EDU 323

MBR in Genetics

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)

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)

Meiosis review

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.

Family Histories

1. How many variations for the trait?
2. Does it occur in every generation? In other words, are there children who have it whose parents do not?
3. Is it on one side of the family or both?
4. Does it affect both males and females?

Review Mendel's model

A look at some famous data...

Gregor Mendel's Experiments with Pea Plants

(published 1865)

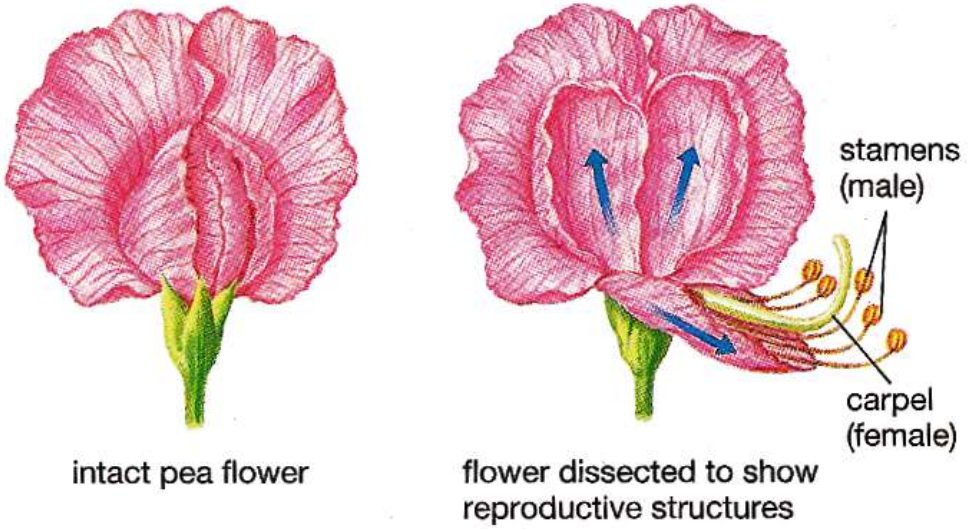
Gregor Mendel was a priest in what is now the Czech Republic. He was a high school science teacher and keeper of the monastery garden.

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.

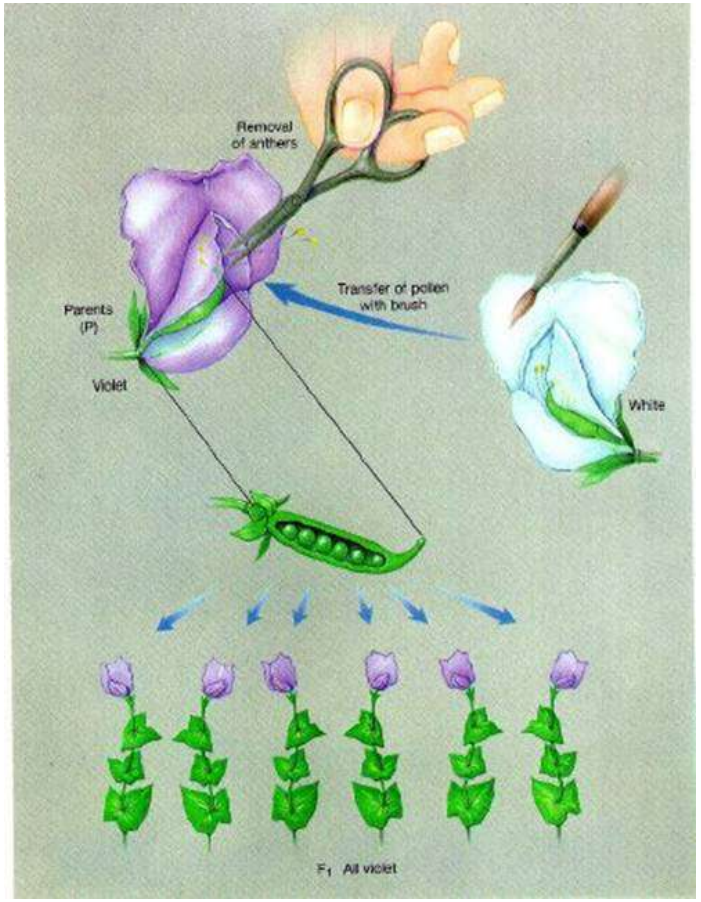
Mendel's garden.

