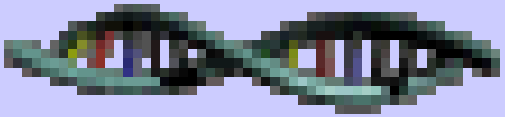
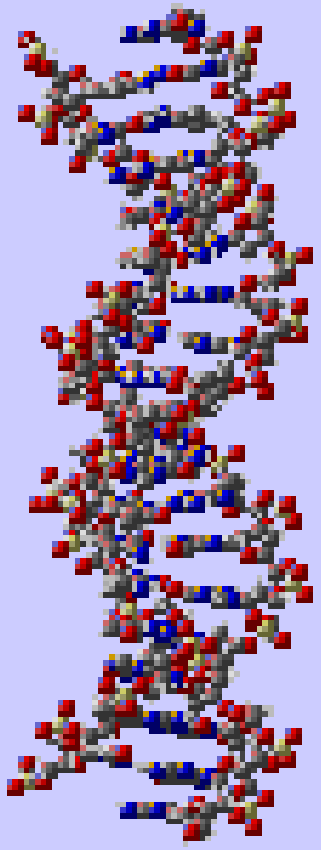
DAY 2

Introduction to Genetics



Heredity

- Passing of traits from parents to their young
- The branch of biology that studies heredity is **genetics**.



Trait

- Characteristic that is inherited

Gregor Mendel

- Austrian Monk, born 1822
- Worked with pea plants to learn how traits were inherited
- Mendelian genetics

explains basic principles of heredity

Why pea plants?

- Pea plants have easy to identify reproductive organs.
- Peas were easy to cultivate, had a short generation time, and could be cross-pollinated (produces seeds that are the offspring of two different plants)

Mendel's Seven Traits

	Flower Color	Flower Position	Pea Color	Pea Shape	Pod Color	Pod Shape	Height
Dominant	 purple	 axial	 yellow	 round	 green	 inflated	 tall
Recessive	 white	 terminal	 green	 wrinkled	 yellow	 constricted	 short

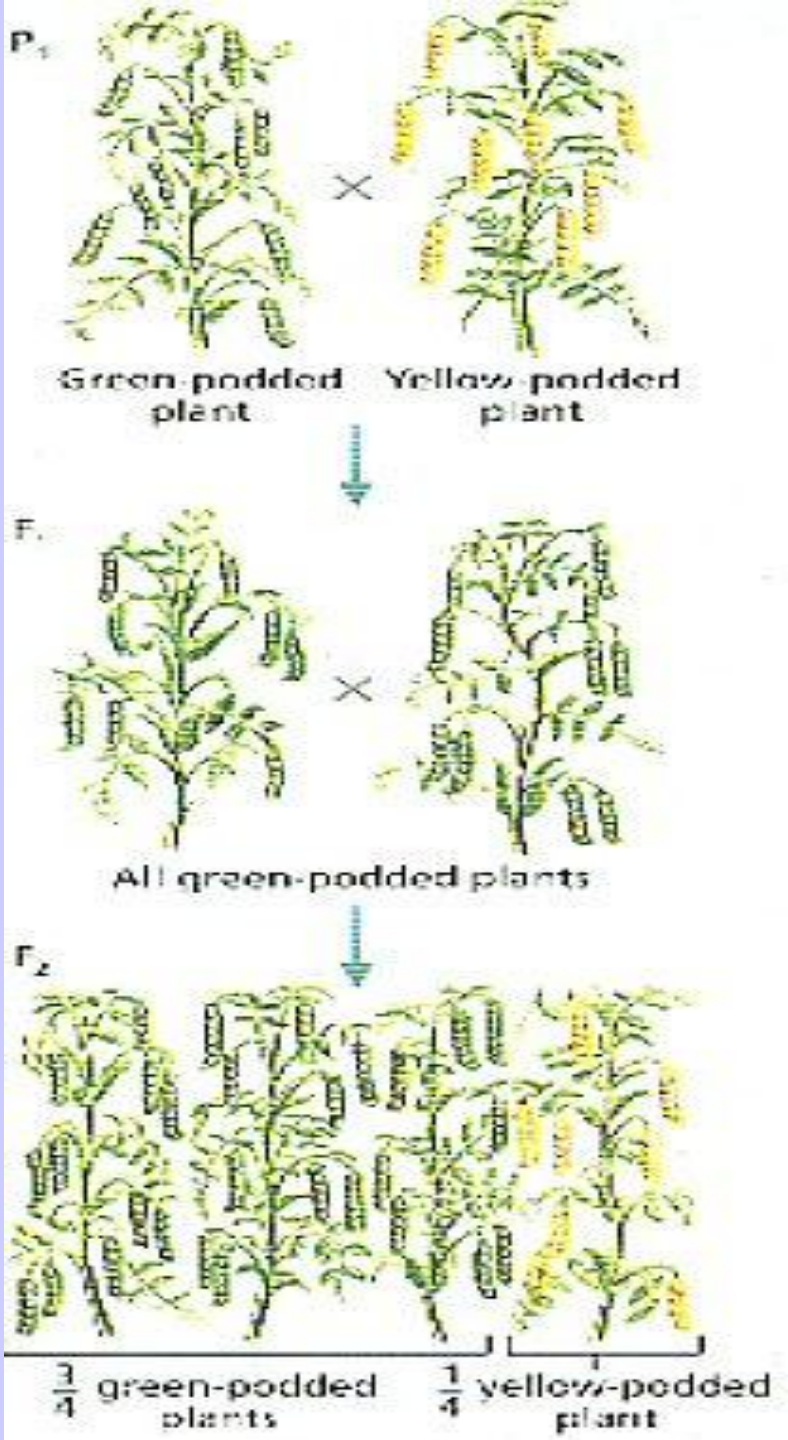
Mendel's Experiment:

