



Mendel and Genetics

Course 281

Introduction to Molecular Biology

Lessons for life



Jim Rohn Official
@OfficialJimRohn

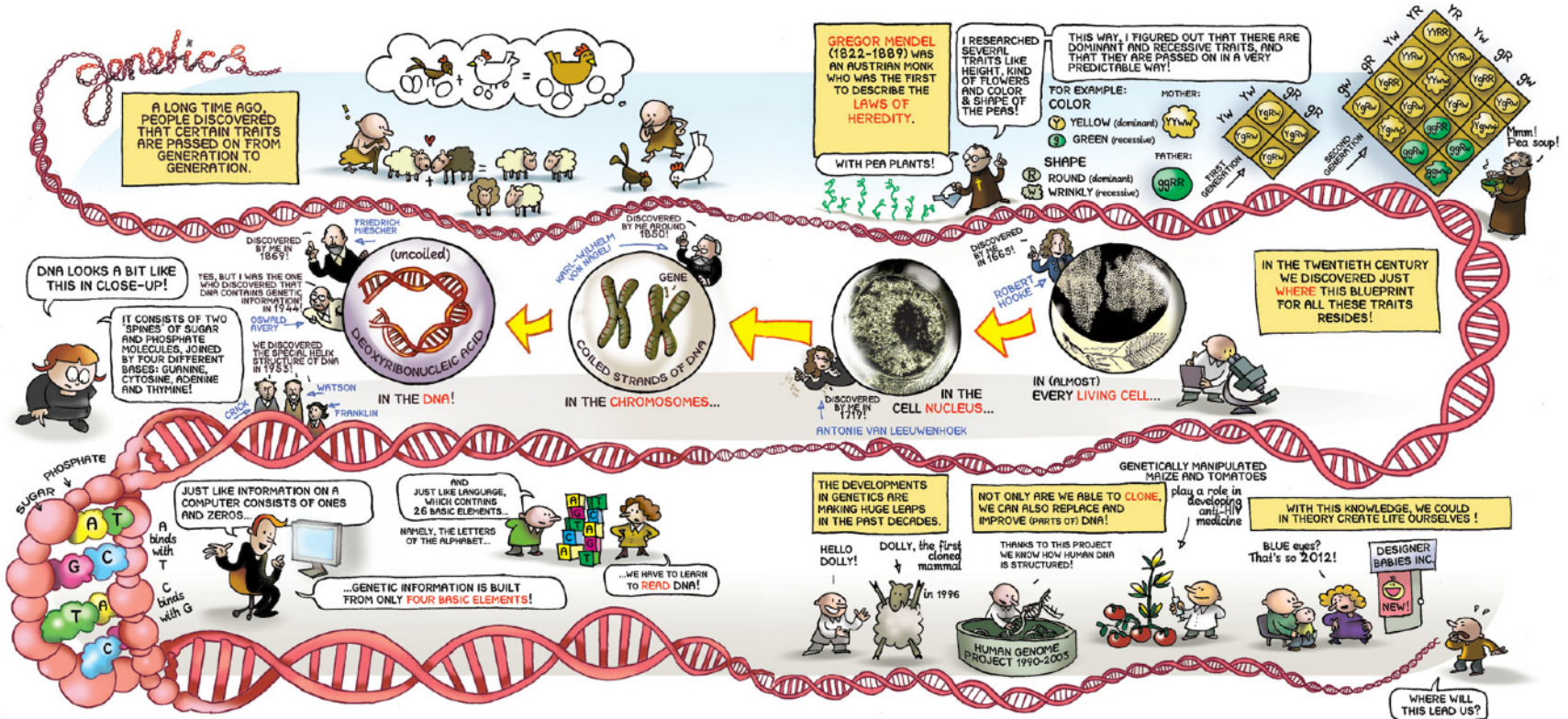
"For every disciplined effort there is a multiple reward." -- Jim Rohn

7/16/14, 5:30 AM

- Understand Mendel's experiments
- Understand the importance of Mendel's experiments to biology.