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…



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

He tested more than 70,000 pea plants!!

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…)

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trait

alleles

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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**.

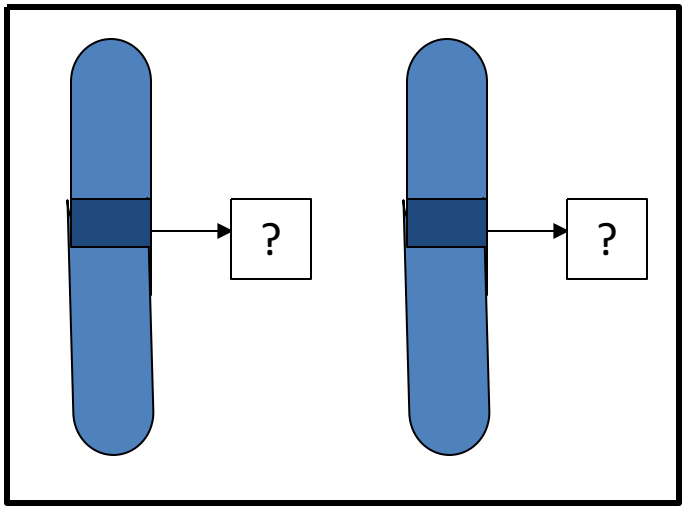
1 = purple allele

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

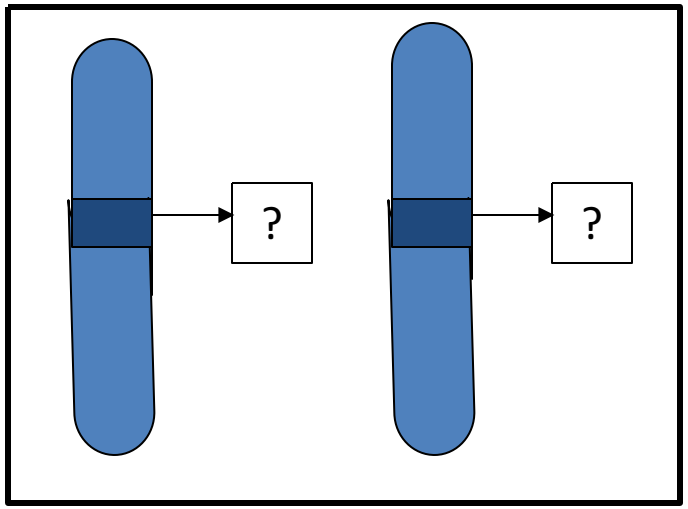
What do you think "pure-breeding" means?

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:



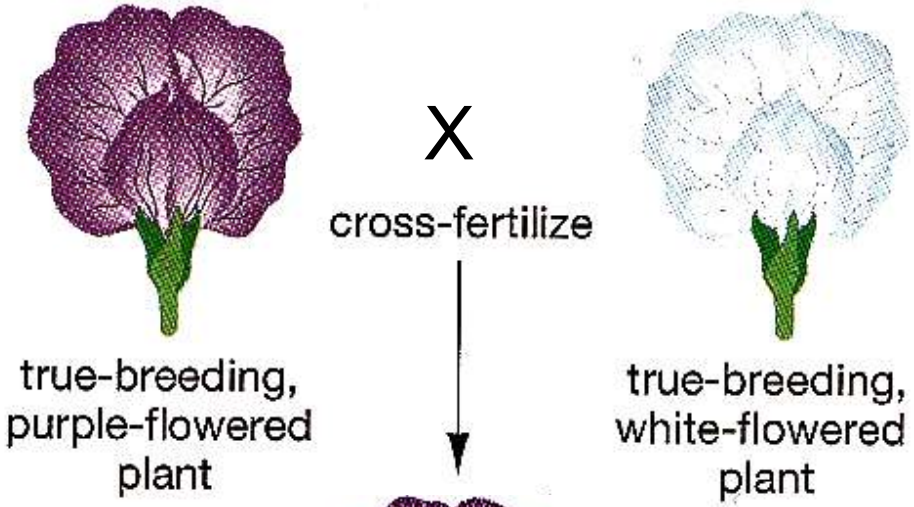
White:



