Lecture 3:

Laws of inheritance

Course 371

Lessons for life

The object of education is to teach us to love what is beautiful.

Plato, The Republic

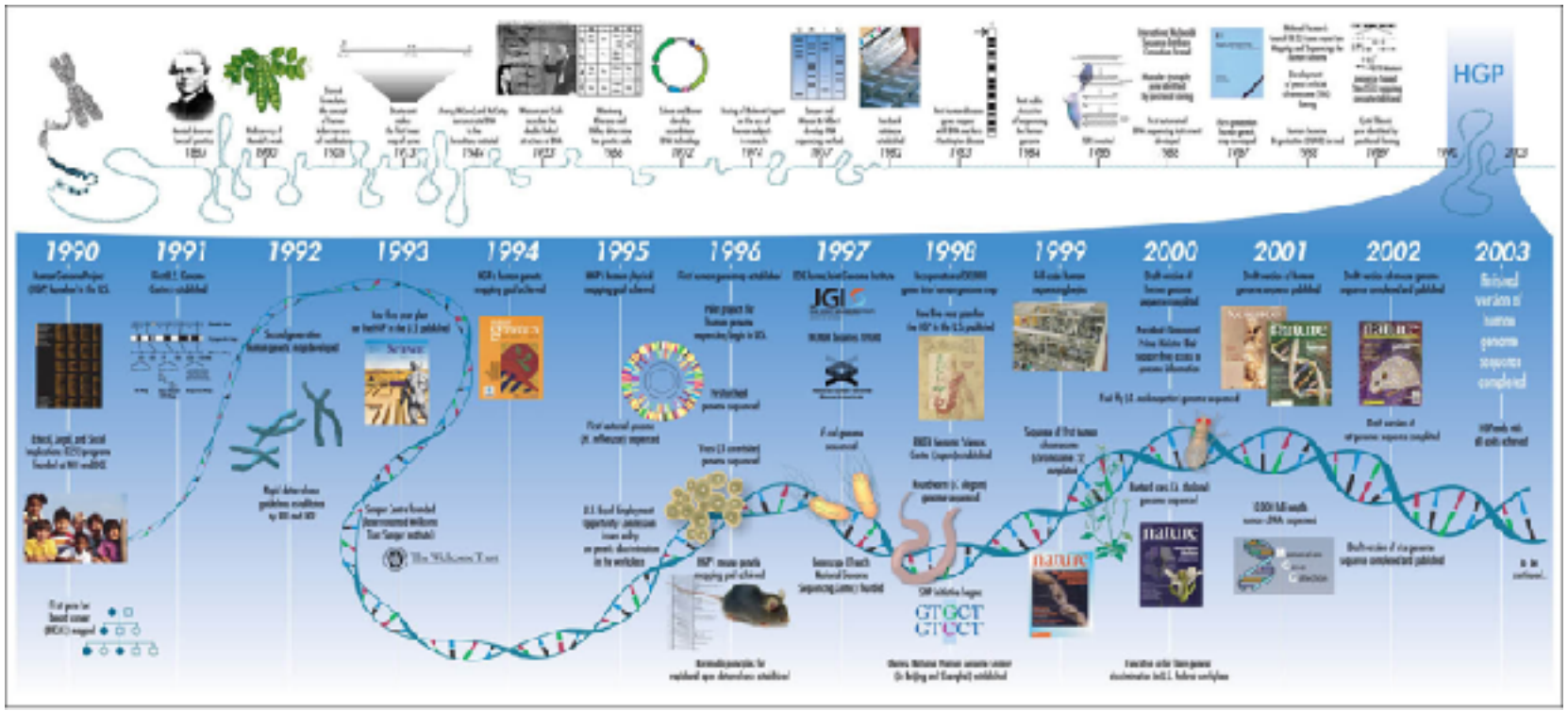
like

AIMS

- Introduce the progression of scientific thought that led to the development of a theory of inheritance.
- Introduce Mendel and his experimental model.
- Introduce the concept of hereditary traits.

DNA timeline

The knowledge we have today about DNA is the result of many experiments. Some experiments go back over 100 years ago.



Genetics/ Mol. Biology

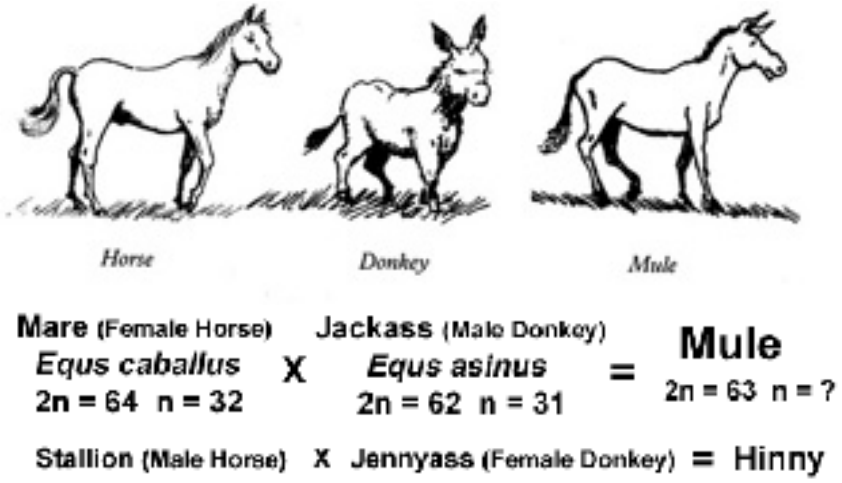
The development of genetics and molecular biology undergone phases of biological thoughts and experiments.

