Mendelian Genetics

Gregor Mendel

- Before Mendel
  - Blended Theory of inheritance
  - Should reach uniform appearance
- Mendel discovered the particulate theory of inheritance
- University of Vienna
- Garden peas

Pea Experiments

- Flower color
  - Purple or white
- Flower position
  - Axial or Terminal
- Seed color
  - Yellow or Green
- Seed shape
  - Wrinkled or round
- Pod Shape
  - Inflated or constricted
- Pod Color
  - Green or yellow
- Stem Length
  - Tall or dwarf

Pea Experiments

- Produced True Breeding plant varieties
  - Always produced same offspring
- True breeding parents are called P generation
- Hybrid offspring of the P generation is called the F_1
- If they are fertilized and produce offspring the offspring are called the F_2

Law of Segregation

- Two alleles are packed into separate gametes.
  - Dominance
  - Recessive
- P or p
- T or t

Terms

- Homozygous
- Heterozygous
- Phenotype
- Genotype
- Testcross

Law of Independent Assortment

- Each pair of alleles segregates to the gametes independently.

Practice

- Monohybrid
- Dihybrid
  - Phenotypic Ratios
  - Genotypic Ratios

Rules of Probability

- Rule of Multiplication
  - The probability that independent events will occur simultaneously is the product of their individual probabilities.
  - Question: cross plants that are heterozygous for flower color. What is probability of them being homozygous recessive?

Rules of Probabilty

- Answer:
  - Probability that egg will get a p
    - ½
  - Probabiltity that sperm will get a p
    - ½
  - Answer
    - ½ x ½ = ¼

Rules of probabiltiy

- Dihybrid answer
  - YyRr x YyRr
  - Probability of YYRR
  - Egg have Y and R
    - ½ x ½ = ¼
  - Sperm have Y and R
    - ½ x ½ = ¼
- ¼ x ¼ = 1/16

Rules of Probabiltity

- Rule of Addition
  - The probabilty of an event that can occur in two or more independent ways is the sum of the separate probabilities of the different ways.

Rules of Probabiltiy

- Cross two Heterozygous for flower color. What is the probability that the offspring is heterozygous?
  - Two ways to be hetero. Either mom give P or p or Dad give P or p
  - Dom Egg with Rec Sperm
    - ½ x ½ = 1/4

Rules of Probabiltiy

- Dom sperm with rec egg
  - ½ x ½ = ¼
  - Overall ¼ + ¼ = 2/4 = ½

Extending Mendel

- Incomplete Dominance
  - Four O'clock Flowers
- Incomplete Dominance vs Codominance
  - MN blood groups
- Dominance doesn't have to do with which can subdue the other, but rather a phenotypic expression.

Extending Mendel

- Multiple Allele Traits
  - ABO
    - An individual only gets two out of the possible alleles.

Extending Mendel

- Polygenic inheritance
  - Quantitative characters
    - Skin color
      - AABBCC dark
      - AaBbCc intermediate
      - aabbcc light

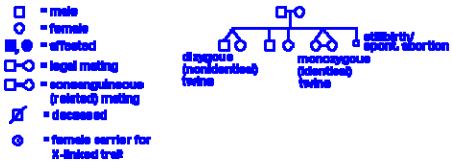
Nature vs. Nurture

- Environmental impact on phenotype
  - Altitude on blood etc…
  - Behavior
- Phenotype integrates the environment and the genotype.

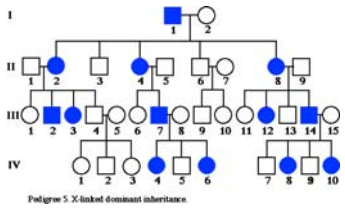
Pedigree

- Review various pedigrees to determine
  - Dominant
  - Recessive
    - Consanguinity
  - Autosomal
  - Sex linked
  - Non-nuclear inheritance

Pedigree Symbols

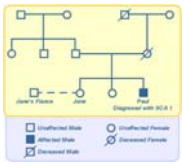


Dominant Pedigree

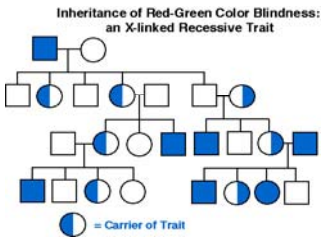


Pedigree 5. X-linked dominant inheritance.

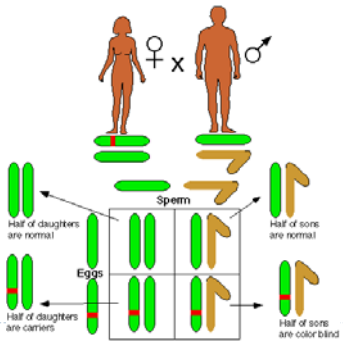
Recessive Pedigree



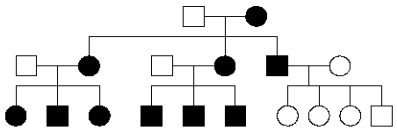
X linked Pedigree



X Linked Pedigree



Non-Nuclear

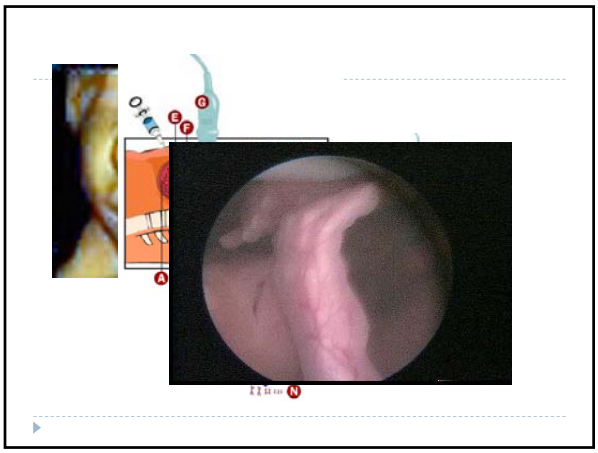


Human genetics

- If two people were getting ready to have children but each had a sibling die of a the same recessive disease, what would be the probability of each being a carrier? What about each at the same time?

How do you tell a person carries?

- Fetal Testing
  - Amniocentesis
  - Chorionic Villus sampling
  - Ultrasound
  - Fetoscopy
- Newborn screening
  - PKU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