Gregor Mendel & His Wacky Peas

How a monk learned about inheritance using a tasty vegetable

This is Gregor Mendel. He was a monk who loved gardening.

In fact, he loved plants so much that he spent a big chunk of his life studying how certain traits were passed from “parent” plant to “baby” plant.

Mendel is most famous for his work with pea plants.

(That's what he's contemplating so seriously in the picture.)

Pea plants have **seven** observable ***characteristics.***
Each characteristic has **two** possible ***traits***.

Characteristic	Possible Traits
1. Plant height	Long or short stems
2. Flower position along stem	Axial or terminal
3. Pod color	Green or yellow
4. Pod appearance	Inflated or constricted
5. Seed texture	Smooth or wrinkled
6. Seed color	Yellow or green
7. Flower Color	Purple or white

Table 14.1 The Results of Mendel's F_1 Crosses for Seven Characters in Pea Plants

Character	Dominant Trait	×	Recessive Trait	F_2 Generation Dominant:Recessive	Ratio
Flower color	 Purple	×	 White	705:224	3.15:1
Flower position	 Axial	×	 Terminal	651:207	3.14:1
Seed color	 Yellow	×	 Green	6022:2001	3.01:1
Seed shape	 Round	×	 Wrinkled	5474:1850	2.96:1
Pod shape	 Inflated	×	 Constricted	882:299	2.95:1
Pod color	 Green	×	 Yellow	428:152	2.82:1
Stem length	 Tall	×	 Dwarf	787:277	2.84:1

By controlling plant pollination (fertilization), Mendel was able to create peas plants that were ***true-breeding (aka "pure")*** for each trait.

- True breeding parent plants always produce offspring with the same trait.
- For example:
  - A plant true-breeding for purple flowers will always produce offspring with purple flowers.
  - A plant true-breeding for white flowers will always produce offspring with white flowers.

What happens if you cross two true-breeding plants???