DNA timeline

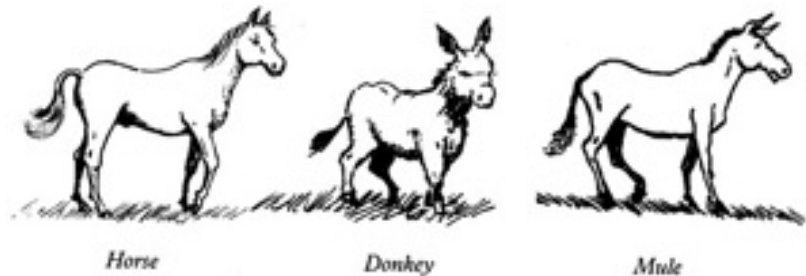
The knowledge we have today about DNA is the result of many experiments. Some experiments go back over 100 years ago.



Species, hybrids, and similarities among related

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

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



Mare (Female Horse) \times Jackass (Male Donkey) = Mule
Equus caballus \times *Equus asinus* =
 $2n = 64 \quad n = 32$ $2n = 62 \quad n = 31$ $2n = 63 \quad n = ?$

Stallion (Male Horse) \times Jennyass (Female Donkey) = Hinny



Species, hybrids, and similarities among related

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

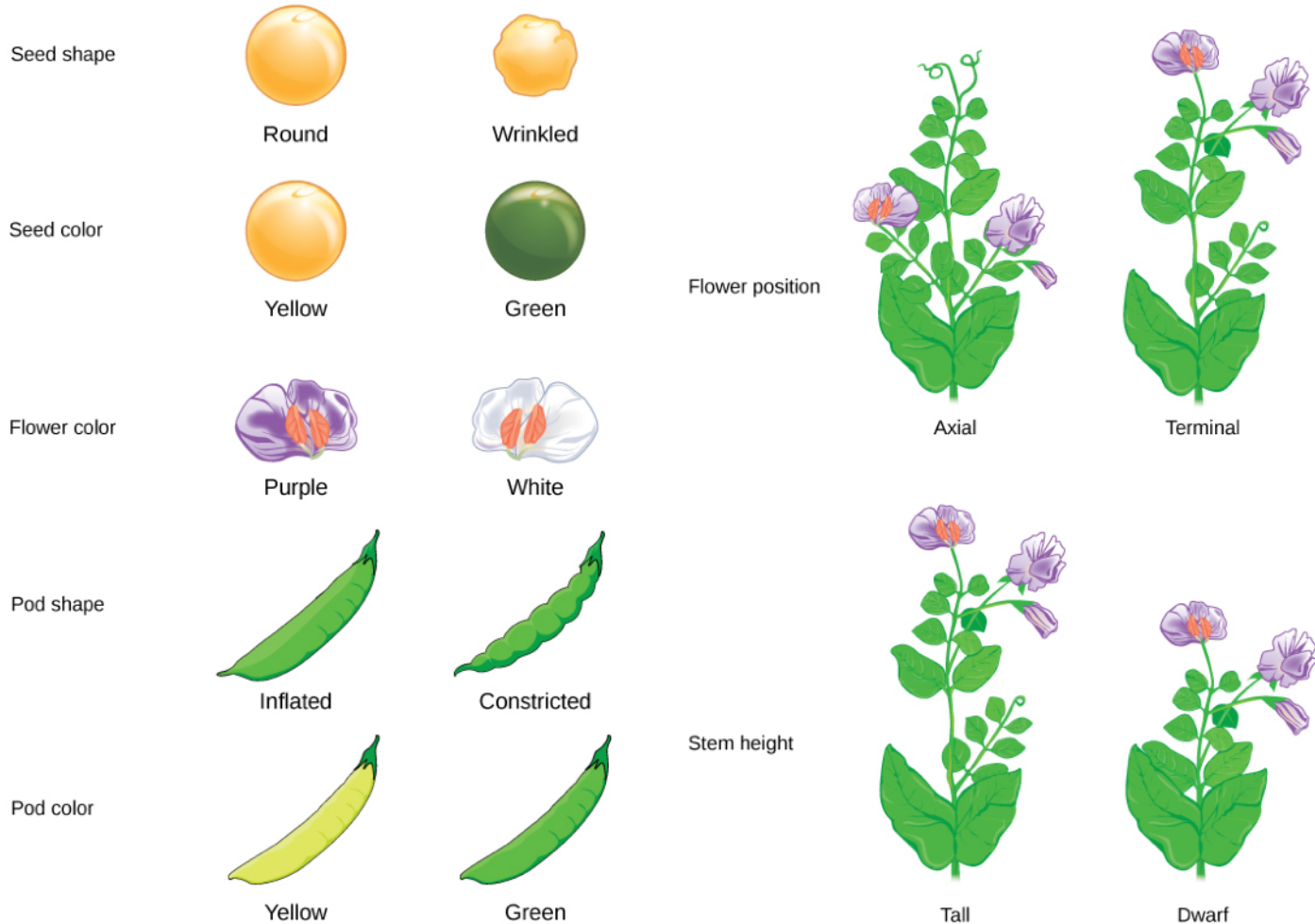
Mendel and the factors

Gregor Mendel (Johann) aimed to study plant breeding in garden pea.



Mendel and the factors

He chose seven unique characteristics that can be easily visualized and identified.



Mendel and the factors

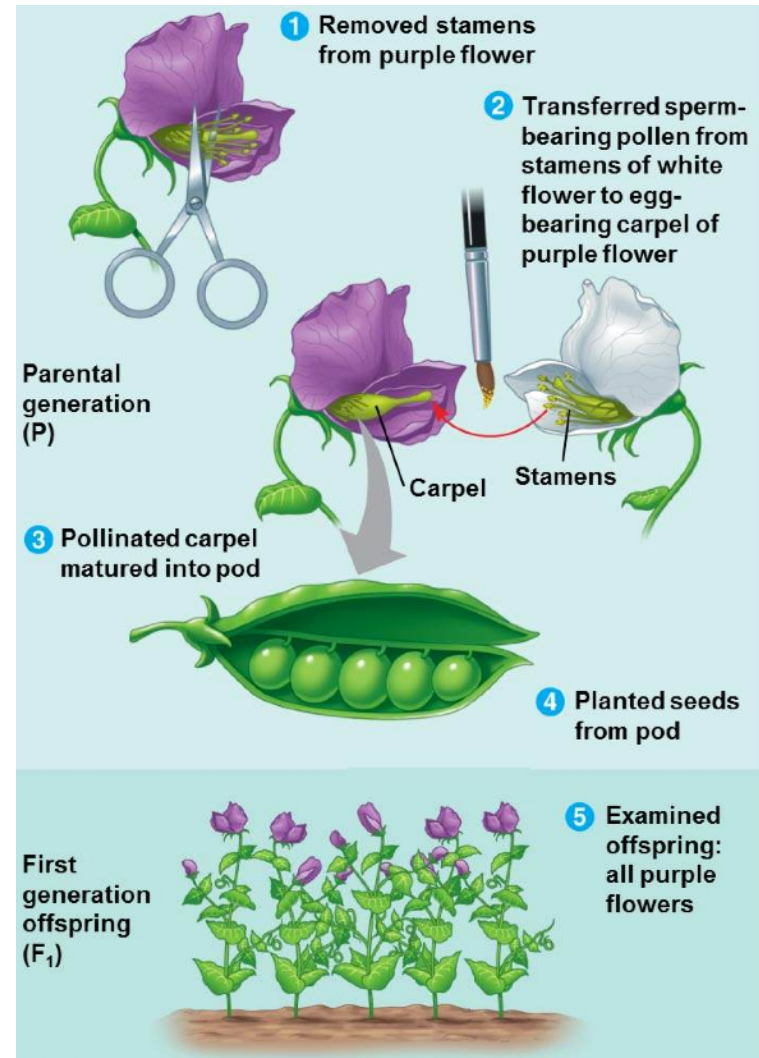
What do we call the characteristics of an organism (appearance/ a blood type etc.)?