1. Scientific motives.
2. Laws of inheritance.
3. Location of the genetic material.
4. Nature and chemical identity of the genetic material.
5. How the genetic code works?

Scientific motives

The chief motives to understand heredity and the bases of it were:

1. Speciation
2. Hybridization
3. Similarities between parents and offsprings



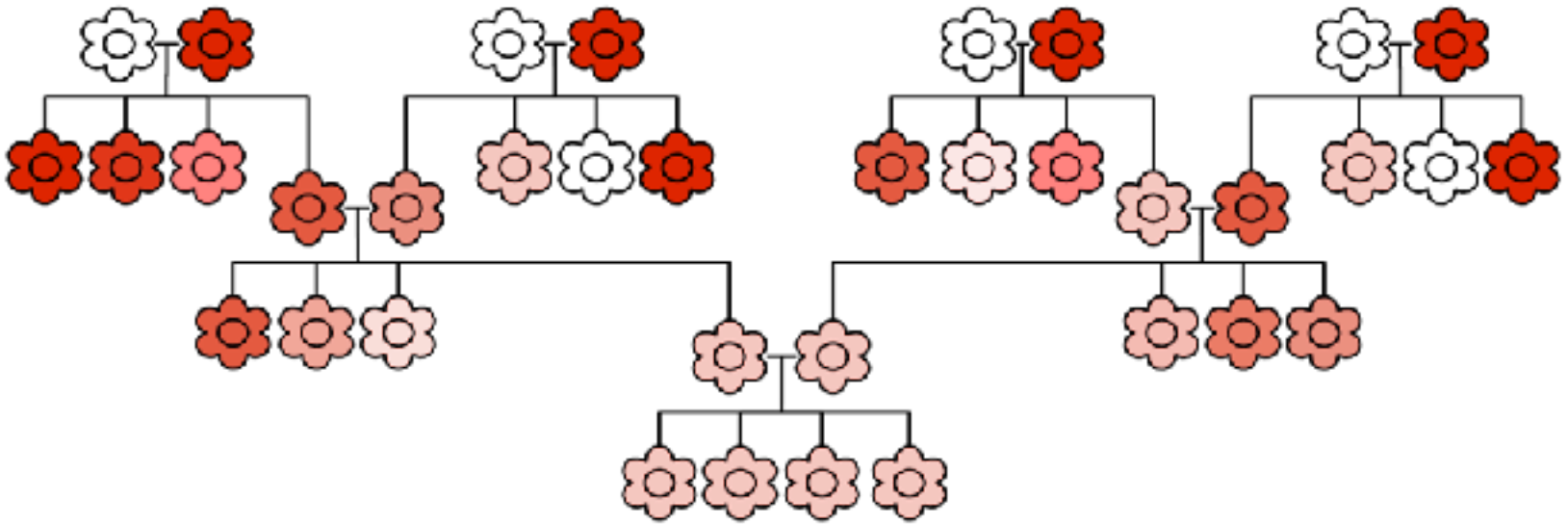
Scientific motives

How can one address question related to the bases of speciation, hybridization, and resemblance among related individuals?

A framework and a general theory of inheritance are needed

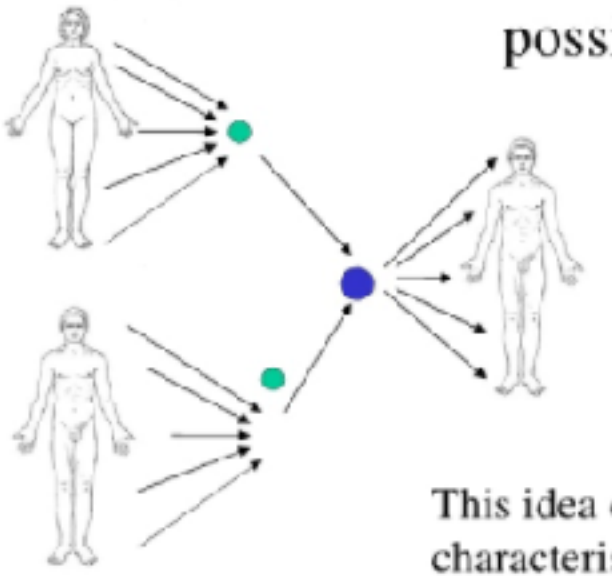
Theories of inheritance

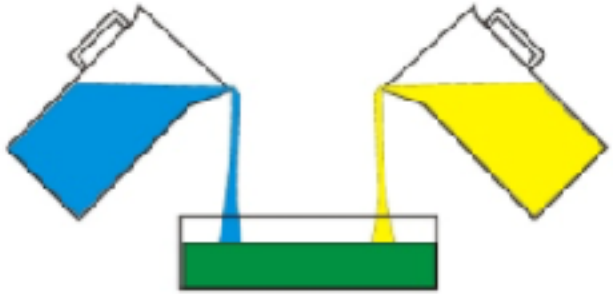
Before Mendel the only proposed theory of inheritance was “**blending inheritance**”.



Theories of inheritance

Pangenesis and the Blending of Bloods: An early hypothesis of how traits are passed from one generation to the next. Pre-Mendel, this was a popular idea, and Darwin even considered it a possibility!





This idea depends on the true mixing of characteristics from each parent.

Theories of inheritance

How traits are passed on?