purple flowers **x** white flowers

or

wrinkled seeds **x** smooth seeds

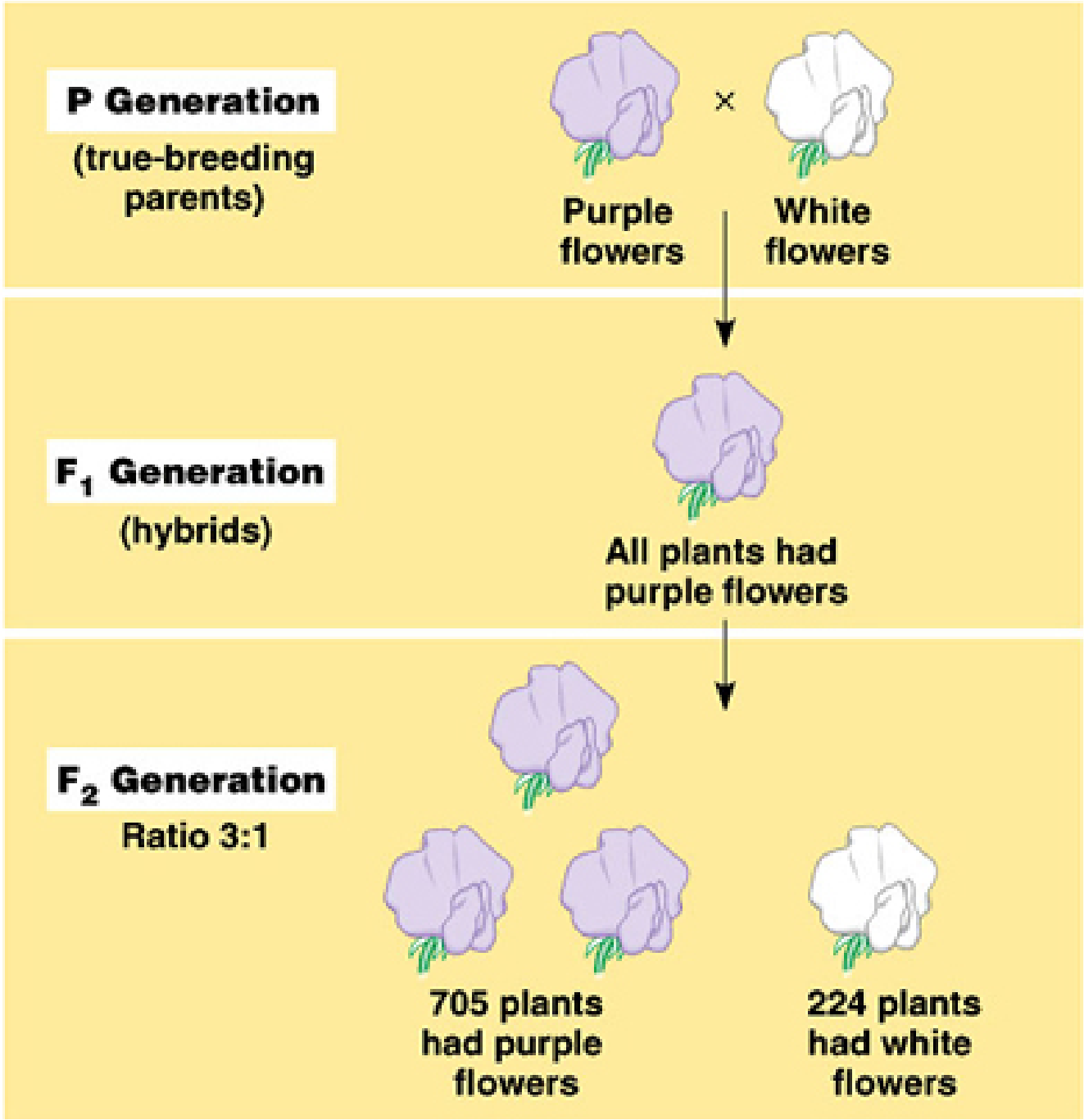
or

tall plants **x** short plants

etc, etc, etc,

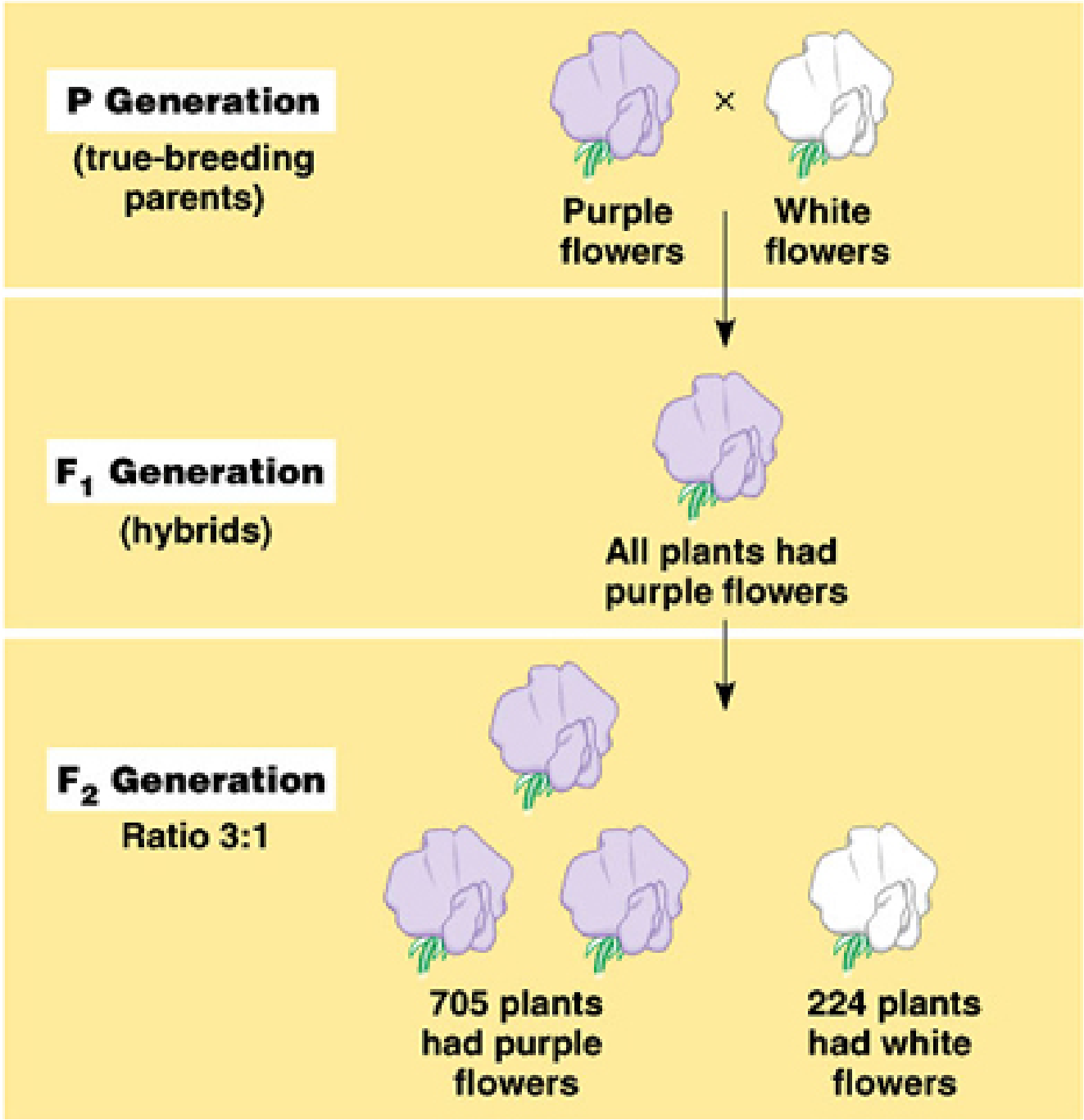
Let's just look at flower color…

- Mendel called the pure (true-breeding) parent plants the **P_1 generation**
  - For each cross (plant "couple"), the P_1 generation consisted of a true-breeding purple plant and a true-breeding white plant



Flower color, continued…

- Mendel called the offspring plants the **F_1 generation** (1 for 1st, F for filial – son or daughter)
  - Plants in the F_1 generation are called ***hybrids*** because their parents have different traits.
  - He discovered that even though one of the parent plants had white flowers, ALL of the offspring had purple flowers!



In every case, one trait "won out" in the F1 generation

- For example:
  - Purple flower color "won out" over white flower color.
  - Smooth seed texture "won out" over wrinkled seed texture.
- Mendel called the trait that *appeared* in the F1 generation (purple flowers) **dominant**.
- He called the trait that *did not appear* in the F1 generation (white flowers) **recessive*.***