1. Controlled the way plants were fertilized

-Self-pollination: pollination of the same flower or flowers of the same plant

2. Worked with only one trait at a time
3. Kept detailed records of his observations

- A **HYBRID** is the product of parent organisms with different forms of One Trait.
- Plants that are **<u>PUREBRED</u>** for a trait always produce offspring with that Trait.



- Mendel made an observation that i**ndividual factors control each trait of a living thing**
  - –We call it **genes**
  - –Different forms of a gene are called **alleles**

ex: tall or short, eye color

Principle of dominance

- *Dominant:* form of a gene that is expressed even if present with a contrasting recessive allele (Tt, TT)
- *Recessive:* description of an allele that is only expressed in the homozygous state (tt)

- The way an organism looks is called the **Phenotype**. The phenotype of a tall plant is tall
- The gene combination of an organism is the **Genotype**. The genotype of a tall plant can be either TT or Tt

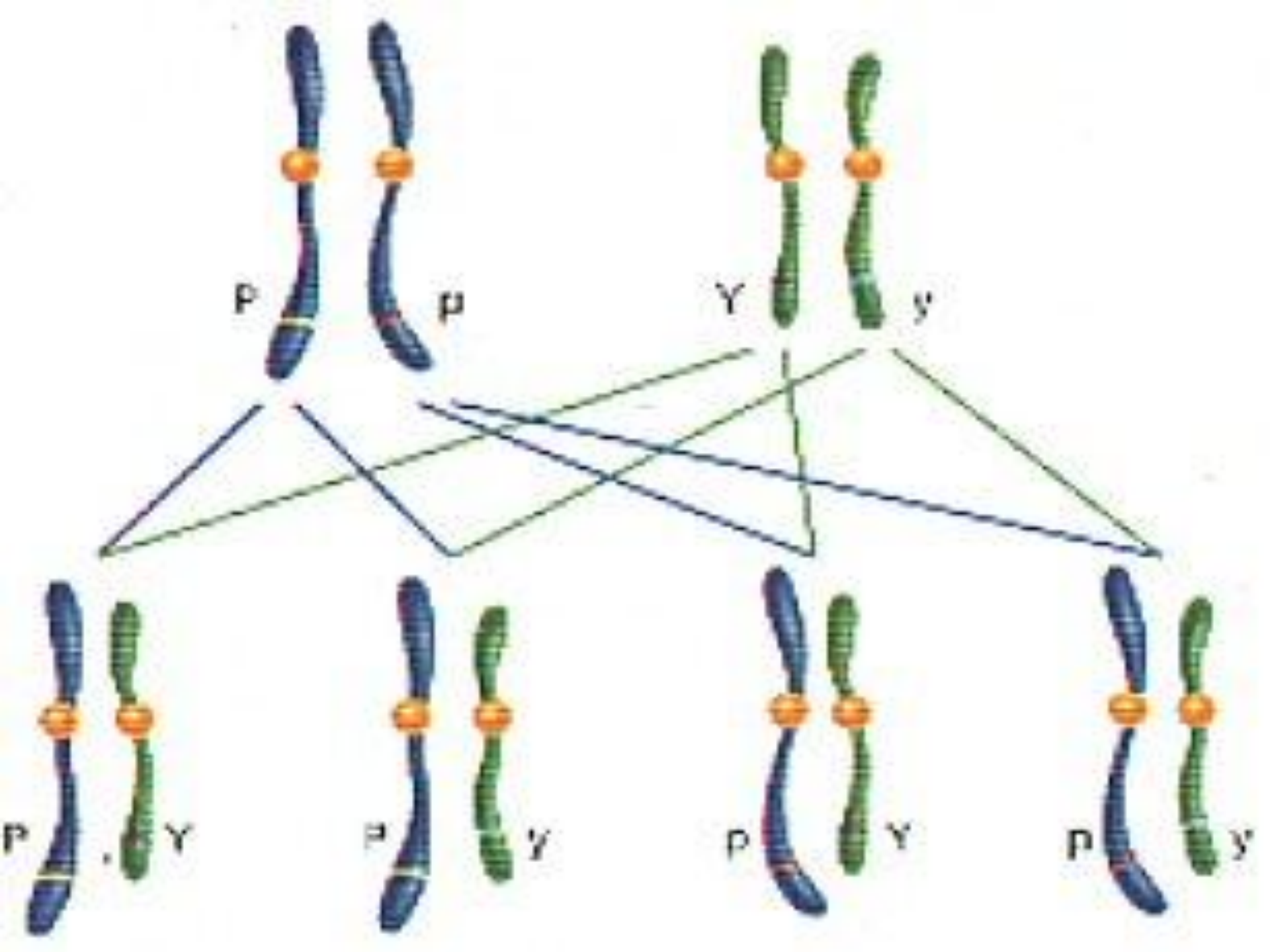
- When the 2 alleles are alike (TT or tt) the organism is said to be **Homozygous**.
- A plant can be either homozygous dominant (TT) or recessive (tt).
- An organism is said to be **Heterozygous** when the 2 alleles are different (Tt).

Trait Lab

DAY 3

Law of Segregation

- each organism contains two factors for each trait
