Unit 7: Genetics

Gregor Mendel – Father of Genetics

- Austrian Monk
- Carried out genetics studies on pea plants

Mendel's Pea Plants

- Studied 7 different pea plant traits
  - Trait – specific characteristic
    - E.g. seed color, plant height
    - Traits are determined by genes that code for them
- Crossed plants with contrasting characteristics
  - E.g. yellow seeds vs. green seeds
  - Original parents – P generation
  - Offspring – F_1 generation

Mendel's Results:

	Flower color	Flower position	Seed color	Seed shape	Pod shape	Pod color	Stem length
P	Purple × White	Axial × Terminal	Yellow × Green	Round × Wrinkled	Inflated × Constricted	Green × Yellow	Tall × Dwarf
F_1	Purple	Axial	Yellow	Round	Inflated	Green	Tall

Mendel's Results:

- The offspring were NOT a blend of the parents
  - Offspring only had the characteristic of ONE parent

- These traits were controlled by one gene that exists in two forms
  - Allele – different forms of genes

Mendel's Conclusions:

1. Biological inheritance is determined by factors that are passed from one generation to the next
2. Principle of Dominance:
   - Some alleles are dominant and some are recessive

Dominant vs. Recessive

- Dominant alleles – will always be expressed
- Recessive alleles – will only be expressed when a dominant allele is not present
  - Masked by dominant alleles

E.g. The allele for tall plants was dominant
E.g. The allele for green seeds is recessive

	Flower color	Flower position	Seed color	Seed shape	Pod shape	Pod color	Stem length
P	Purple × White	Axial × Terminal	Yellow × Green	Round × Wrinkled	Inflated × Constricted	Green × Yellow	Tall × Dwarf
F_1	Purple	Axial	Yellow	Round	Inflated	Green	Tall

Mendel's Next Question: Did the recessive alleles disappear or were they still present?

- Crossed F_1 offspring
  - Created F_2 offspring

F_1 Cross Results:

- Recessive alleles reappeared!
  - ~1/4 of the F_2 offspring showed the recessive allele

Explanation:

Mendel's conclusion:

3. When the F1 generation crosses, the gametes are segregated (separated).

= Law of Independent Assortment

- Each gamete only carries 1 copy of the gene
  - E.g. A gamete will only have the tall allele or the short allele. Not both

Can we predict the outcome of genetic crosses?

- i.e. what is the probability that an offspring will have a certain allele and express a specific trait?

Vocab-

- Genotype – genetic make-up
- Phenotype – physical characteristic

- Homozygous – organisms that have the same allele for a trait
- Heterozygous – organisms that have different alleles for a trait

Examples: Height of Plant

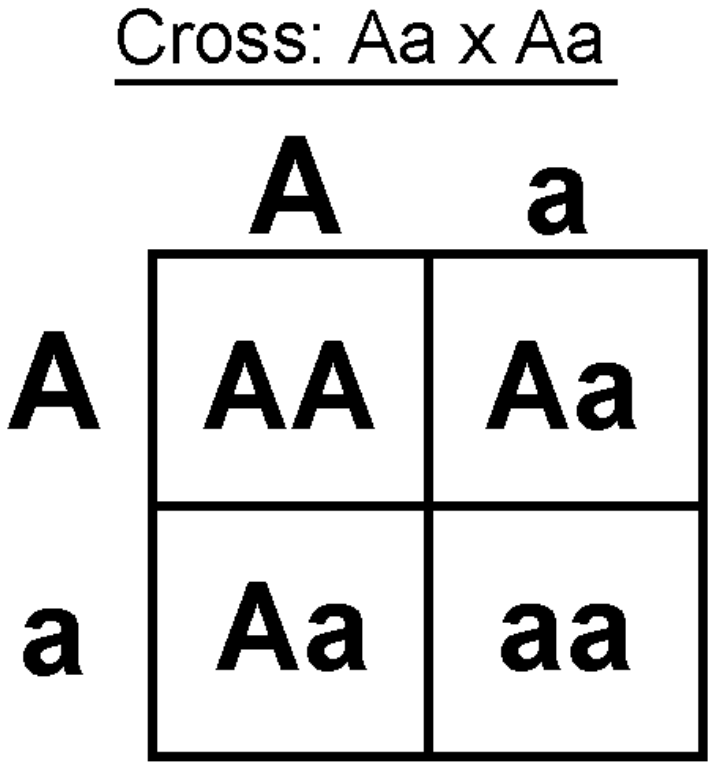
- T = tall allele, t = short allele
- Dominant alleles are represented by capital letters
- Recessive alleles are represented by lowercase letters
- Remember – you get one from each parent
  - E.g. genotype = TT, Tt, tt
  - E.g. phenotype = tall or short