Mendel and the factors

Why garden peas? How to cross carefully?

published his results, he explained why he had chosen peas: firstly 'interference from foreign pollen cannot easily occur', but just to be sure, 'a number of the potted plants was placed in a greenhouse during the flowering period; they were to serve as controls for the main experiment in the garden against possible disturbance by insects'.¹⁴ In addition, there was 'the ease with which this plant can be cultivated in open ground and in pots'. As Knight had found before him, Mendel thought the pea's 'relatively short growth period' was a 'further advantage worth mentioning'; there was no need to wait years for the result. And finally, although 'artificial fertilization is somewhat cumbersome', in peas 'it nearly always succeeds'. He explained his technique: before the pollen could ripen, 'each stamen is carefully extracted with forceps, after which the stigma can be dusted with foreign pollen'.¹⁵

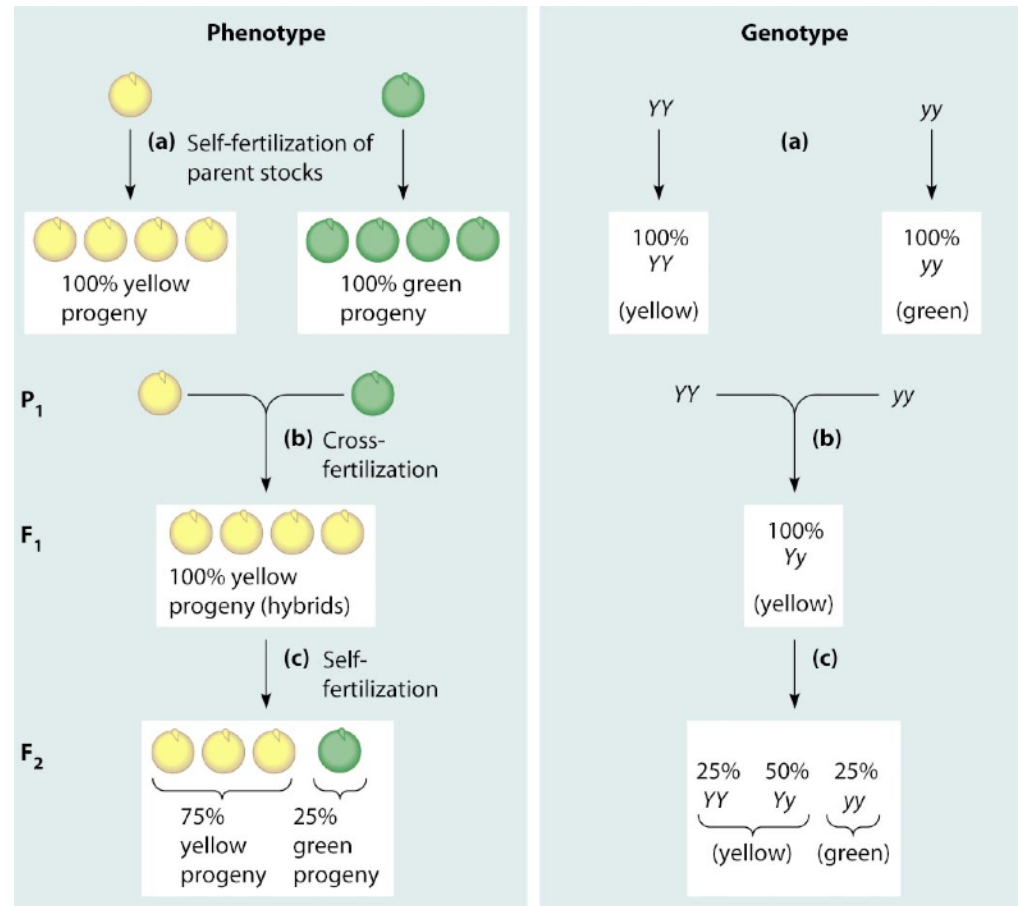
Mendel spent two years testing a total of 24 crosses on pea



Mendel and the factors

Mendel's first experiment

1. Establish pure lines of each character.
2. Cross breed the pure lines.
3. Inspect the first generation.
4. Self cross the first generation.
5. Inspect the second generation.



