christopher

Driving question:

Applying the model

Mendel Practice

- We'll be using a fruit fly breeding simulation called Virtual Genetics Lab (free online)
- In this simulation you begin with a field population: imagine someone went out to the dumpster and caught a group of fruit flies
- Your task is to breed these flies to find out the mode of inheritance for the particular trait.

VGL Practice One

- Go to the VGL program and select “new problem” from the file menu
- Pick the file “VGL” and select the problem labeled **Level02.pr2**
- After receiving instruction on how to use the simulation your task will be to figure out which variation is dominant and which is recessive. Be prepared to explain your reasoning.
- If you finish one problem you may go on to another by exiting the problem (don’t save) and opening a new one. (note, the computer randomly assigns genotypes to phenotypes, so it is possible that you will see the same traits and variations and that they are not inherited in the same way as they were the first time.

Pick and present

- Pick one of the problems on which you worked and prepare a whiteboard illustrating what it is you figured out about the inheritance of that trait.
- Organize your presentation by making a clear claim (i.e. XXX variation is dominant to YYY variation) and citing the evidence from your crosses

VGL Practice Two: Two traits at a time

- go to problem **TwoGenes01.pr2**
- go through a similar process as you did for the first problem, but now you need to figure out each trait.

The bittersweet gift

- read the article quietly and make note of what information you have from it about the underlying genetics.
- Answer the questions

writing prompt

- Take on the role of a genetic counselor.
- Imagine Caleb comes to you at the age of 25 and tells you this story of his family and wonders about the chances of passing this disorder onto his own children.
- Summarize your findings about his odds in a letter to Caleb.

What determines a plant's ability to produce chlorophyll?

- What's already happened:
  - seeds were "planted" and left in the light for 3 days. No sprouts were observed.
  - dishes were moved to a dark environment and left for 7 days.

TODAY:

1. Label one dish A and the other B. Label with your group name.
2. Count # of green and albino plants in each dish and record. Minimize amount of time dish A is in light.
3. Put A back in box.
4. Put B under lamp.

Revising/Adding to the model

- VGL: **OneGene02.pr2 (codom)**
- **VGL: Level08.pr2 (2 or 3 alleles)**
- **Task: make a Prezi to show how to work through figuring out genotypes given your new mode of inheritance**

Genetics notation

- from 1,11,22,2
- to a system kids might see on tests and in high school

Make a baby!!

- goals:
  - practice w/ new notation
  - apply genetics model
  - have fun!

Procedure

- Assume both parents are heterozygous for every trait.
- Make a baby by flipping a coin to determine the allele the baby gets from each parent for each trait
- First figure out the sex of your baby by flipping a coin for the father only (why?)
  - heads= Xtails= Y
- Determine the rest of the traits
  - heads=dominant alleletails= recessive allele
  - for codominant traits
    - heads= variation on left; tails=right