Survey of Bio.

wk. 10

MON, 2009-11-02, 8-9:20AM:

Gregor Mendel: monk, 1st to correctly describe the inheritance of genes (overridden by Darwin at time)

Most dominance is not one gene (simple dominance), so Mendel was written off until after his death.

Did experiment on peas.

PROTEINS have many functions: enzymes, contractile, hormonal, structural, receptor (cell-cell recognition). GENES code for polypeptides (proteins).

Science seminar: Wed 2009-11-04 2pm b.410, r.131

Phenotype: observable characteristics of an organism (think photography).

Genotype: Combination of alleles of an organism.

Allele: variation of a gene / alt. forms of a gene.

Phenotype can also be non-visible characteristics like blood type, which doesn't reveal genes. Think phenomenon.

Genotype + Environment → (yields) Phenotype.

Genotype (alleles of genes) interact with environment to produce the phenotype (observable characteristic).

The environment has little influence on eye color & some other genes. For other genes, environment is important (i.e. age). Environment: internal like age yields gray hair, or M/F hormones. External: like sun yields tan, or low sulfur sweetens Vidalia onions.

pH of the soil makes different-colored flowers sometimes

~~The~~ Temperature in Himalayan rabbit. Cold ice yields darkcolored ears & tail but white body.

Skin color is influenced by genes & environment.

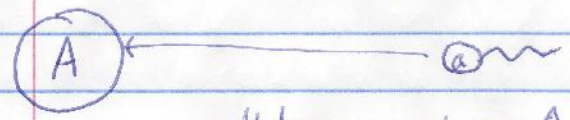
Mon, 2009-11-02, 8-9:20 AM:

Diploid organism has <u>only</u> two alleles.

If both alleles are the same = homozygous genotype or individual is a homozygote (AA, aa).

Otherwise, heterozygous genotype or individual is a heterozygote (Aa).

There is only one allele per gamete (egg / sperm).



Fusion of gametes @ fertilization yields allele pairs, i.e Aa here AA

Mendel crossed a pure-breeding parent (purple flowers) with a pure-breeding parent (white flowers) aa

Offspring of P generation is called the F1 generation

F1 generation had ALL purple flowers.

Monohybrid Cross: $F_1 \times F_1$ yielded F_2 generation with $\frac{3}{4}$ purple & $\frac{1}{4}$ white, even though the parents were all purple

Let "A" = purple allele of the flower color gene

let "a" = white allele of the flower color gene (mutant)

	A	A
a	Aa	Aa
a	Aa	Aa

(purple)

(white)

Punnett square for F_1 (yields) all purple

yields F_2:

	A	a
A	AA	Aa
a	Aa	aa

1 = AA, 2 = Aa } purple

1 ~~X~~ = aa } white

3 purple, 1 white

Alternate forms of a gene are called alleles. One allele comes from each parent (meiosis), yielding 2 in the offspring (i.e flowers).

MON, 2009-11-02, 8-9:20 AM:

Aa is as purple as possible. AA is just the same phenotype. Recessive phenotype = aa

	A	a
a	Aa	aa
a	Aa	aa

→ 50% chance of recessive phenotype

Mendel's principle of segregation: pairs of alleles separate in gametes, then combine in fertilization (refuse)

Complete a.k.a. Simple Dominance

Mendel confirmed his genetics for 7 things in peas:
flower color, flower position, seed color, seed shape, pod shape, pod color, stem length.
one chromosome = one allele, Mendel got lucky? OR picked 7 traits for completeness.
Peas have 7 chromosomes
Mitosis / Meiosis was discovered <u>after</u> Mendel. Then he was understood.
A- means we don't know the 2nd allele (A or a?)
Birds: yellow / green bird = natural (wild type)
Selective breeding yields abnormal sky-blue color.
*Unaffected carriers of cystic fibrosis = Ff = one dominant & one recessive allele. Could pass on to children, but the parent has the dominant phenotype.
A woman w/ bb (blue eyes) has children to a man w/ Bb (brown eyes). 50% chance of Brown eyes (Bb)
50% chance of Blue eyes (bb)

	A	a
A	AA	Aa
a	Aa	aa

← 25% of homozygous dominant (AA)
← 50% of heterozygous dominant (Aa)
← 25% of homozygous recessive (aa).

MON, 2009-11-02, 8-9:20 AM

Homozygous: an organism is AA or aa (same alleles).
Heterozygous: an organism is Aa (different alleles).
~~aa~~ yellow × black = all yellow ∴ Yellow is dominant.
Freckles, widow's peak (hair), & free vs. attached earlobes are simple dominance problems (Mendel).
Multi-choice tests can be as hard as solving problems normally.

TUE, 2009-11-03, 9:30-10:50 AM

	A	a
A	AA	Aa
a	Aa	aa

Homozygous genotype = AA or aa
Heterzygous genotype = Aa

Mendel crossed a pure-breeding purple flower w/ a pure-breeding white flower yielding an F_1 generation with all PURPLE flowers.