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

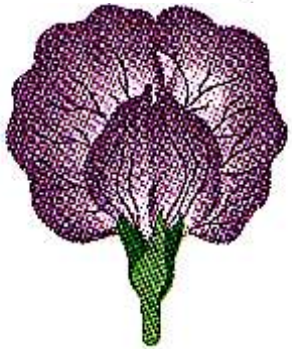
P

(parental cross)



F1

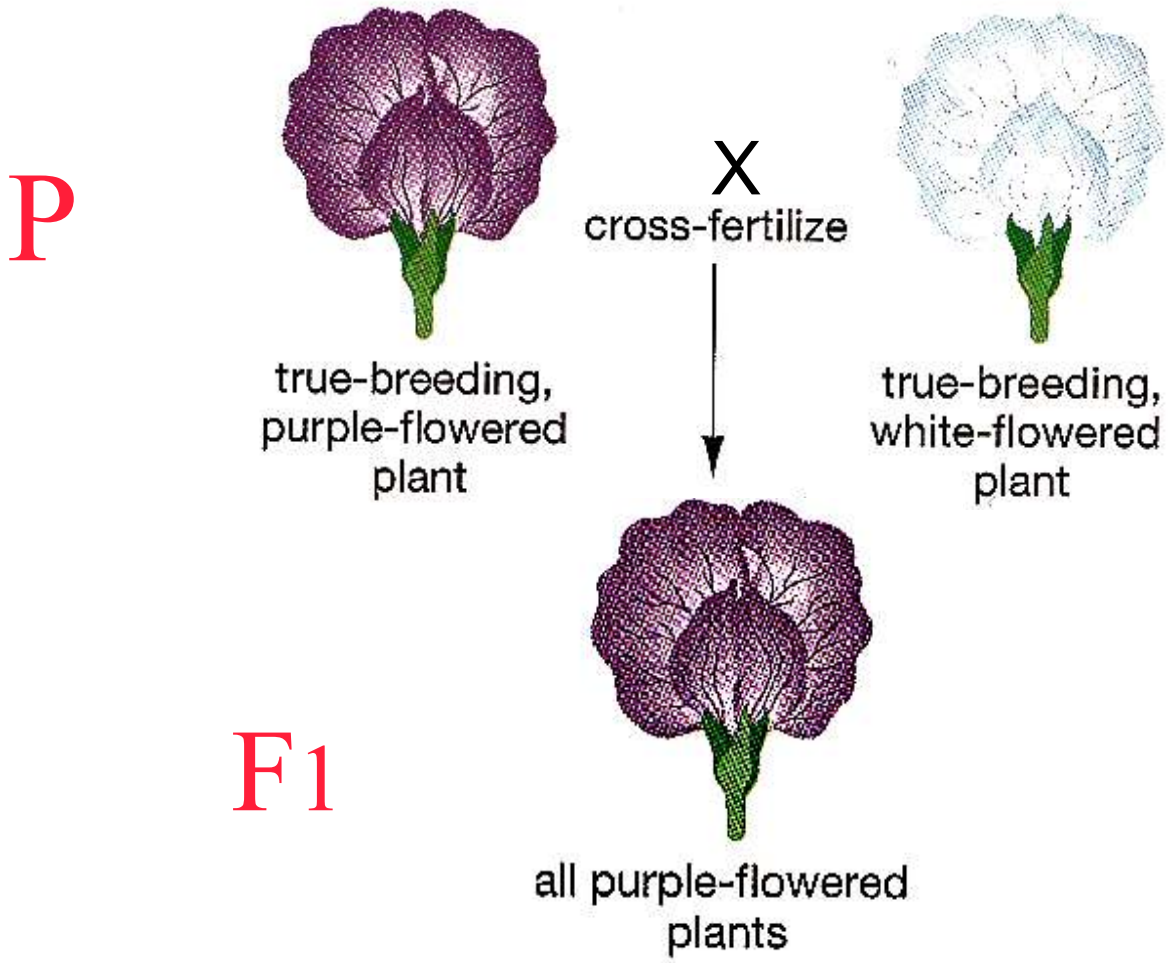
(offspring of parental cross)



What do you think happened in the F1 generation?