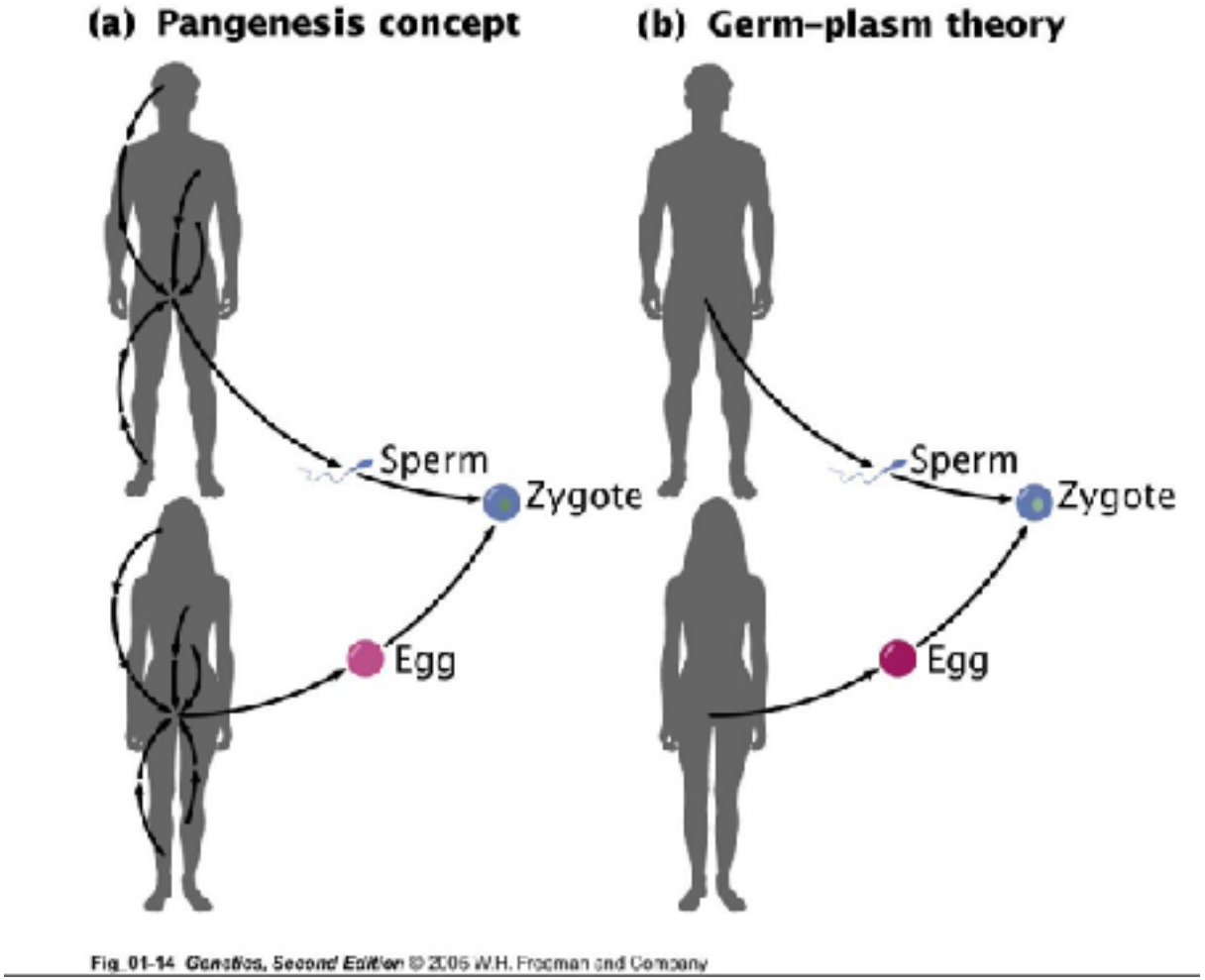


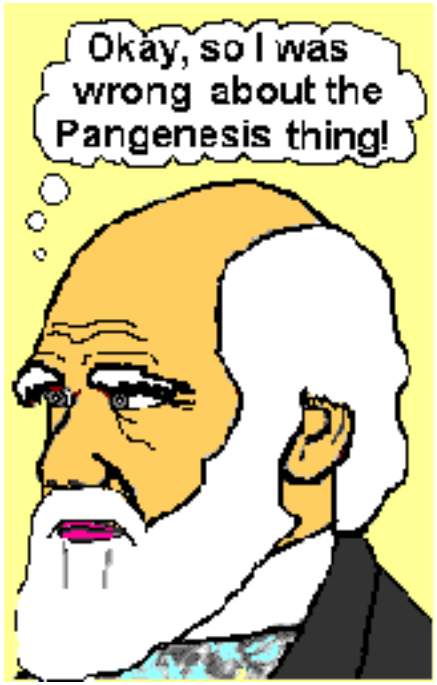
Fig. 01-14 *Genetics, Second Edition* © 2006 W.H. Freeman and Company

Theories of inheritance

Darwin's hypothesis of Pangenesis

"Gemmules" travel from every part of the body to the reproductive system to pass the traits to future generation.

Hypothesis not supported by scientific evidence.



Citation: O'Connor, C. & Miko, I. (2008) Developing the chromosome theory. Nature Education 1(1):44

Mendel and his peas

Gregor Mendel (Johann) studied heredity by the systematic breeding experiments of garden pea (*Pisum sativum*).

