MENDELIAN PATTERNS OF INHERITANCE

11.2 MENDEL'S LAW

Law of Segregation

- Each organism contains 2 factors for each trait.
- Factors segregate during formation of gametes.
- Each gamete contains 1 factor for each trait.
- Fertilization gives each new individual 2 factors for each trait.

- **Gene locus:** specific location of alleles on homologous chromosomes.
- **Dominant allele** masks or hides expression of **recessive allele**.
- **Recessive allele** exerts its effect only in homozygous state.

Genotype versus Phenotype

- **Genotype:** alleles an individual receives at fertilization (dominant, recessive).
- **Phenotype:** physical appearance of individual (tall, short, etc.).

Mendel's Law of Independent Assortment

- States that each pair of alleles segregates (assorts) independently of other pairs.
- All possible combinations of alleles can occur in gametes.
- Only applies to alleles on different chromosomes.

Testcross

- **One-trait testcross:** used between individual with dominant phenotype & individual with recessive phenotype to see if individual with dominant phenotype is homozygous

or heterozygous.

- **Two-trait testcross:** tests if individuals showing 2 dominant characteristics are homozygous for both or for 1 trait only, or heterozygous for both.
- If an organism heterozygous for two traits is crossed with another recessive for both traits, expected phenotypic ratio is 1:1:1:1.

Autosomal dominant disorders:

- Affected children usually have affected parent
- Heterozygotes are affected
- 2 affected parents can produce unaffected child
- 2 unaffected parents will not have affected children

Autosomal recessive disorders:

- Most affected children have normal parents
- 2 affected parents always produce affected child
- Close relatives who reproduce together are more likely to have affected children

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11.3 MENDELIAN GENETICS

Multiple Allelic Traits

- When a trait is controlled by multiple alleles.
- Gene exists in several forms, but each person has 2 alleles.
  - 4 possible phenotypes (blood types): A, B, AB, O
  - **Codominance**: both alleles are fully expressed.
  - Rh factor is inherited independently from ABO system; Rh^+ allele is dominant.

Incomplete Dominance

- **Incomplete dominance**: offspring show traits intermediate between 2 parental phenotypes.
  - True-breeding red & white-flowered four-o'clocks produce pink-flowered offspring.
  - 1 allele of a heterozygous pair only partially dominates expression of its partner.
  - Curly-haired Caucasian & straight-haired Caucasian have wavy-haired offspring.
  - Cystic fibrosis & FH

Incomplete Penetrance

- Offspring does not always show dominant allele.

Polygenic Inheritance

- 1 trait is governed by 2 or more sets of alleles.
- Dominant alleles have quantitative effect on phenotype: each adds to the effect.
- The more genes involved, the more continuous is the variation in phenotypes, resulting in bell-shaped curve.
- **Multifactorial traits:** controlled by polygenes subject to environmental influences.
  - Coats of Siamese cats & Himalayan rabbits
  - Human skin color
  - Cleft lip, clubfoot, congenital dislocations of the hip, hypertension, diabetes, schizophrenia, allergies & cancers.
  - Behavioral traits including suicide, phobias, alcoholism, & homosexuality.