

Comparing Reproduction

ASEXUAL vs. SEXUAL

asexual	similarities	sexual
- 1 parent	- creates offspring	- 2 parents
- identical genetics	- offspring grow/develop	- genetic variation
- quicker & less energy	- use DNA	- slower & more energy
<i>advantages</i>		<i>advantages</i>
- well-adapted (stable environment)		- increased diversity
- large # offspring quickly		- adapt to changed (unstable environment)
- reliable (fewer steps)		- genetic variation
- no need for a mate		
- less time & energy		

MEIOSIS vs. MITOSIS

meiosis	similarities	mitosis
- 2 divisions = 4 daughter cells	- interphase	- 1 division = 2 daughter cells

Comparing Reproduction (cont)

- genetic variation	- forms of reproduction	- genetically identical
- half # chromosomes (23)	- stage names	- same # chromosomes (46)
- sex cells/gametes		- somatic cells

Meiosis Definitions

- heredity:	transmission of traits from 1 generation to the next
- gametes:	haploid reproductive cells (egg/sperm)
- gene locus:	gene's specific location on the length of a chromosome
- karyotype:	display of chromosomes matched up with their pairs (based on length)
- homologous chromosomes:	pair of chromosomes that have the same length, stain pattern, and genes controlling the same characteristics
- sex chromosome:	chromosome responsible for determining the sex of an individual
- autosome:	chromosome NOT directly involved in determining sex
- <i>diploid cell~</i>	2 chromosome sets (2n) = 46; somatic cells
- <i>haploid cell~</i>	1 chromosome set (n) = 23; gametes



Meiosis Background

Meiosis I is called?

↳ reductional division

Meiosis II is called?

↳ equational division

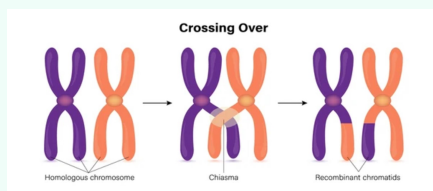
Original source of all genetic diversity?

↳ mutations

Term for different version of a gene?

↳ alleles

Variation



- **crossing over:** genetic rearrangement between sister chromatids by exchanging corresponding segments of DNA

↳ combining DNA from 2 parents into a single chromosome = *variation*

- **independent assortment:** each pair of homologous chromosomes are positioned independently of other pairs

↳ each daughter cell represents 1 outcome --- formula: 2^n

- **random fertilization~**

↳ fusion of gametes ($2^{23} \times 2^{23}$) = *variation*

Genetics Definitions

- *blending hypothesis~* genetic material contributed by both parents mixes (like paint)

- *particulate hypothesis~* parents pass on genes that retain their separate identities in offspring (like deck of cards)

Genetics Definitions (cont)

- *true-breeding strain~* plants, that after many generation of self-pollination, have produced only the same variety as the parent (homozygous)

- **hybridization:** crossing of 2 true-breeding varieties

- **P generation:** the true-breeding *parent* individuals

- **F1 generation:** hybrid offspring arising from a parental cross (*first filial*)

- **F2 generation:** offspring from the interbreeding of the F1 generation (*second filial*)

- **homozygous:** 2 identical alleles

- **heterozygous:** 2 different alleles

- **phenotype:** physical/physiological traits

- **genotype:** genetic makeup/set of alleles

- **testcross:** breeding an organism of unknown genotype w/ *homozygous recessive* to determine the unknown genotype

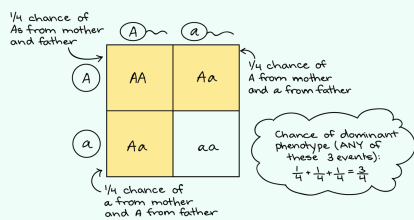
- **monohybrid cross:** cross between 2 organisms that *heterozygous* for the trait

- **dihybrid cross:** cross between 2 organisms that are *heterozygous* for *both* traits

Mendel's 3 Laws

- 1. Law of Dominance:** Some alleles are dominant and cover up the recessive alleles.
- 2. Law of Segregation:** An organism has two alleles for each gene but they can only pass on one.
- 3. Law of Independent Assortment:** Genes found on separate chromosomes are inherited independently of each other.