Mendel and the factors



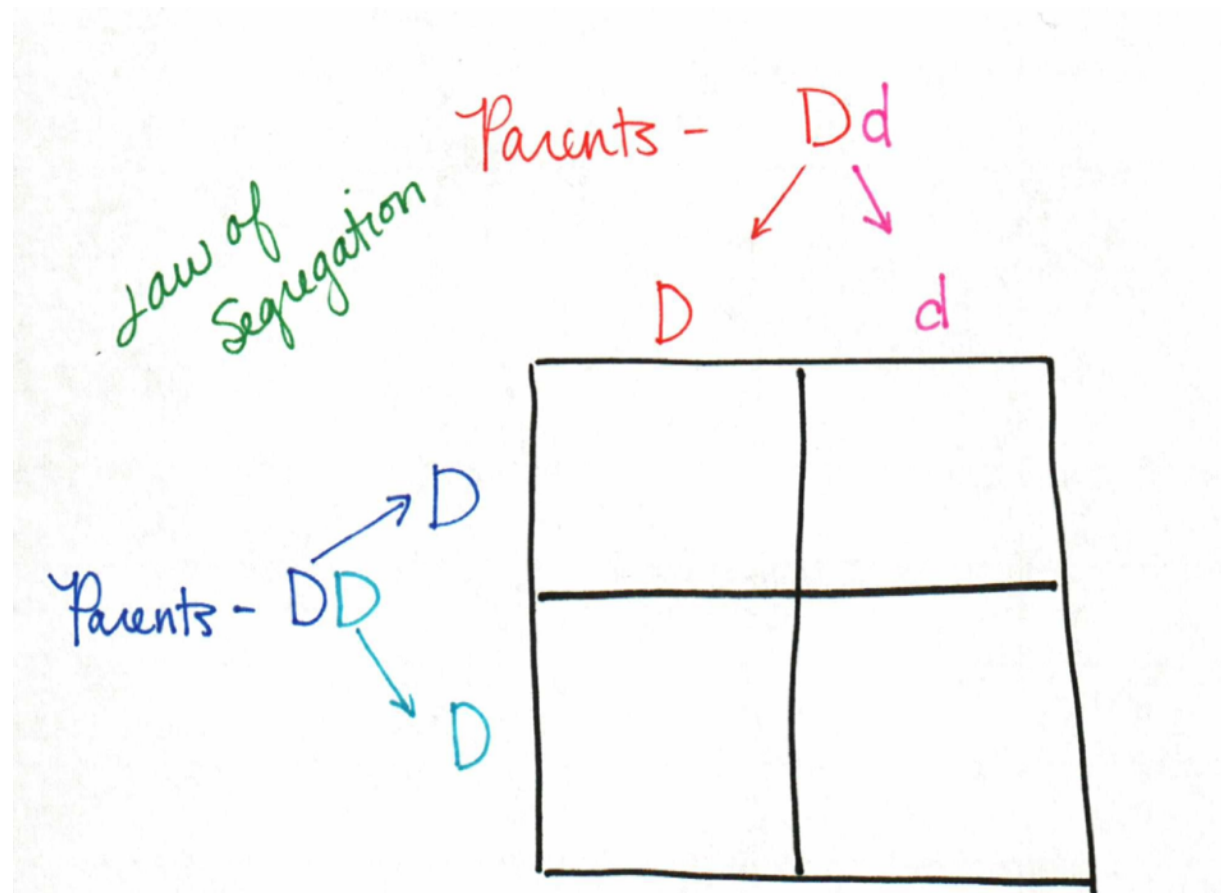
1. First experiment conclusions:

- The cross of pure lines give the appearance of one of the parents in the first generation.
- The selfing of the first generation results in the reappearance of one of the parents' characteristics.
- A factor/particle is within the plant that results in the appearance of the plant.
- The absence or appearance of a specific character depends on the combination of factors.

Mendel and the factors

Mendel's first law

Segregation of factors (alleles)



Mendel and the factors

What is a genotype?

What is a homozygous?

What is a heterozygous?



How many phenotypes are present in Mendel's monohybrid F1 generation?

How many genotypes are present in Mendel's monohybrid F1 generation?

How many phenotypes are present in Mendel's monohybrid F2 generation?

How many genotypes are present in Mendel's monohybrid F2 generation?