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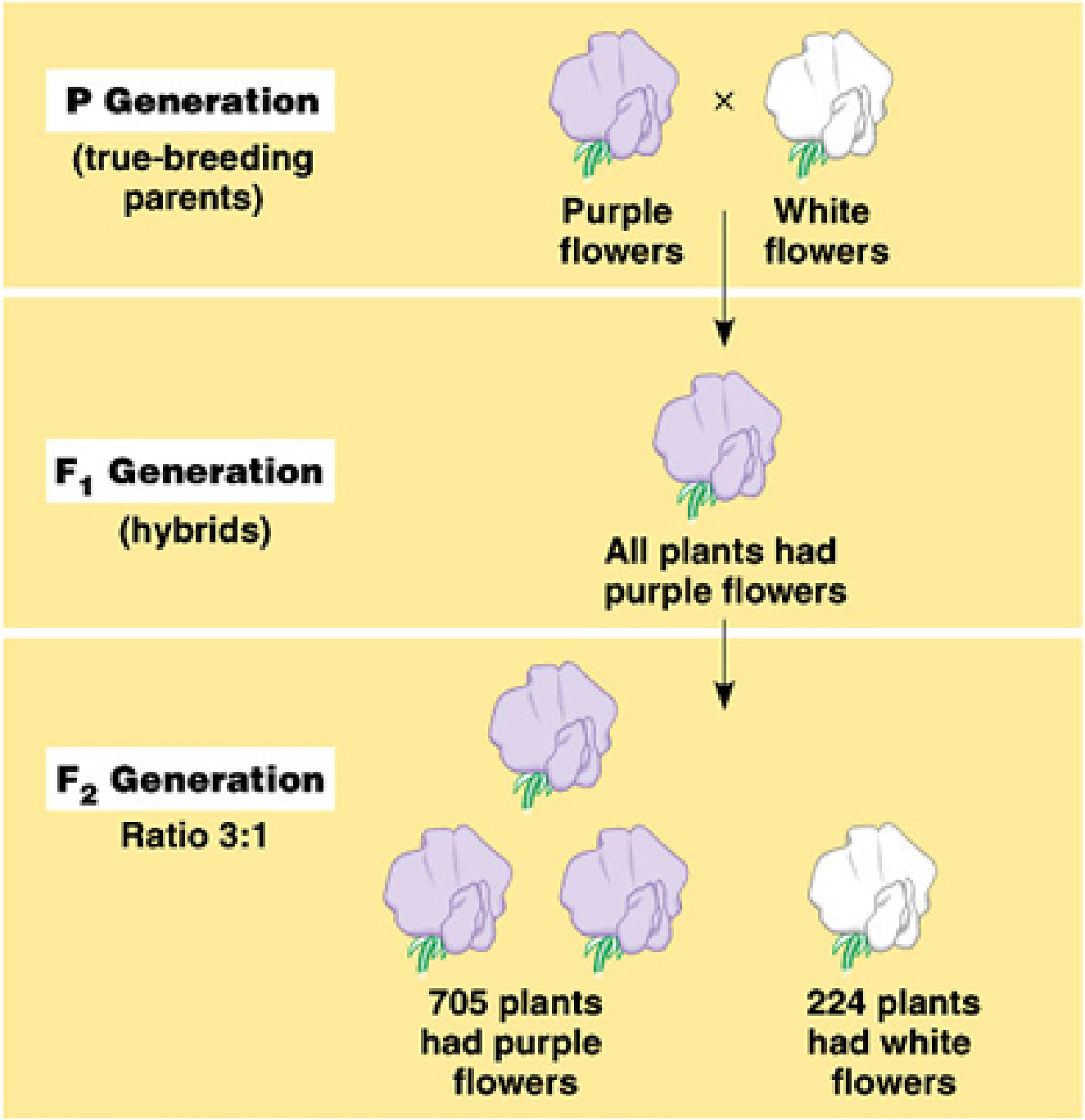
What do you think happened when Mendel let plants from the F_1 generation self-pollinate?

Was the second filial generation (F_2) true-breeding for the dominant trait?

No!

Some of the plants (about ¼) showed the recessive trait.