Examples: Height of Plant

- T = tall allele, t = short allele
- Remember – you get one from each parent
  - E.g. homozygous = TT, tt
  - E.g. heterozygous = Tt

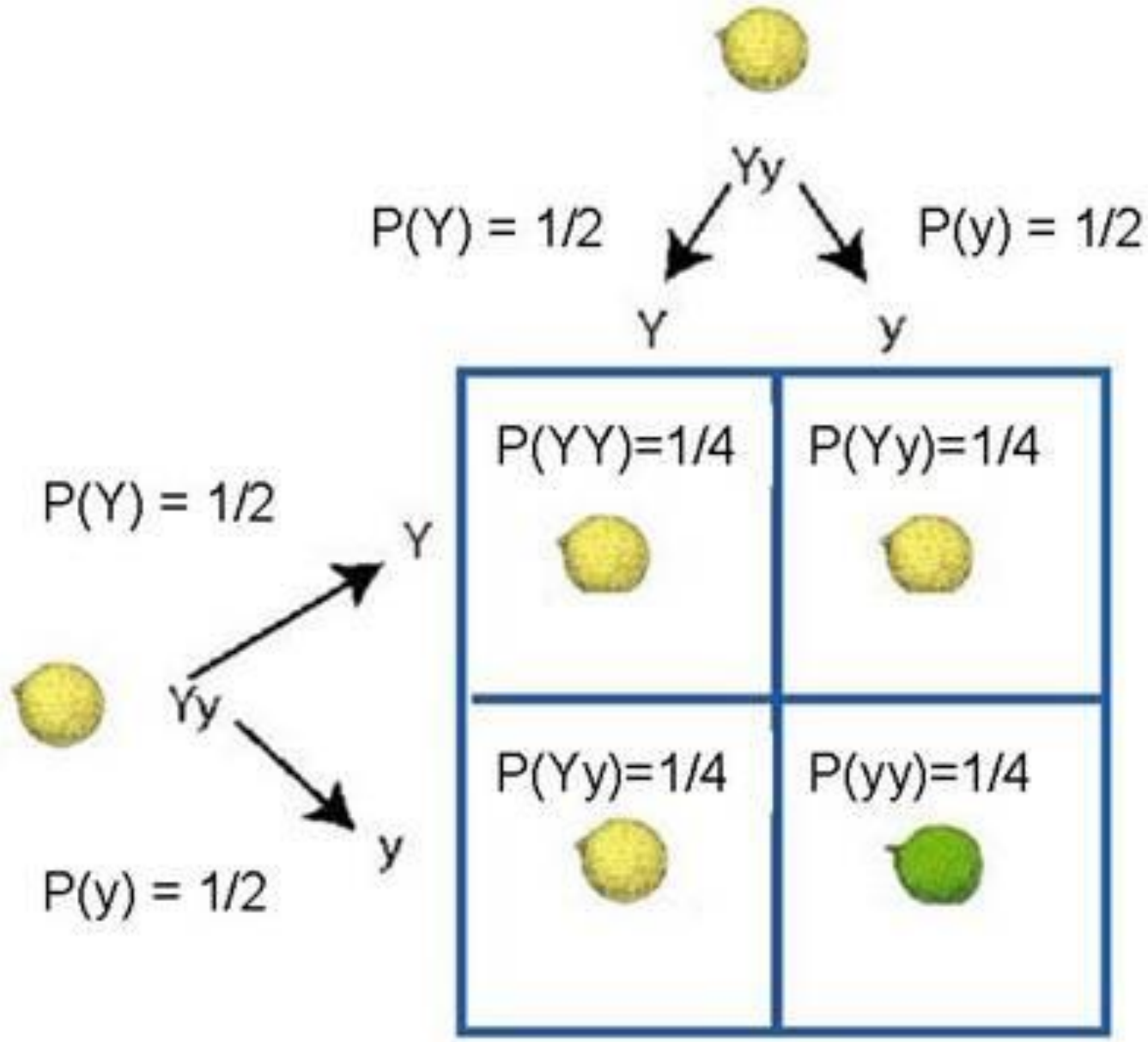
Punnett Squares

- Used to predict the outcome of genetic crosses!
- Monohybrid cross



Example Problem:

- Y = yellow seed, y = green seed
- Complete a Punnett Square for the cross Yy x Yy


Yy
P(Y) = 1/2
P(y) = 1/2
Y
y
P(YY)=1/4
P(Yy)=1/4
P(Y) = 1/2
Y
Yy
P(Yy)=1/4
P(yy)=1/4
y
P(y) = 1/2