Mendel and his peas

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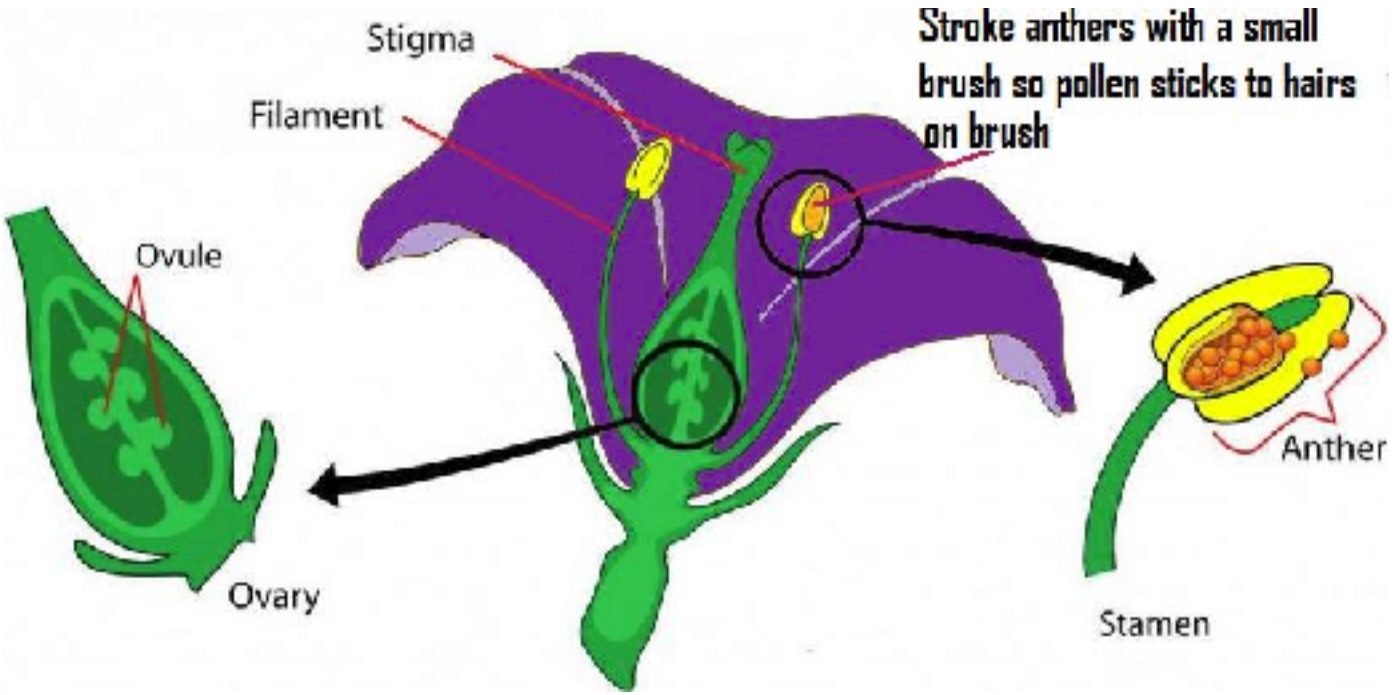
Mendel's Peas

Why Pea plants:

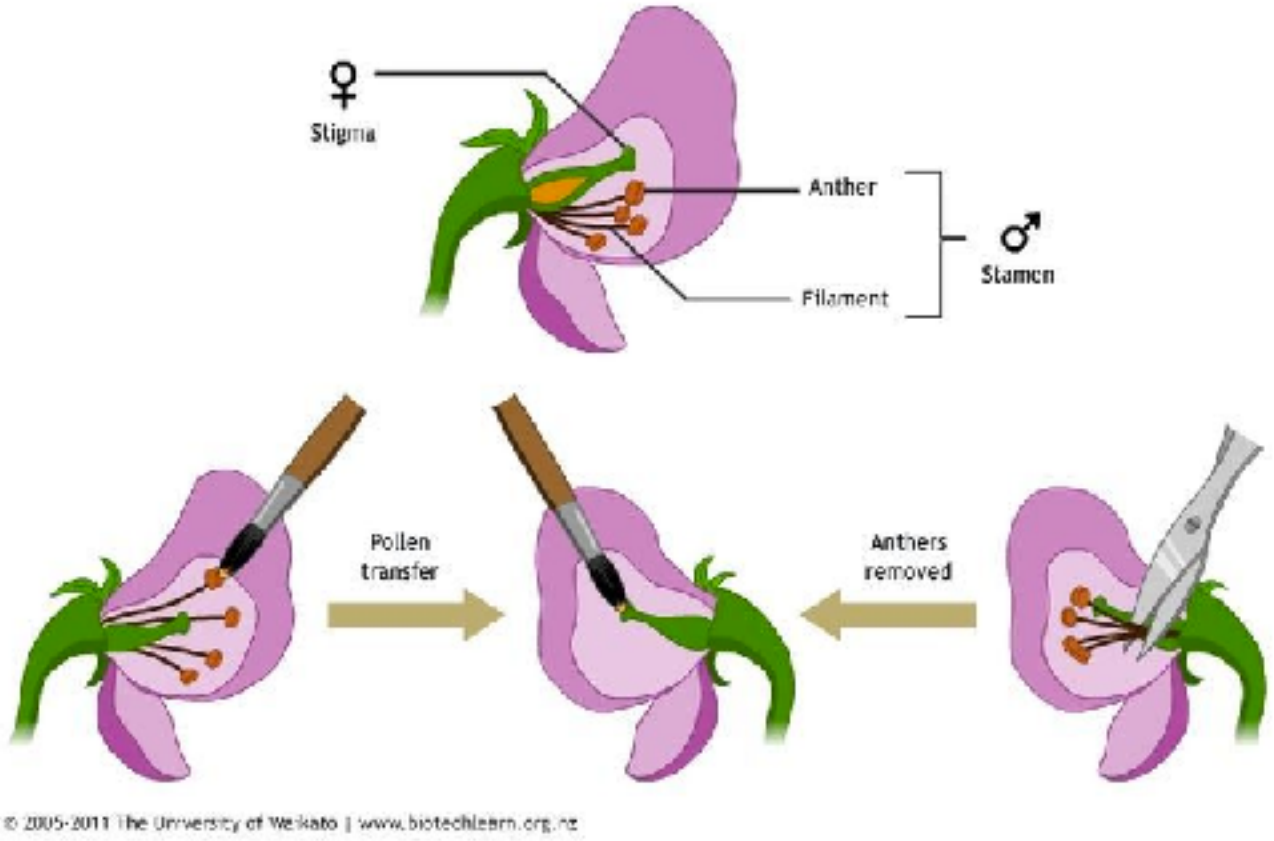
1) Simple flower anatomy.