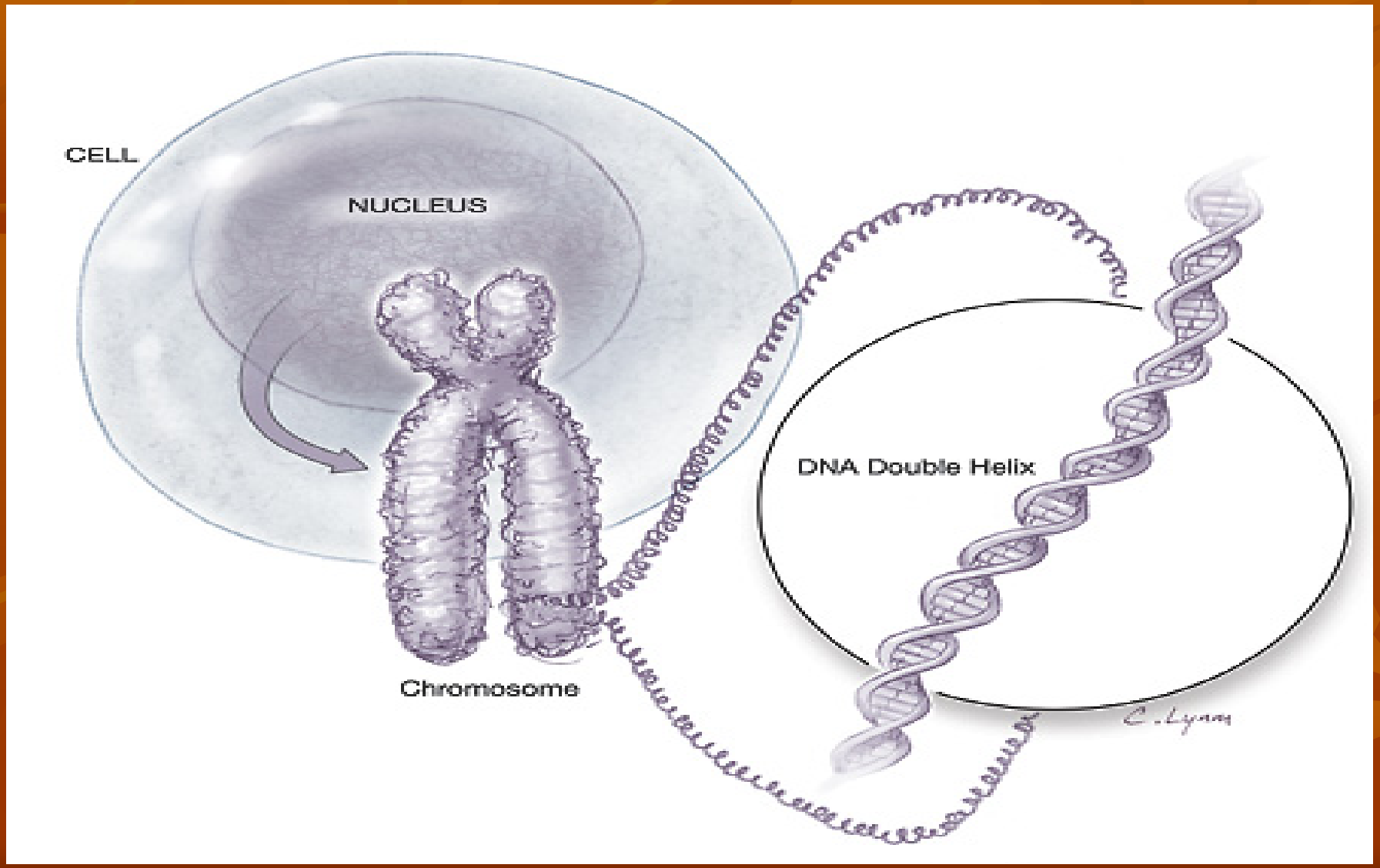


So…

Even though the F1 generation ***looked*** like true-breeding purple plants, they carried the trait for white flowers somewhere inside.

Where was this trait hidden???

In the plant's DNA of course!



Each characteristic = a gene

A gene is segment of DNA that codes for a particular characteristic.

