

Genetics

- Science of heredity
- Studies how the form and appearance is established by genes and influenced by environment
- Form = morphology
- Appearance = phenotype
- Essence of heredity: different species reproduce to give new members of same species
- Phenomena of Heredity: ability of a cell to copy its DNA into identical progeny cells, passing traits from parents to offspring
- Mendelian genetics provides mechanism to explain inheritance trait

- Key concepts:
- 1. 2 Laws of Inheritance: Law of Segregation and Law of Independent Assortment
 - Law of Segregation: genes separate during gamete formation
 - Law of Independent Assortment: genes sort independent of each other
- 2. Statistical probability govern Mendelian Inheritance
- 3. Human traits obey Mendel's Laws

- We can observe and analyze 2 aspects of heredity: Mendelian genetics and molecular genetics
- Mendelian genetics: quantitative analysis of morphological characters. Look at experiments to predict pattern of inheritance
- Molecular genetics: molecular mechanisms responsible for appearance
- Dogma of molecular biology: DNA -> transcription -> RNA -> translation -> protein

- Mendel was a monk at Abbey of St. Thomas
- Bred *Pisum Sativum* plants = flower sweet pea plant
- Used self pollination and cross-pollination of true breeding parents for single genetic trait with 2 phenotypes
- Parent = true breeding (round seed x wrinkled seed)
- F1 = round seed x round seed
- F2 = 3 round seed x 1 wrinkled seed
- Sweet pea flowers are monoecious: have both male and female reproductive organs
- Pollen mother cells are diploid
- Self-pollination: anthers produce pollen grains which contain male gametes and are taken up stigma
- Cross-pollination: pollen grains to stamens and carpel = reciprocal cross
- Mendel's characters:
 - o Flower color Purple v. white
 - o Seed color: yellow v. green
 - o Seed shape: round v. wrinkled
 - o Pod shape: inflated v. constricted
 - o Pod color: green v. yellow
 - o Flower position: axial v. terminal
 - o Stem length: tall v. dwarf
- Mendelian observations = Particulate Inheritance

- Physical inheritance discernable as factors or particles
- These particles are:
 - o Discrete (no blending of traits)
 - o Preserved through inheritance over generation
 - o Occurs in pairs (diploid)
 - o Some particles mask expression of others
- Law of Segregation: when gametes are formed, 2 particles of each individual parent separate from each other and each offspring receives 1 particle from each parent
 - o Represented by monohybrid cross
- “particles” are genes or molecular items
- represented by upper case (dominant) and lower case (recessive) letter
- allele = morphological form of shape
 - o gene that codes for different form of similar protein
 - o governs gene's phenotype
- alleles occur at specific place on chromosome = gene locus
- recessive trait = disappears in F1 generation
- dominant trait = does not disappear in F1 generation
- each individual has only 2 alleles for specific trait
- RR = homozygous dominant = one allele (R)
- Rr = heterozygous dominant = two alleles (R and r)
- rr = homozygous recessive = one allele (r)