Mendel's Peas

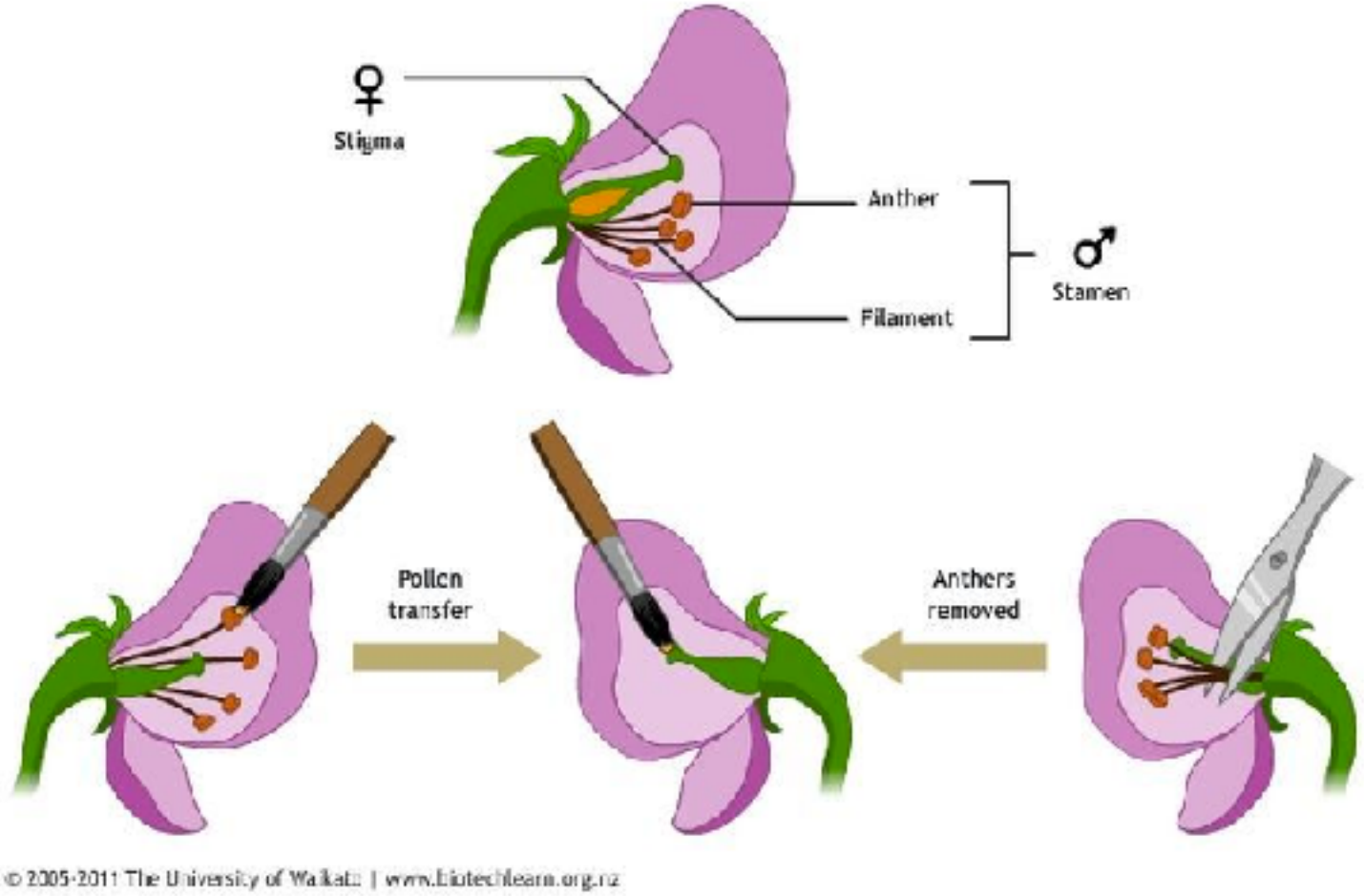
Why Pea plants:

2) Male and female flower parts can be easily manipulated to ensure cross results.



