

Biology 20 GENETICS

Genetics:

Genetics History:

Aristotle: pangenesis
Anton von Leewenhoek: homunculus
Regnier de Graff:

Blended Theory:

Mendel (1822-1884):

Particulate theory:

Gene idea:

Character:

Trait:

Terms:

Alleles:

Dominant alleles:

Recessive alleles:

Genotype:

Homozygous dominant:

Homozygous recessive:

Heterozygous:

Phenotype:

Punnet square:

What determines the phenotype? The arrangement of the alleles in the genotype determines.

True breeding:

Homozygous tall:
TT x TT

Homozygous short:
tt x tt

Phenotype?

Phenotype?

Cross of the homozygous plants (P Generation):

Tall (TT) x Short (tt) => Offspring are the F₁ (1st filial) Generation

Genotypes:

Phenotypes:

Breeding the F₁ Generation:

Tall (Tt) x Tall (Tt) pea plants => Offspring are the F₂ Generation

Genotypes:

Phenotypes:

Genotypic ratio:

Phenotypic ratio:

Monohybrid cross: the cross which tracks **single** character of inheritance

Mendel's Principle of Segregation:

a) the pair of genes for each character:

b) fusion of gametes at fertilization:

How does the principle of segregation relate to meiosis? (p. 144; Fig. 8.17A)

Monohybrid cross: Two people that are heterozygous for brown eyes mate. What are the possible eye colors of their offspring?

Note: B = brown
b = blue

Dihybrid cross:

Mendel's Principle of Independent Assortment:

a)

b) formula: 2^n where n = # of heterozygous pairs

How many unique gametes will be produced for the following genotypes?

a) RrYy _____ gametes

b) AaBbccDD _____ gametes

c) AAAbb _____ gametes

Mendel used pea characteristics => Seed color: Yellow (Y) - green (y)
Seed shape: Round (R) - wrinkled (r)

F₁ Generation cross: RrYy x RrYy (both heterozygous round and yellow seeds)

Phenotypic ratio:

Test cross:

Ex. Purple flower (P)
White flower (p)

PP or Pp x pp

--	--

--	--

Complete dominance:

Incomplete dominance:

F₁ hybrids:

Ex. Snapdragons
RR = red
rr = white
Rr = pink

Hypercholesterolemia
HH = normal (make LDL receptors)
hh = severe disease (can not make LDL receptors)
Hh = mild disease (makes some LDL receptors)

Codominance:

Multiple alleles:

Ex. A, B, O => three alleles => I^A , I^B , i

Blood type	Possible Genotypes	Antigens on RBC	Antibodies in serum
A	$I^A I^A$ $I^A i$	A	anti-B
B	$I^B I^B$ $I^B i$	B	anti-A
AB	$I^A I^B$	AB	---
O	ii	---	anti-A anti-B

Type O:

Type AB:

Foreign **antigens** cause the body to produce **antibodies**.

Antibodies:

Antigen:

Rh factors:

Rh (+)

Rh (-)

RhoGAM:

Pleiotrophy:

EX. Tigers & Siamese cats:

Epistasis:

Ex. P = purple p = white C = color c = no color

ppcc = white

PpCc = Purple

PPcc = white

Polygenic inheritance

Phenocopy

Recessively Inherited Disorders:

If heterozygous:

Types:

Albinism:

Cystic fibrosis:

Tay-Sachs disease:

Sickle-cell anemia (1 in 400 African-Americans born in US)

Consanguinity:

Dominantly Inherited Disorders:

Types:

achondroplasia (dwarfism):

Huntington's disease:

Polydactyly:

Linked genes:

Sex-linked genes:

Genes located:

Fathers pass X-linked alleles to **only** and **all** of their?

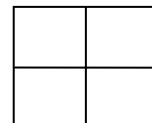
For example: A = normal gene; a = gene associated with a disorder

<u>Genotype</u>	<u>Phenotype</u>	<u>Genotype</u>	<u>Phenotype</u>
$X^A X^A$	normal female	$X^A Y$	normal male
$X^A X^a$	normal female (carrier)	$X^a Y$	sex-linked disorder
$X^a X^a$	sex-linked disorder		

Males have more sex-linked disorders than females. WHY?

A man with normal vision marries a woman who has normal vision but whose father was colorblind.

- 1) What are the genotypes of the man and woman?
- 2) What percentage of their children will have normal vision?
- 3) What percentage of their sons will have normal vision?
- 4) What percentage of their daughters will have normal vision?
- 5) Will they have any colorblind children? If so, whom?



Sex Influenced Traits:

Pattern-baldness:	Genotype	Men	Women
	BB	normal	normal
	Bb	bald	normal
	bb	bald	thin

1) BbXY → what's the phenotype?

2) BbXX → what's the phenotype?

Technology is providing new tools for genetic testing and counseling:

Carrier recognition:

Tests for heterozygous carriers for:

Enables people to:

Could also be abused:

Fetal testing:

If a couple learns that they are both carriers for a genetic disease, can decide to have a child can determine if the fetus has the disease.

Alpha fetoprotein (AFP):

Amniocentesis:

Chorionic villi sampling (CVS):

Ultrasound:

Fetoscopy:

Newborn screening = to detect genetic disorders such as phenylketonuria (PKU)

- PKU is recessively inherited and occurs in about 1 in 15,000 births in the US