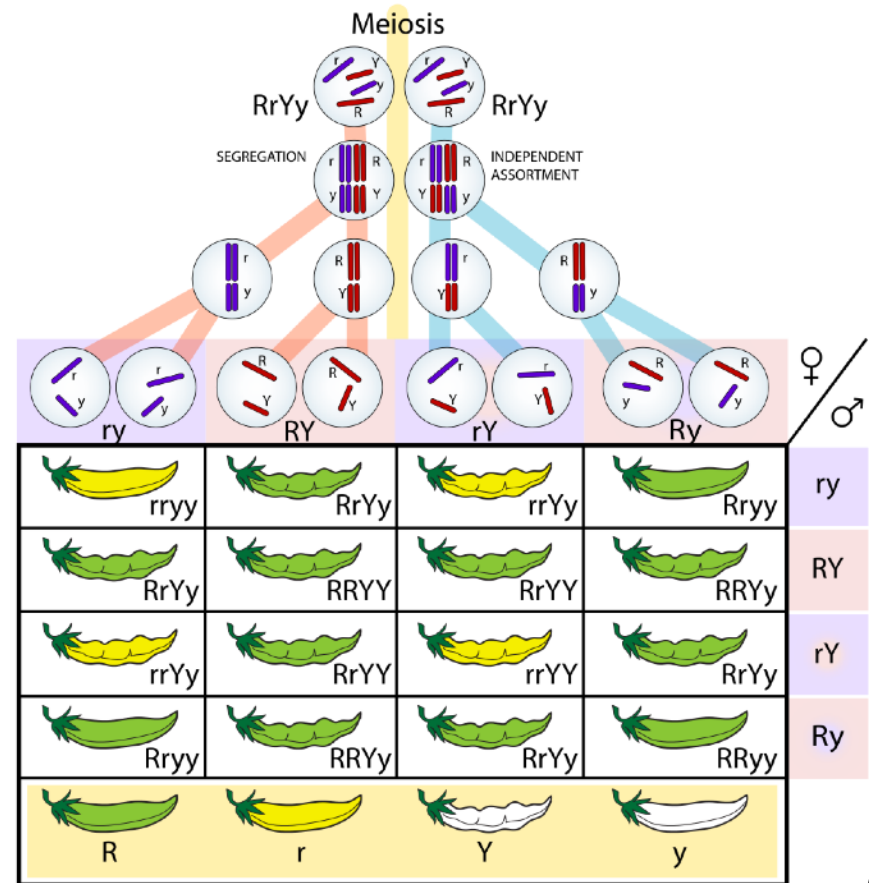
Which of the following best describes Aa?

- A. Genotype
- B. Heterozygous
- C. Dominant
- D. (A) and (B)
- E. All of the above

Mendel and the factors

Mendel's second experiment

1. Establish pure lines of two characters in each plant.
2. Cross breed the pure lines.
3. Inspect the first generation (all should be the same).
4. Self cross the first generation.
5. Inspect the second generation.



Mendel and the factors



Second experiment conclusions:

















- The cross of pure lines give the appearance of one of the parents in the first generation.
- The selfing of the first generation results in the reappearance of different combinations of the parental types.
- A factor/particle are combined randomly as if they were independent entities.
- Multiple factors (now called genes) contribute to the physical qualities of an organism.

Mendel and the factors

Mendel's second law

Independent assortment

- F₁ cross
RrYy × RrYy
-  round yellow
 -  round green
 -  wrinkled yellow
 -  wrinkled green

	RY	Ry	rY	ry
RY	RRYY 	RRYy 	RrYY 	RrYy 
Ry	RRYy 	RRyy 	RrYy 	Rryy 
rY	RrYY 	RrYy 	rrYY 	rrYy 
ry	RrYy 	Rryy 	rrYY 	rryy 

Mendel and the factors

...perimented with pea plants, ...
...ity partly for this reason.) But by n...
... trait at a time, Mendel could see that each...
... trolled by a separate factor. Mendel never used th...
... identified the discrete, inheritable factors we call g...
... Mendel's peas were the Newton's apple of biology. Mendel...
... Beyond his qualitative discoveries, Mendel...
... quantitative footing. He adored th...
... of meteorology, the translati...
... same way...
... ink



So what?

Where is Mendel's position in the story of molecular biology?

1. Mendel proved that particles reside in the plant give rise to its physical qualities (i.e. flower color).
2. Mendel provided biologist with the law that governs the passing of characteristics from generation to another.

The next questions to ask were

Where these factors (now called genes) are located?

What are they made of?