Mendel's Peas

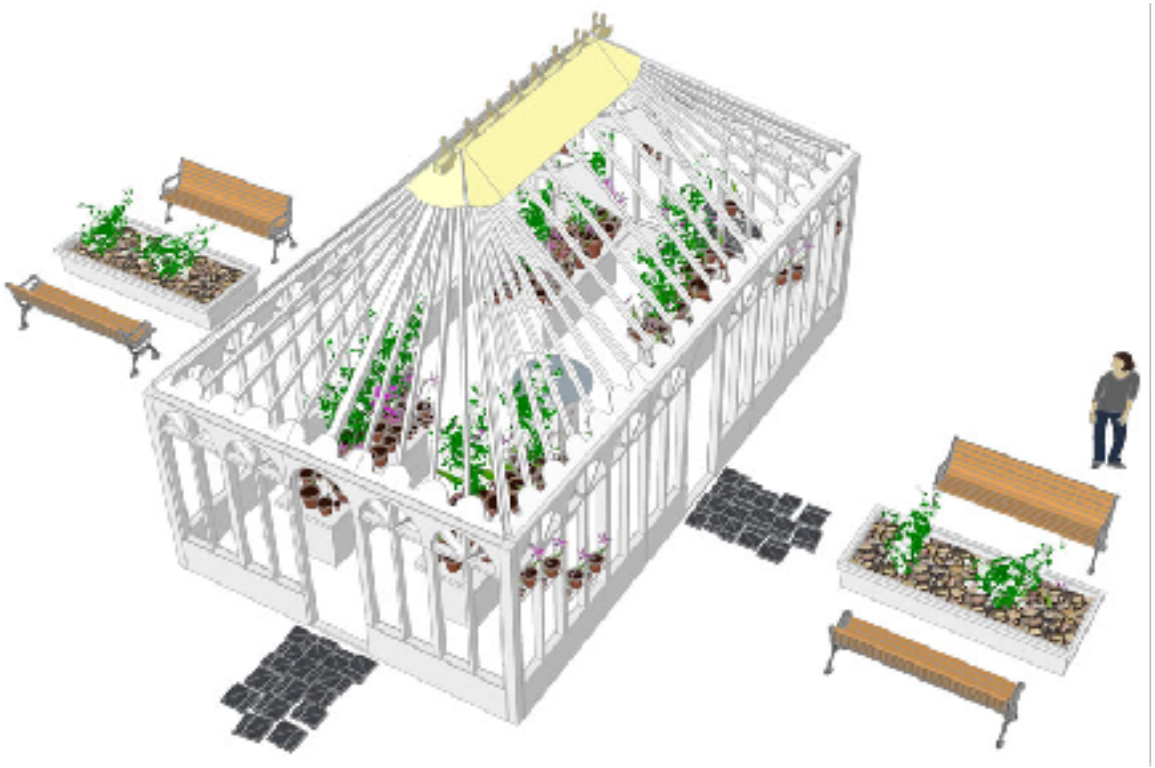
Why removing the male parts (anther is important)?



Mendel's Peas

Why Pea plants:

3) Plants can be easily placed in a closed greenhouse during flowering time (to serve as controls for the plants in the field).



Mendel's Peas

Why Pea plants:

4) Can be easily planted in ground or in pots.

Mendel's Peas

Why Pea plants:

5) Relatively short growth period.

Mendel's Peas

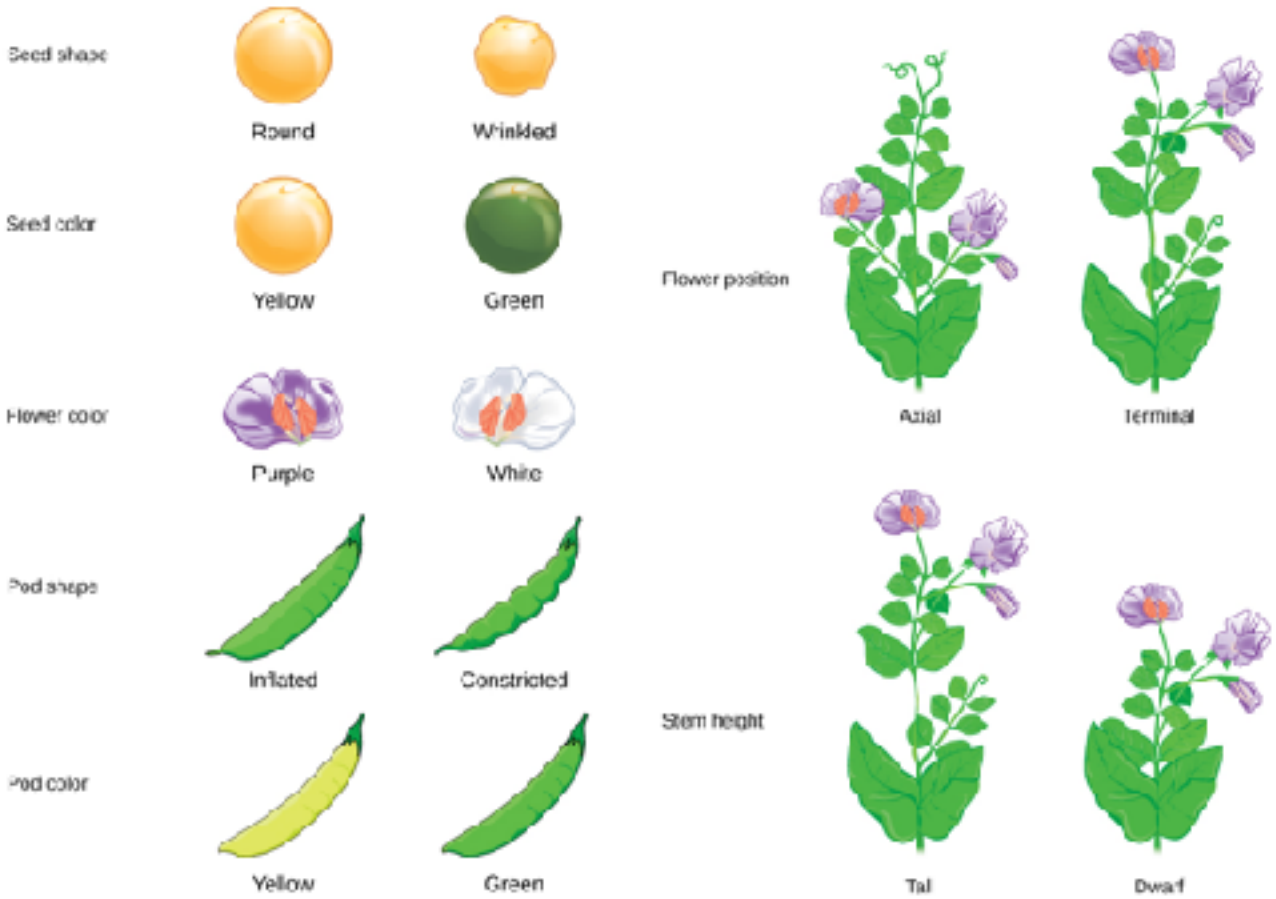
Why Pea plants:

6) Artificial fertilization is doable and likely to succeed.

