Topic 7: Heredity - Inheritance

SCI141

Objectives

- Describe basic genetic inheritance terminology.
- Complete monohybrid and dihybrid genetic crosses.

Earlobe Variation

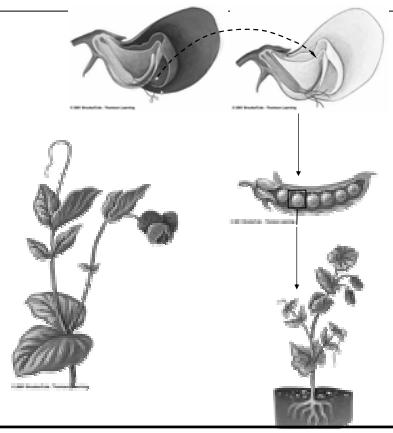
- Whether a person has attached or detached earlobes depends on a single gene
- Attached earlobes: two copies of the recessive allele for this gene
- Detached earlobes: either one or two copies of the dominant allele

Early Ideas about Heredity

- People knew that sperm and eggs transmitted information about traits
- Blending theory
- Problem:
  - Would expect variation to disappear
  - Variation in traits persists

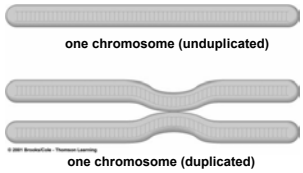
Gregor Mendel

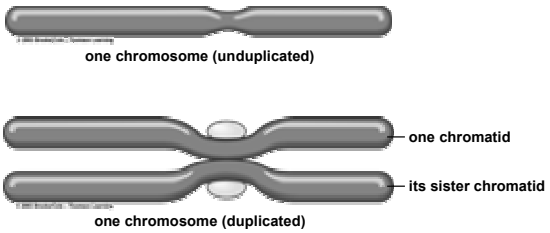
- Strong background in plant breeding and mathematics
- Using pea plants, found indirect but observable evidence of how parents transmit genes to offspring



Chromosome

- A DNA molecule & attached proteins
- Duplicated in preparation for mitosis





Chromosome Number

- Sum total of chromosomes in a cell
- Somatic cells
  - Chromosome number is diploid (2*n*)
  - Two of each type of chromosome
- Gametes
  - Chromosome number is haploid (*n*)
  - One of each chromosome type

Genes

- Units of information about specific traits
- Passed from parents to offspring
- Each has a specific location (locus) on a chromosome

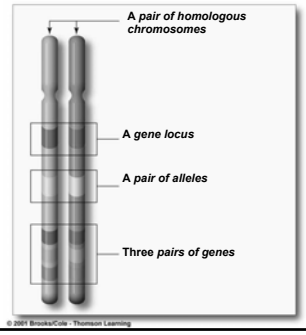
Alleles

- Different molecular forms of a gene
- Arise by mutation
- Dominant allele masks a recessive allele that is paired with it

Allele Combinations

- Homozygous
  - having two identical alleles at a locus
  - *AA* or *aa*
- Heterozygous
  - having two different alleles at a locus
  - *Aa*

Genetic Terms



Genotype & Phenotype

- Genotype refers to particular genes an individual carries
- Phenotype refers to an individual's observable traits
- Cannot always determine genotype by observing phenotype

Tracking Generations

- Parental generation *P*
  mates to produce ↓
- First-generation offspring F_1
  mate to produce ↓
- Second-generation offspring F_2

Dominance

- Dominant Alleles
- Recessive Alleles
- Codominance

Monohybrid Crosses

Experimental intercross between two F_1 heterozygotes

AA X *aa* ⟶ *Aa* (F_1 monohybrids)

Aa X *Aa* ⟶ ?

Steps in Solving Crosses

1. Assign a symbol for each allele
2. Determine parental Genotypes
3. Determine parental Gamete possibilities
4. Determine cross possibilities

Tourette's syndrome

- Tourette's allele is dominant
- Let's say that both parents are heterozygous for Tourette's syndrome

Assign a symbol for each allele

- T = Dominant
- t = recessive

Parental Genotype

- Both parent or heterozygous
- What does that mean?

Determine possible gametes

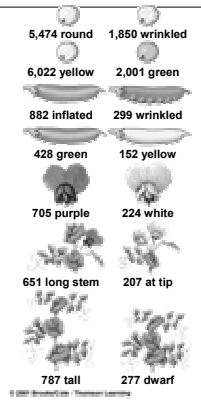
- Parents are Tt
- Possible gametes are?

Use Punnett Square

	T	t
T		
t		

Mendel's Monohybrid Cross Results

F_2 plants showed dominant-to-recessive ratio that averaged 3:1



Multiple alleles

- More than two alleles are possible
  - Blood type
    - Three alleles
    - I^A → A type
    - I^B → B type
    - i → recessive

Polygenic Inheritance

- More than one gene is responsible for a trait
- Skin Color

Locus 1	d^1d^1	d^1D^1	d^1D^1	D^1D^1	D^1d^1	D^1d^1	D^1D^1
Locus 2	d^2d^2	d^2d^2	d^2D^2	D^2d^2	D^2d^2	D^2D^2	D^2D^2
Locus 3	d^3d^3	d^3d^3	d^3d^3	d^3d^3	D^3D^3	D^3D^3	D^3D^3
Total number of dark-skin genes	0	1	2	3	4	5	6

Very light — Medium — Very dark

Let's try some crosses