Probability



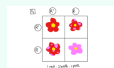
- **multiplication rule of probability:** probability of independent events occurring at the same time is the *product of their individual probabilities*
- **addition rule of probability:** probability of mutually exclusive events occurring is the *sum of their individual probabilities*

Incomplete Dominance



- **incomplete dominance:** phenotype between both parents
- ↳ genotype isn't completely dominant
- ↳ use capital letter with a superscript
- ↳ C → protein → trait

Codominance



- **codominance:** 2 alleles that each affect the phenotype in separate ways
- ↳ use capital letter and superscript
- ↳ R' → protein → item A → red
- ↳ R → protein → item B → pink

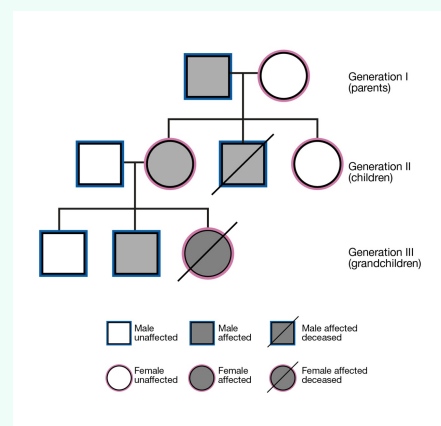
Blood Types

A	$I^A I^A / I^A i$
B	$I^B I^B / I^B i$
O	ii
AB	$I^A I^B$
alleles present=	3
recessive allele=	O
codominant alleles=	A & B

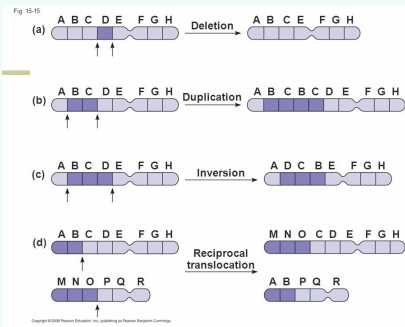
Sex-linked Genes

- **male** = XY
- **female** = XX
- **X inactivation:** most of 1 X chromosome in each cell becomes inactivated
- **Barr bodies:** inactive X chromosome condenses
- **gene SRY** (sex-determining region of Y): Y gene results in a male
 - ↳ makes transcription factor that binds to other genes causing them to transcribe
- **sex-linked genes:** genes on sex chromosomes
- father passes Y to sons & X to daughters
- mother passes X to sons/daughters
- **sex determination in birds:**
 - ↳ sex chromosome in *egg*
 - ↳ **male** = ZZ
 - ↳ **female** = ZW

Pedigree Chart



Chromosomal Mutations



- large scale chromosomal mutation = *change in phenotype*
- *three possible causes of mutations:*
 1. physical/chemical disturbances
 2. errors during meiosis
 3. random mutation

Chromosomal Disorders

- **nondisjunction:** pair of homologous chromosomes/sister chromatids fail to separate
- **aneuploidy:** 1 or more chromosomes have extra copies/deficient number
- **monosomic (monosomy):** diploid cell that has *1 copy* of a chromosome (not 2)
- **trisomic (trisomy):** diploid cell that has *3 copies* of a chromosome (not 2)
- **polyploidy:** organism has more than *2 complete chromosome sets*
- **Down syndrome:** extra chromosome 21 (trisomy)
- **Klinefelter syndrome:** extra X chromosome in males (XXY)
- **Turner syndrome:** loss of X chromosome in females (X0)
- **XXY:** extra Y chromosome in males
- **XXX:** extra X chromosome in females

Genomic Imprints

genomic imprints:

expression of an allele in offspring depends on whether the allele is inherited from mother/father

When does it occur?

during gamete formation

What chemical change does it involve?

methyl group added to cytosine nucleotides (inactivates alleles)

Which organelles contain their own DNA?

mitochondria & chloroplasts

When do these organelles get passed to offspring?

during fertilization, mitochondrial DNA from mother

Why are genetic defects of mitochondrial genes likely to affect the functioning of the nervous/muscular system?

they are the most susceptible to energy deprivation (which ATP comes from mitochondria)

Linkage Group

- **linkage group:** all the loci that "move together" in inheritance
- **frequency of recombination:** the frequency that crossing over will occur between two genes
- **gene map:** chromosome map that shows the relative locations of genes
- **linked genes:** located close enough together on a chromosome that they tend to be inherited together
- **'wild type':** phenotype most commonly observed