- factors segregate, or separate during Meiosis; each gamete contains one factor for each trait.


P
p
Y
y
P
Y
p
y
P
Y
p
y

PUNNETT SQUARE

- a diagram use to predict the probability that certain traits will be inherited by offspring.

(Bb)

(pp)

(BB)

	B	b
B	BB	Bb
B	BB	Bb

(PP)

	P	P
P	Pp	Pp
P	Pp	Pp

(Bb)

(Bb)

	B	b
B	BB	Bb
b	Bb	bb

Practice Monohybrid problems

DAY 4

BELL RINGER

1. In chimpanzees, straight fingers are dominant (S) to bent fingers (s). Predicts the phenotypes expected for the offspring of the following cross between a heterozygous and a homozygous recessive chimpanzees

a. 3 bent to 1 straight

b. 2 bent to 2 straight

c. All straight

d. 2 Ss to 2 ss

2. The trait for albinism (a) is a recessive one. If an albino woman marries a normal pigmented male, and they have a normal pigmented child, predict what would be the genotype of the mother and father?

a. aa;AA b. aa;Aa c. Aa; AA

d. AA; aa e. aa; either Aa or AA

3. If an albino woman marries a normal pigmented male, and they have 3 normal pigmented and 4 albino children, predict what would be the most logical genotype of the mother and father?

a. aa;AA b. aa;Aa c. Aa; AA

d. AA; aa e. aa; either Aa or AA

4. Tongue rolling is a dominant trait (R). What would be the expected tongue rolling ability of the children from a marriage between a non-rolling mother and a rolling father whose mother could not roll her tongue?