Mendel's Peas

Why Pea plants:

7) Clear and distinct visual Traits/characters.

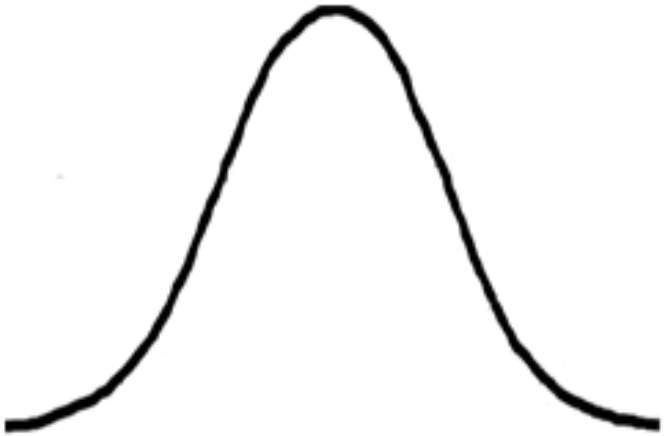


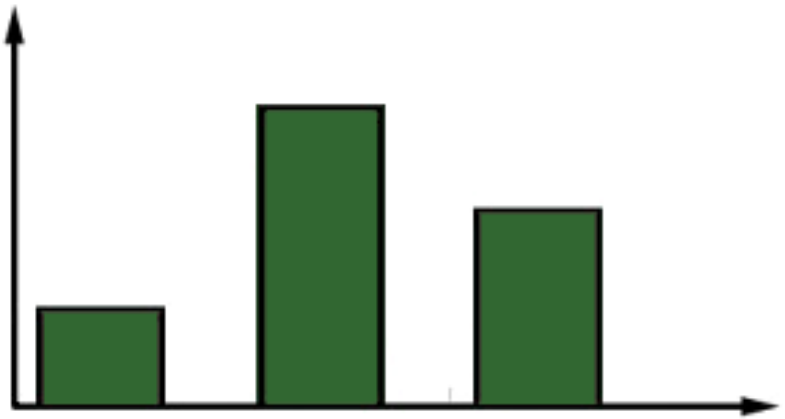
Mendel and the factors

What kind of traits/characters are these?

Traits and characters

Traits can be continuous or discontinuous (also called discrete)





Continuous Variation

- No distinct catagories
- Tends to be quantitative
- Controlled by a lot of genes
- Strongly influenced by the environment

Discontinuous Variation

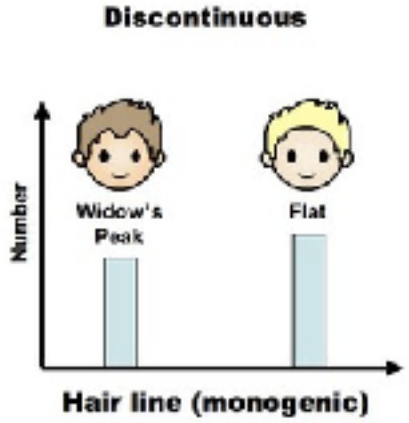
- Distinct catagories
- Tends to be qualitative
- Controlled by a few genes
- Unaffected by the environment

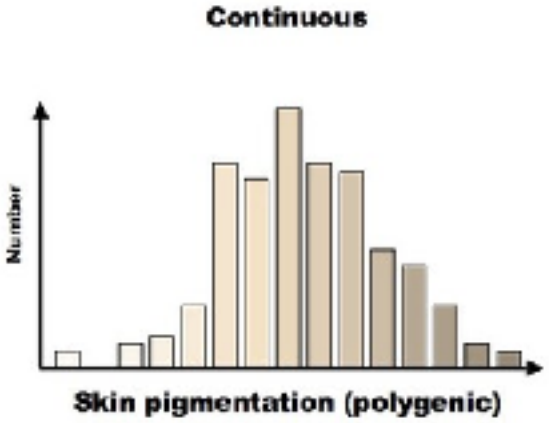
Mendel and the factors

Which trait is

1) **continuous**
2) **discontinuous**

in the lower picture?