To study

Homozygous

Mendel's first law

Heterozygous

Genotype

Independent assortment

Phenotype

Segregation of alleles

Mendel's second law

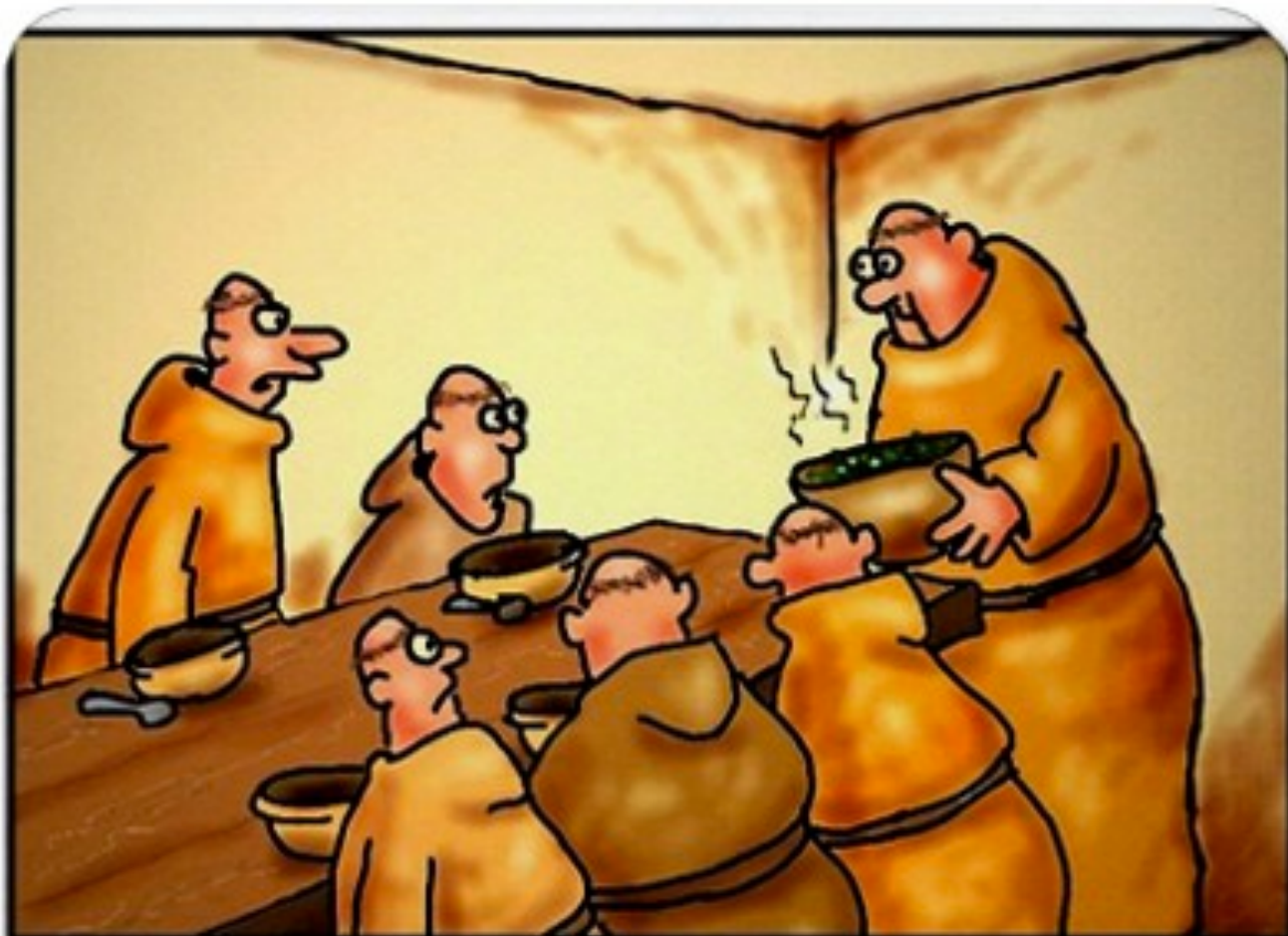
Dominant

Recessive

Expectations

- You know Mendel's experiments (monohybrid and dihybrid) and laws resulting.
- You know the importance of the experiments to the study of DNA.

For a smile



"Brother Mendel, we grow tired of peas!"