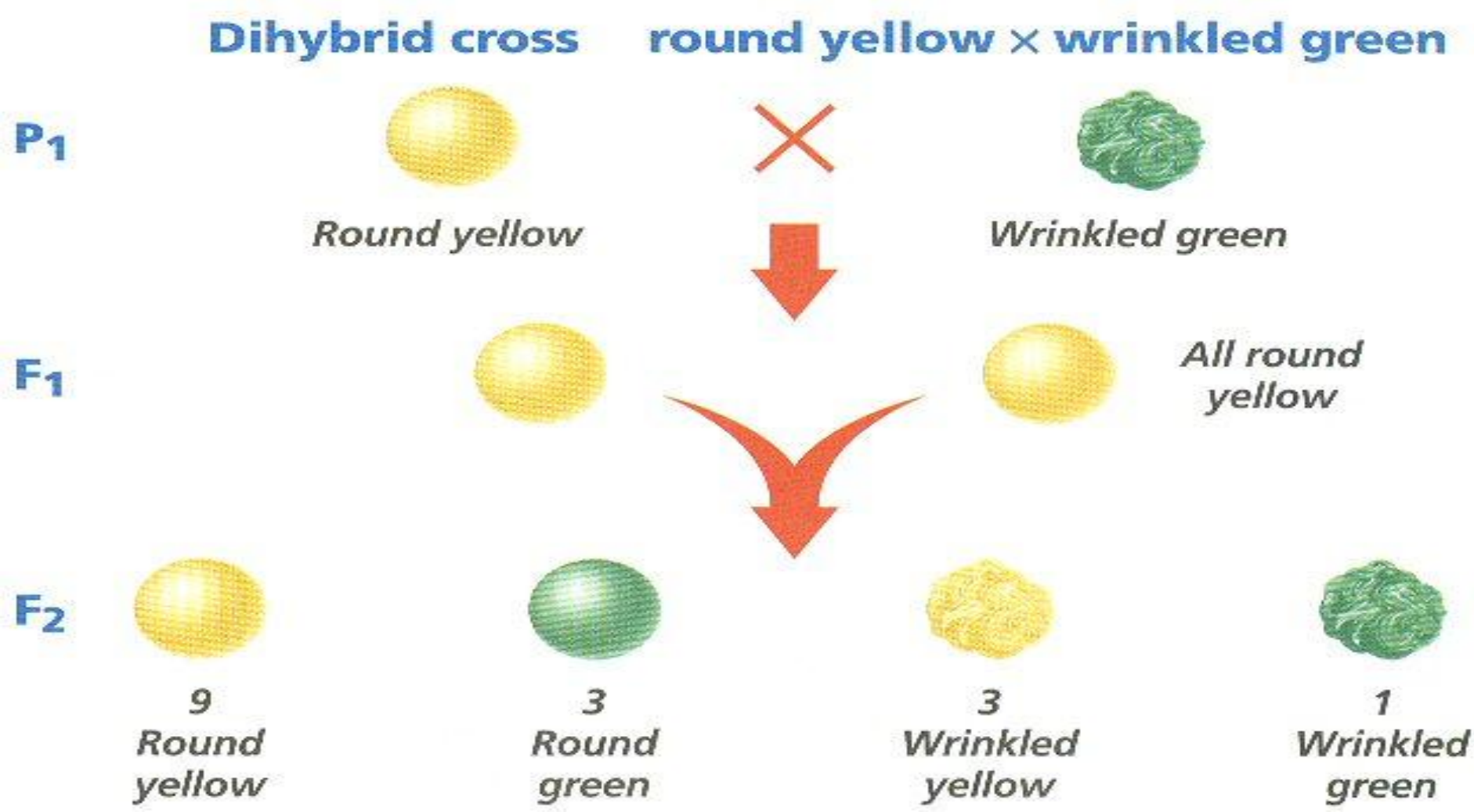
a. ¾ rollers; ¼ non rollers
b. 00% rollers; 0% non rollers
c. ½ rollers; ½ non rollers
d. 0 rollers; 100% non rollers

- **Law of Independent Assortment** stated that traits are inherited independently of each other

Dihybrid Crosses

- **Mendel manipulated 2 traits rather than 1.**
- **Parents**
  - **RRYY x rryy**
  - **F1– all yellow, and round**
  - **F2 generation 9,3,3,1**

When Mendel crossed true-breeding plants with round yellow seeds and true-breeding plants with wrinkled green seeds, the seeds of all the offspring were round and yellow. When the F_1 plants were allowed to self-pollinate, they produced four different kinds of plants in the F_2 generation.