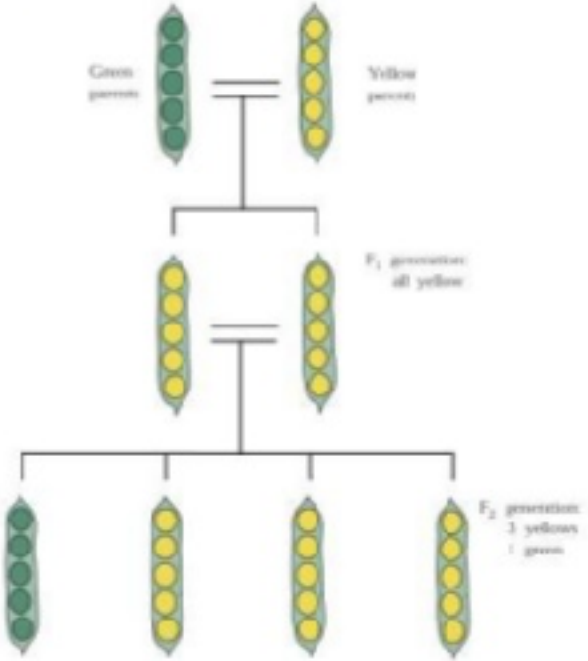




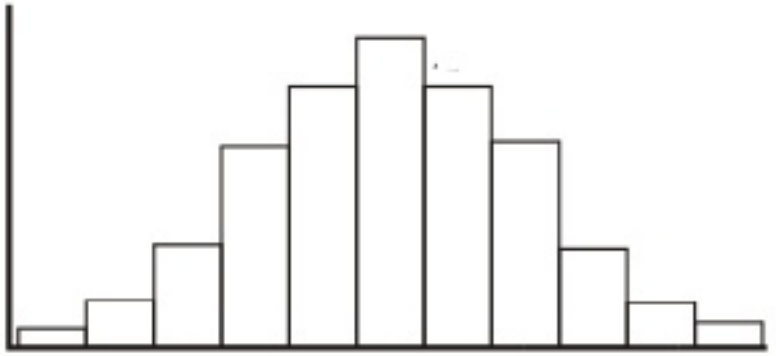
LIFE 8e, Figure 10.17

Mendel and the factors

Mendel studied discontinuous (discrete) traits

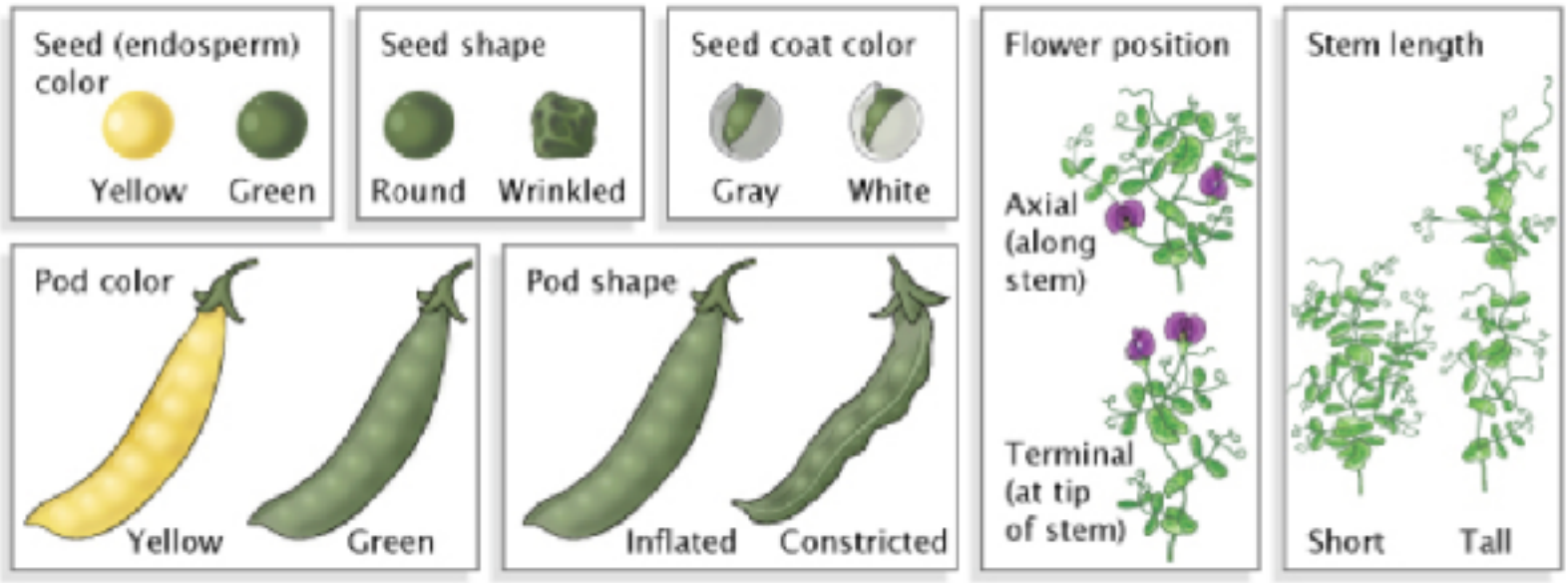


Darwin observed continuous variation



Mendel's discrete characters

Mendel chose seven discrete characters that can be easily be visualized and identified.



Citation: Miko, I. (2008) Gregor Mendel and the principles of inheritance. Nature Education 1(1):134

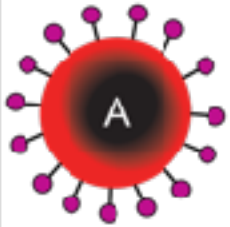
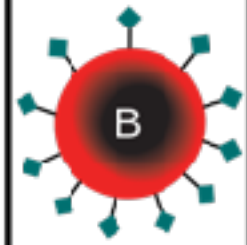
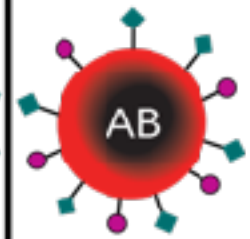
Mendel's discrete characters

What do we call the characteristics of an organism?

Should traits be only the ones that we see them?

Mendel's discrete characters

Some traits cannot be visualized but analyzed biochemically

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in Red Blood Cell	 A antigen	 B antigen	 A and B antigens	None

To study

continuous trait

pangenesis

discrete trait

continuous trait

visual traits

discontinuous trait

speciation

hybridization

gemmules

phenotype

blending inheritance

biochemical traits

Expectations

- You know the motives behind studying heredity.
- You know Mendel and his experimental model.
- You understand the characteristics that makes pea plants a good experimental model.
- You understand continuous and discontinuous traits.

For a smile


NO WONDER I'M AWAKE! IT FEELS LIKE I'M SLEEPING ON A THEORY OF INHERITED TRAITS!
HAH!
THE MONK & THE PEA