2 gametes

	A	A
a	Aa	Aa
a	Aa	Aa

F_1 genotypes of the progeny

=>

	A	a
A	AA	Aa
a	Aa	aa

F_2

A = purple
a = white

4 purple (phenotype) → 4:0 ratio

3 purple : 1 white

Recessive alleles must be homozygous to express their phenotype.

$F_1 \times F_1$ Aa genotype

↓ meiosis yields (sperm or eggs)

A gamete a gamete

Mendel got 3 yellow seeds to 1 green seed in F_2
3 axial flowers to 1 terminal flowers,
3 inflated to 1 constricted pod,
3 purple to 1 white flower, etc.

TUE, 2009-11-03, 9:30-10:50 AM

Mendel came after Darwin but <u>before</u> Mitosis & Meiosis.

	A	a
a	Aa	aa
a	Aa	aa

Punnett square = 1 Aa : 1 aa

2 Aa : 2 aa

"Wild type" is most commonly found in nature.

Wild AA yellow bird w/ aa blue bird gives Aa yellow bird.

Aa × Aa gives $\underbrace{1AA : 2Aa : 1aa}_{\text{genotypic ratio}} = \underbrace{3 \text{ yellow} : 1 \text{ blue}}_{\text{phenotypic ratio}}$

An Unaffected carrier for cystic fibrosis has Aa. The mutant allele (a) can be passed on to offspring.

Wed rm. 131
2-3pm sci sem.

Homologous chromosomes have same genes at specific locus (location). Homo = same Hetero = different

* Dwarfism is dominant but most of us have both recessive genes.
* Recessive disorders: albinism, cystic fibrosis, sickle-cell disease
* Tay-Sachs disease, galactosemia, phenylketonuria
* Dominant disorders: Dwarfism, Alzheimer's (one type), etc.
* cannot tell from karyotype

☺ Some traits are not simple-dominance/monohybrid that Mendel studied.

TUE, 2009-11-03, 12:30-1:50 PM

Genotype + Environment yields phenotype. But environment is often an unimportant factor, such as in eye color, which is only genes.

Your phenotype is also affected by hormones and age.

Himalayan rabbit: shave + ice = black hair grows back

TUE, 2009-11-03, 12:30-1:50 PM,

For homozygous genotypes, think homosexual.

boy + boy or girl + girl AA or aa

For heterozygous genotypes, think heterosexual

boy + girl Aa

(A) ← (a) one parent gives one allele 1 + 1 = 2
other parent gives one allele

☺ Pea plants were easy for Mendel to work with because they can self-fertilize & are simple.

(P generation) → (F1 generation) → (F_2 Generation)
parental familial 1 familial 2

AA × aa → Aa × Aa → miscellaneous

4 Aa 1 AA : 2 Aa : 1 aa genotype genes

4 purple : 0 white 3 purple : 1 white phenotype phenomenon

photography

	A	A
a	Aa	Aa
a	Aa	Aa

□ = genotypes of F_1

	A	a
A	AA	Aa
a	Aa	aa

□ = genotypes of F_2

AA aa → Aa one gamete (random) from each parent

☺ Mendel stopped at 7 pea traits as a monk for completeness.

Biblical numerology: God made Earth in 6 days & rested 1. 6 + 1 = 7

AA × aa = 4 Aa = 4 purple : 0 white

Aa × Aa = 1 AA : 2 Aa : 1 aa = 3 purple : 1 white

Aa × aa = 2 Aa : 2 aa = 1 purple : 1 white

A testcross is a mating between an unknown genotype (AA or Aa) & a homozygous recessive (aa). If $\frac{1}{2}$ purple $\frac{1}{2}$ white

If F_1 is all dominant (i.e purple), parent is AA parent is Aa.

TUE, 2009-11-03, 12:30-1:50 PM:

Capital letters are always first: Aa not aA

	F	f
F	FF	Ff
f	Ff	ff

A man & a woman can have a child who has cystic fibrosis without having cystic fibrosis themselves, if they are both heterozygous (carriers) = Aa (Ff in this case).

The odds are 25% cystic fibrosis, 75% normal.

$\frac{2}{3}$ of the normals (50% of total) will be <u>unaffected</u> carriers, like the parents.

② The ability to taste a chemical called PTC requires one dominant allele. Pp × Pp (2 parents w/ recessive = heterozygote = can taste)

	P	p
P	PP	Pp
p	Pp	pp

$\frac{3}{4}$ can taste

$\frac{1}{4}$ cannot

$\frac{2}{4}$ are unaffected carriers (can taste)

$\frac{1}{4}$ are ~~homo~~. dominant (PP)

Alleles are <u>alternative forms</u> of a gene.

Freckles, widow's peak, & free earlobes are dominant traits! So most people are aa to not have freckles.

Down syndrome patients have 3 alleles on chromosome #21.

Deafness can be genetic or environmental, i.e listening to loud music constantly.

Carrier is a description of the heterozygous genotype, not phenotype. The phenotype is the same as the homozygous dominant genotype (AA).

Any percentage in genetics is a coin toss. You could have 5 boys or 5 girls in a row.

END