rryy

RRYY

	ry	ry	ry	ry
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy

RrYy

RrYy

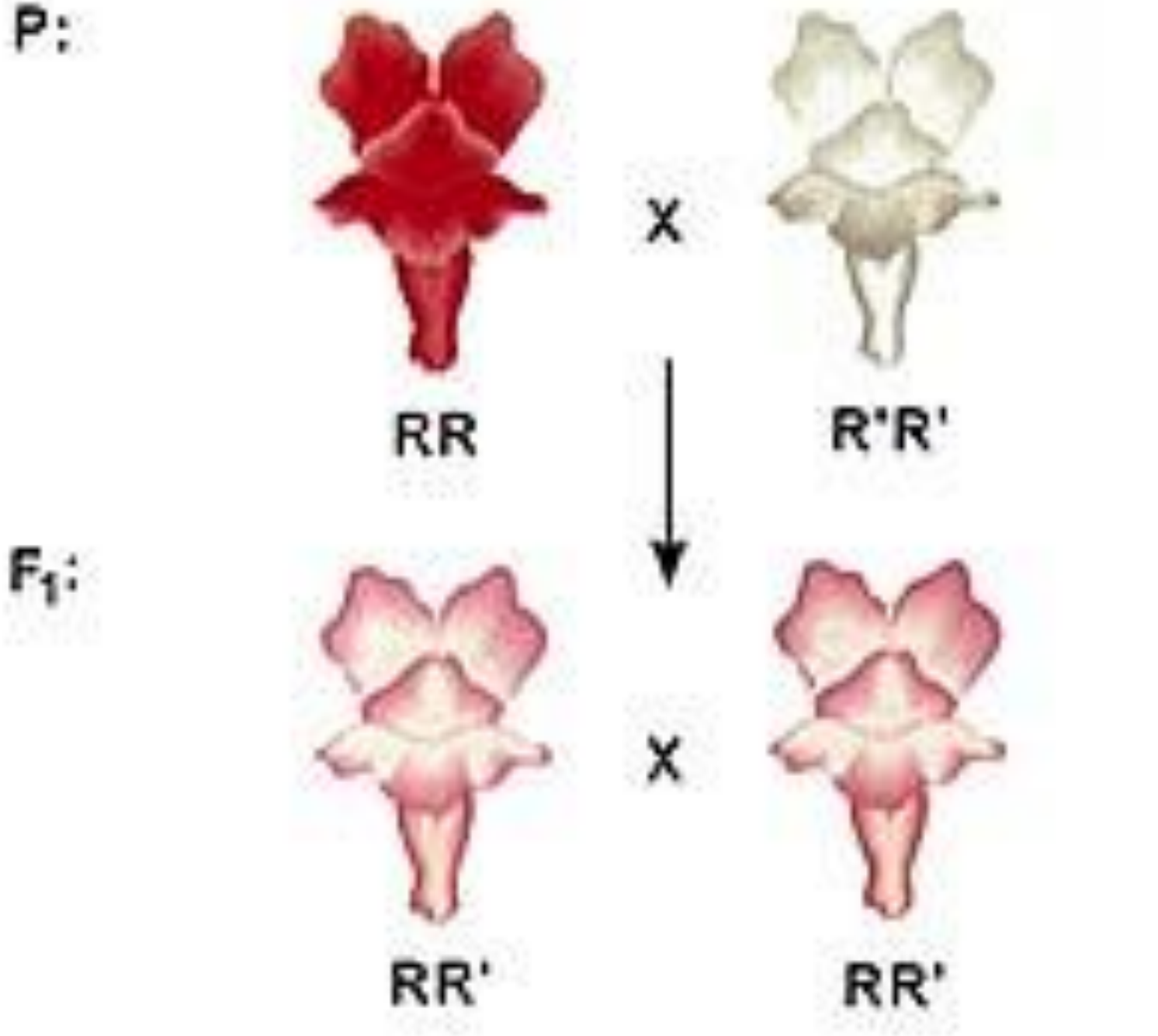
	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

