Mendel & Genetics

Gregor Mendel & His Peas

Mendel's work with peas

- **Gregor Mendel** was an Australian monk who did a series of experiments to show that traits **do NOT** occur purely at **random**.
- He recognized that traits occur in family pedigrees according to certain patterns of inheritance.
- While at the monastery Mendel did experiments with pea plants.

Mendel's work with peas

- He did pea plant studies, and discovered some seeds were **smooth** others **wrinkled**, some were **green** others **yellow**, some **tall** others **short**.
- All sorts of variations were observed.
- He would record and experiment over and over, and he came across some patterns:

Mendel's work with peas

- He observed the variation in these plants.
- **Term to know:**
- **Variation:** the occurrence of an **inherited trait** that makes a person or thing **different** from other members with in the same species.

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- TALL X TALL = **4 ALL TALL PLANTS**
- TALL X TALL= **3 TALL 1 SHORT**
- TALL X SHORT = **ALL 4 TALL**
- SHORT X SHORT = **ALL SHORT**

Mendel's work with peas

- Was there a pattern in these results that supported Mendel's hypothesis... that the traits of offspring came from their parents???
- or were the results random???

Mendel's work with peas

- Cross pollination of plants with certain traits with plants having contrasting traits.
- He determined which traits were inherited by offspring plants
- Established **mathematical ratios** from the counts of the contrasting traits that were displayed.
- These ratios describe **"genetic factors"** that control traits in terms of probability.

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- Mendel's "Factors" are now known as **genes**
- **Definition: Gene:**
- **A unit of heredity**; a discrete portion of a chromosome thought to be responsible for the production of a single type of "**factor".**
- The "factor" responsible for the inheritance of a genetic trait.

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- **Gene-Chromosome Theory:**
- **Definition: A theory of genetic inheritance that is based on current understanding of the relationships between the biochemical control of traits and the process of cell division.**

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- **Chromosomes/Chromatids:**
- (Remember meiosis & mitosis) the chromosome is made up of **2 chromatids**
- **Alleles:**
- **Definition: One pair of genes** that exist at the same location on a pair of homologous chromosomes and cause parallel control over the same genetic trait.

SOME MAJOR GENETIC PATTERNS:

Genes of certain pairs can have contrasting (different or opposite) effects on the same trait.

- However, only one may be **expressed**, while the other is **masked**.
- **Dominant: The gene that is expressed**
- **Recessive: The gene that is masked**
- In "dominance problems" **dominant alleles** are usually symbolized by a **capital letter (A)** while the **recessive allele** for the same trait is given the **lower case (a)** of the same letter.

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- If the two inherited traits are **alike** (TT or tt) the combination is called: **homozygous**
- If the two inherited traits of this allelic pair are **different** (Tt) this combination is called : **heterozygous** (or hybrid)

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- Example:
- Garden peas: tall plants vs short plant
- **T** = tall allele **t** = short allele
- In fertilization homologous chromosomes are separated in meiosis, and the fertilization of the egg brings together the union of 2 different chromosomes.
- In this cases two alleles for every trait are inherited.

Mendel's work with peas

- **Phenotype:** The physical appearance, (what you see!) expression of the genetic make-up of the offspring
- **Genotype:** The genetic makeup (the genes!) of the offspring that determines the phenotype

Brainpop Heredity & Mendel

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Mendel's work with peas

- So Mendel tried to cross his tall plants and see what would happen.
- Remember, each trait has 2 genes. Mom will donate HALF of 2 genes and Dad will donate HALF of 2 genes.
- When Mendel crossed this is what the cross pattern looked like:

DADs Genes	Moms Genes T	T
T	TT	TT
T	TT	TT

All 4 offspring (which are in the white boxes) are HOMOzygous dominate 100% dominant

- Next Mendel tried to cross 2 short plants and see what would happen.
- Remember, each trait has 2 genes.
- Mom will donate HALF of 2 genes
- Dad will donate HALF of 2 genes.
- But this time the results were different! WHY?? When Mendel crossed this is what the cross pattern looked like:

DADs Genes	Moms Genes t	t
t	tt	tt
t	tt	tt

ALL 4 offspring are were homozygous (tt) but this time they're recessive or SHORT! 100% Recessive!

- Next Mendel tried to cross 2 tall plants and see what would happen. Remember, each trait has 2 genes.
- Mom will donate HALF of 2 genes
- Dad will donate HALF of 2 genes.
- But this time the results were different! WHY?? When Mendel crossed this is what the cross pattern looked like:

DADs Genes	Moms Genes T	Moms Genes t
T	TT	Tt
t	Tt	tt

3 offspring are dominate, but only 1 is homozygous (TT)

This time there's a recessive or SHORT who's also homozygous (tt) and 50% are heterozygous or Tt

Mendel's work with peas

- Note that 3 of these offspring would show the phenotype of the dominant gene,(being tall!)
- even though their "genetic make-up is different, (TT, Tt)
- while only one would show the recessive trait (tt) and be short.

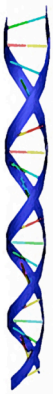
Punnett Squares

Some Punnet Square Fun!

- Use the following percentages as they pertain to the information given:
- a) 0%
- b) 25%
- c) 50%
- d) 75%
- e) 100%

- What are the chances of mm x MM parents having a homozygous recessive offspring: ___
- 0%
- What are the chances of Mm x Mm having a homozygous dominant offspring:
- 25%
- What is the percent of mm x mm parents having heterozygous offspring: ___
- 0%

- What is the percent of Mm x Mm having heterozygous offspring: ___
- 50%
- What is the percent of Mm x Mm having homozygous recessive off spring: ___
- 25%
- What percent of Pp x pp offspring will be heterozygous: ___
- 50%



- What percentage of Pp x pp homozygous recessive: ___
- 50%
- What percentage of PP x PP homozygous dominant: ___
- 100%
- What percentage of PP x PP offspring will have a dominant phenotype? ___
- 100%
- What percentage of PP x PP offspring will have a recessive phenotype? ___
- 0%