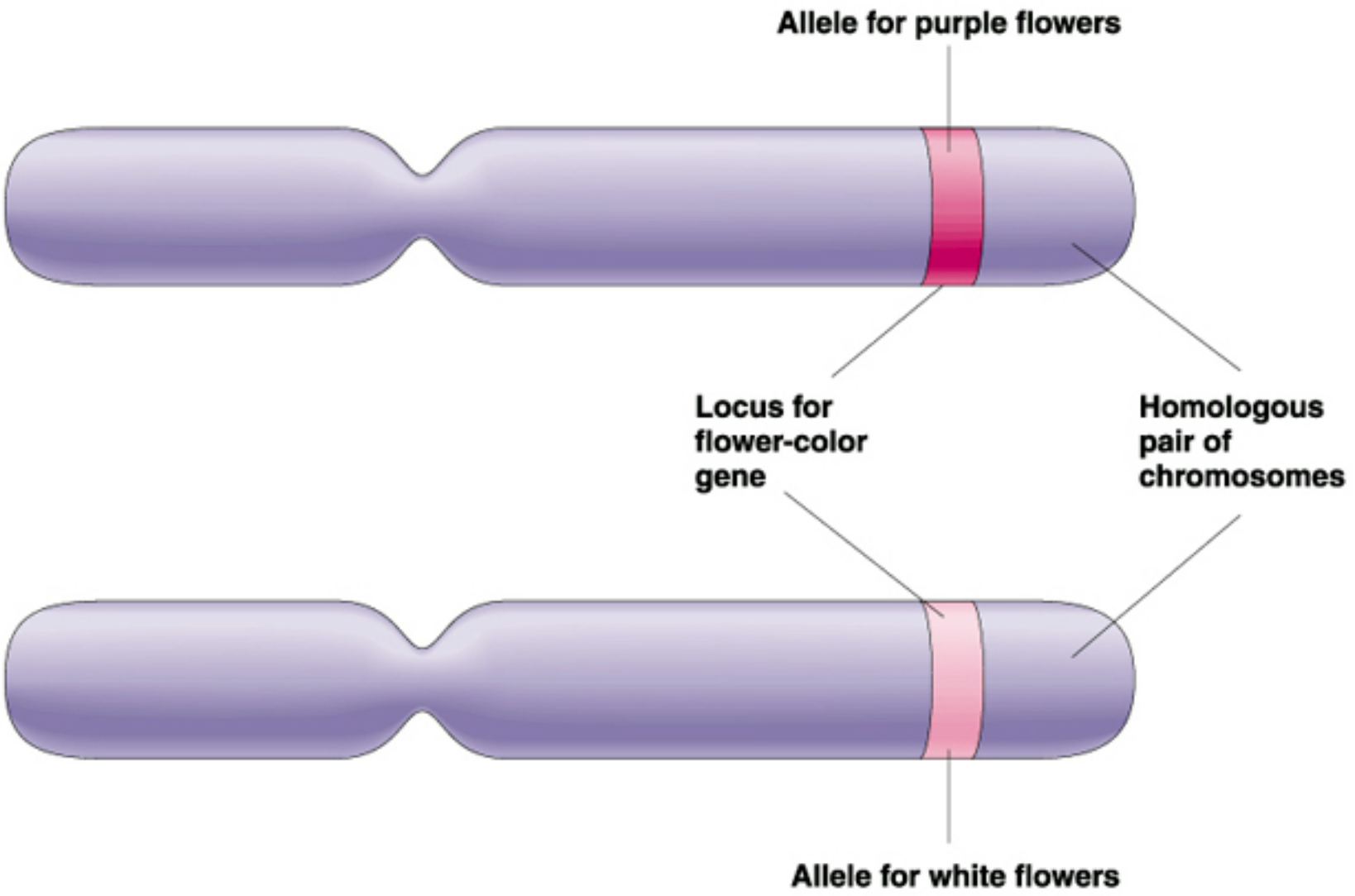
For example:

- There's a gene for plant height
- There's a gene for seed color
- There's a gene for flower color

etc…

Each alternative form of a particular gene = an *allele*

- For example:
  - The plant height gene has two alleles, tall and short.
  - The flower color gene has two alleles, purple and white
  - The seed texture gene has two alleles, wrinkled and smooth.



In addition to the idea that some traits are dominant and some are recessive, Mendel came to two conclusions:

1. ***The Law of Segregation:*** Two factors (alleles) control each specific characteristic (gene). These factors (alleles) are separated during the formation of gametes.
2. ***The Law of Independent Assortment:*** Factors (alleles) for different characteristics (genes) are distributed to gametes independently. This means that the allele for seed texture isn't dependent on the allele for plant height, etc.

Humans (of course) have genes too! Our different alleles create our beautiful diversity.

Let's check out some of the different alleles present in our class!