All 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

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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…)

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variation

dominant

recessive

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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.

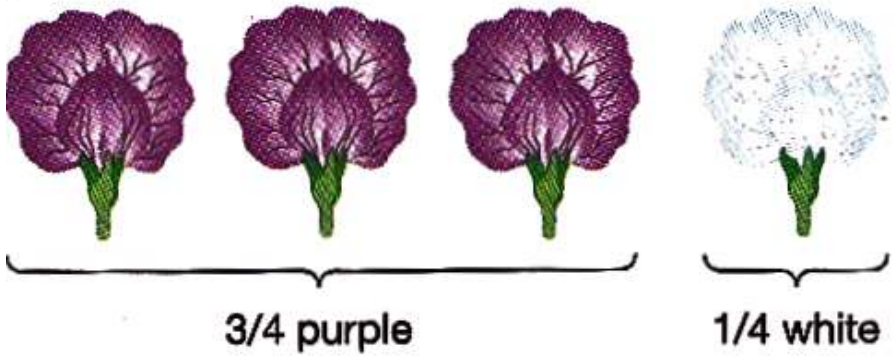
F1

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.

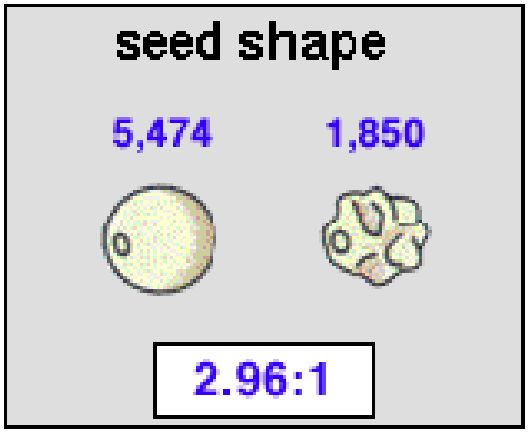
J. Using the model, ***explain how white flowers came from the two purple F_1 parents.***

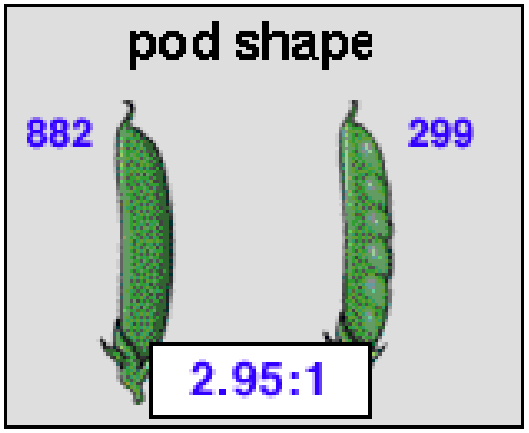
Explain why there are three times more purple offspring than white.

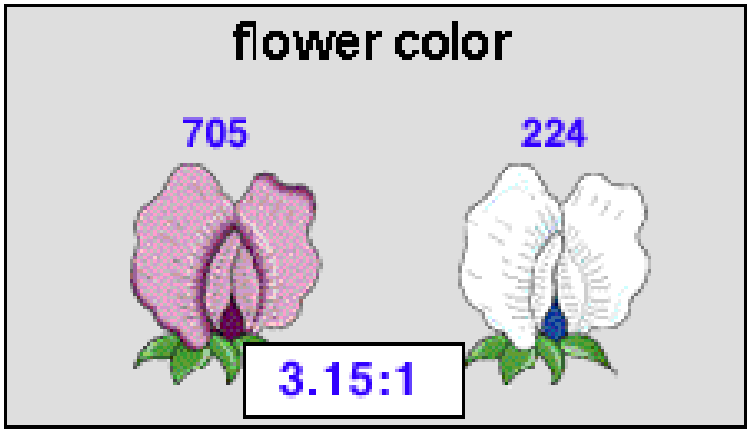
Mendel did the same experiments with several other traits in pea plants. All produced the same result:

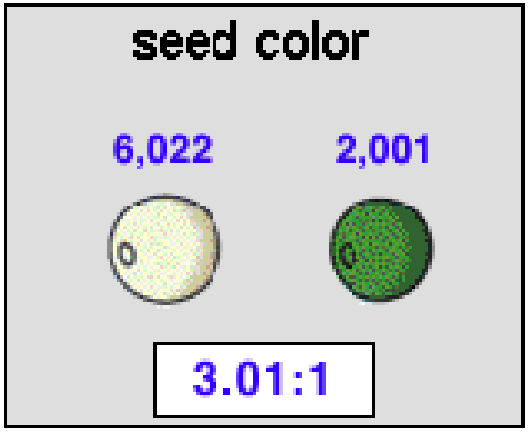
One variation of the trait disappeared in the 1st generation then reappeared in the 2nd. The ratio was always 3:1.

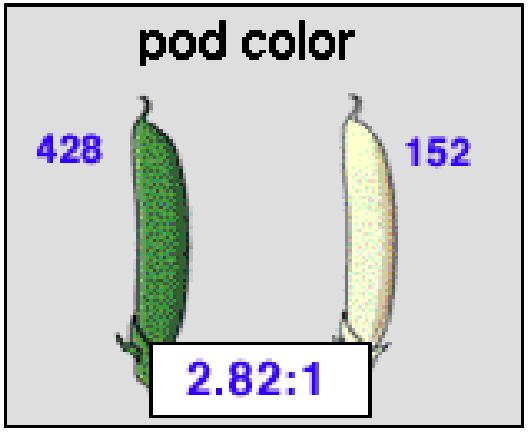
2nd generation data for various traits:

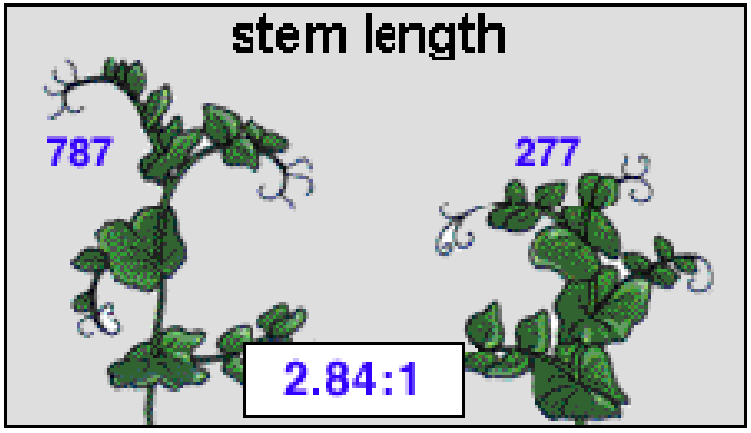












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Applying the model

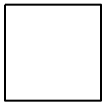
All in the Family

A Model of Inheritance

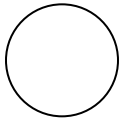
L. Coleman 2013

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



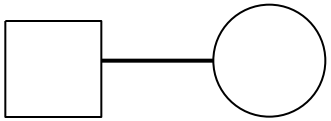
male



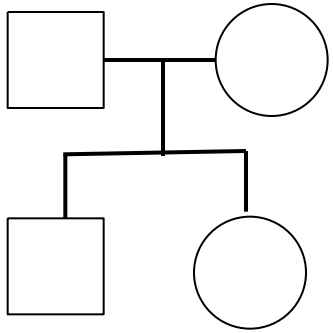
female

affected male

affected female



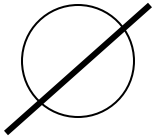
a mating



parents

offspring

siblings



deceased

Trait: **Albinism**

George

Arlene

Sandra

Tom

Sam

Wilma

Ann

Michael

Daniel

Alan

Abigail

Christopher

The Kendrick Family

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.