When heredity follows different rules

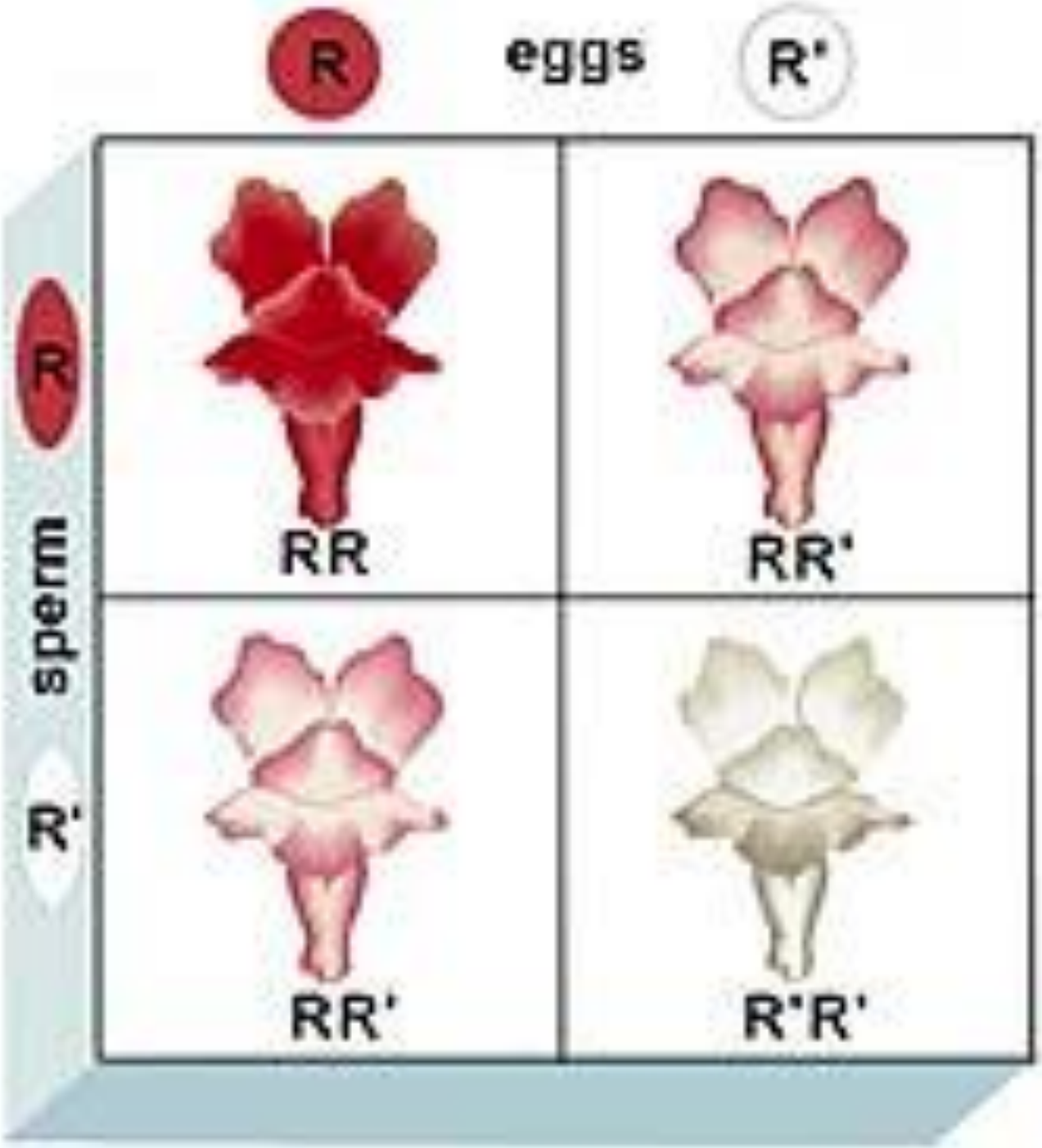
- Mendel's pattern of inheritance is called simple. But most alleles are not simply dominant or recessive.
- **What determines dominance**? Dominant genes code for polypeptides (enzymes) that work

Incomplete dominance

Incomplete dominance occurs when Two or more alleles influence the Phenotype, resulting in a Phenotype intermediate between the Dominant Trait and Recessive Trait.


P:
X
RR
R'R'
F1:
X
RR'
RR'

F_2:



Codominant alleles

- When there are 2 dominant alleles.
- Example: black and white rooster and chicken produce heterozygous-checkered color.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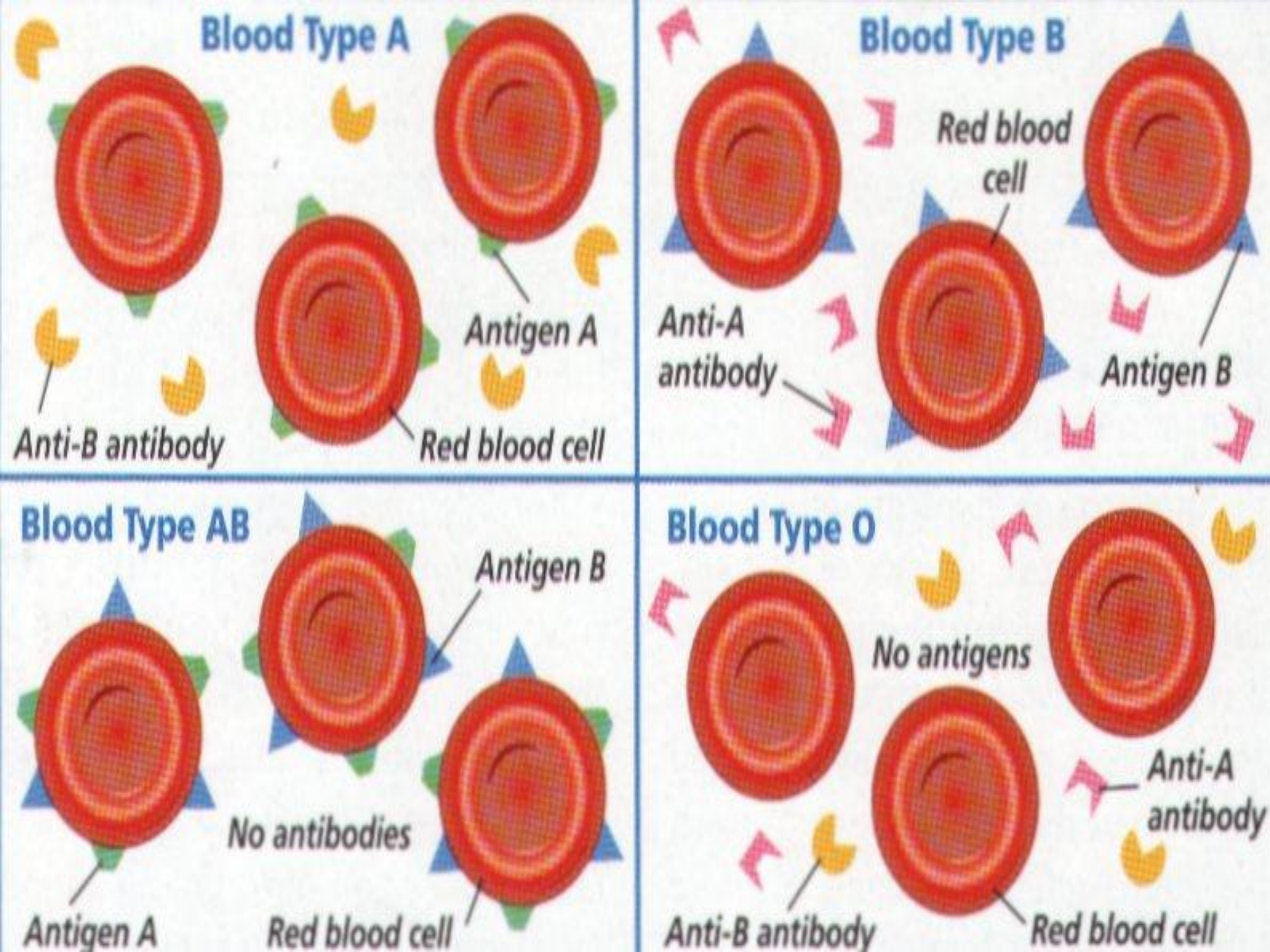
Polygenic Inheritance

Traits which are the result of many gene combinations.

Example of human traits: height, body weight, and skin color.

Multiple Alleles

- Mutations can cause the presence of more than 2 alleles. Some traits have up to 100 alleles. Example: rabbit fur color (at least 4 alleles), fruit fly eye-color, and blood typing.


Blood Type A
Antigen A
Anti-B antibody
Red blood cell
Blood Type B
Red blood cell
Anti-A antibody
Antigen B
Blood Type AB
Antigen B
No antibodies
Antigen A
Red blood cell
Blood Type O
No antigens
Anti-A antibody
Anti-B antibody
Red blood cell

Blood Donor Table

Blood Type	Can Donate To	Can Receive From
A	A, AB	A, O
B	B, AB	B, O
AB	AB	A, B, O
O	A, B, AB, O	O

Environmental factors

Internal

- Age
- Gender (hormone differences). Example: presence of horns.

External factors can all influence gene expression.

- Temperature (rabbit fur color, bacteria)
- Nutrition
- Light
- Chemicals, Infectious diseases