1. **Chapter 5**
   Extensions & Modifications of Basic Principles
2.
   - Cuénot's odd yellow mice
3. **5.1 Dominance**
   - Incomplete
   - Codominance
     - MN blood types
       - Antigens on blood cells
   - Ex: Cystic fibrosis (CFTR gene)
     - Molecular level
     - Physiological level
     -
   - Allelic interaction between gene products
4. **5.2 Penetrance & Expressivity**
   - Penetrance
     - % of individuals with genotype that express expected phenotype
   - Incomplete penetrance
     - Polydactyly
       - Out of 42 only 38 express: penetrance = 38/42= 0.9= 90%
   -
   - Expressivity
     - Degree of expression
       -
   - Cause
     - Other genes
     - Environment
5. **5.3 Lethal Alleles**
   - Lethal allele
     - Early development
   - Snapdragons & Cuenot's mice
     - Dominant color
     - Recessive lethal
       - 2:1 ratio in progeny
       -
   - Dominant lethal alleles
     - Huntington disease
6. **5.4 Multiple Alleles**
   - > two alleles at a given loci
     - Allelic series
     - Individuals only possess 2 alleles
   - Mallard feather patterns
     - 3 alleles $M^R > M > m^d$
     - Possible genotypes = [n(n+1)]/2
       - n = # different alleles
       -
   - ABO
     - $I^A > i$ $I^B > i$ $I^A = I^B$

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- A – galactosamine
- B – galactose
- Charlie Chaplin 1941 (O)
  - Mom (A)
  - Child (B)

7 **Extensions Problem Set 1**

- Using observed #'s to obtain proportions of particular phenotypes (ratios)
- Monohybrid (phenotypic proportions in 4ths)
  - (Observed progeny with phenotype x 4) / total progeny
- Dihybrid (phenotypic proportions in 16ths)
  - (Observed progeny with phenotype x 16) / total progeny
- Try simplest case first use X^2 to prove fit to ratios

8 **5.5 Gene Interaction**

- Previous crosses
  - Monohybrid
    - Multiple alleles
    - Incomplete dominance & codominance
  - Dihybrid
    - Independent assortment (9:3:3:1)
    - Independent phenotypic expression
      - ☐Ex: seed shape has no influence on seed color
- Gene interaction
  - Dihybrid
    - Independent assortment (9:3:3:1)
    - Phenotypic expression is <u>not</u> independent
      - ☐Genes influence the expression of other <u>non allelic</u> genes

9 **5.5 Gene Interaction**

- Products of different loci combine
  - <u>Genotype</u> <u>phenotype</u>
    $Y^+\_C^+\_$ red
    $Y^+\_$ cc peach
    yy $C^+\_$ orange
    yycc cream

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- Gene interaction with Epistasis
  - Epistasis = One loci hides effect of a <u>different locus</u>
    - Note: dominance = one allele hides effect of another allele at <u>same locus</u>
  - epistatic gene
    - Hides effect of other loci
  - Hypostatic gene
    - Hidden by other loci
  - Epistatic genes may be dominant or recessive

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- Recessive epistasis (lab coat color & Bombay phenotype)
  - First gene determines pigment type
    - B = black
    - b= brown
  - Second gene adds pigment to hair shaft
    - E = allows pigment addition
    - e = prevents pigment addition
  - Recessive (9:3:4):

Lab coat color-	Genotype	phenotype
9	B_ E_	black
3	bb E_	brown
3	B_ ee	yellow
1	bb ee	yellow

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- Dominant epistasis (summer squash color)
  - First gene determines pigment production
    - W = inhibits production
    - w= allows production
  - Second gene determines type of pigment
    - Y = yellow
    - y = green
  - Dominant (12:3:1):

summer squash-	Genotype	phenotype
9	W_ Y_	white
3	W_ yy	white
3	ww Y_	yellow
1	ww yy	green

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- Duplicate recessive epistasis (freshwater snail)
  - First gene determines enzyme 1 production
    - A = produce enzyme I (converts pigment A → B)
    - a = no enzyme 1 produced
  - Second gene determines enzyme 2 production
    - B = produce enzyme 2 (converts pigment B → C)
    - b = no enzyme 2 produced
  - Duplicate recessive (9:7)

	Genotype	phenotype
9	A_ B_	pigmented
3	aa B_	albino
3	A_ bb	albino
1	aa bb	albino

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  - Determine the type of epistasis worksheet
    - P: Homozygous yellow corn x homozygous purple corn
      F1: are intercrossed
      F2:
      - Determine the genotypes in yellow & purple kernels.
      - What type of epistasis is responsible for the observed progeny?
- 15
  - Complementation tests
    - 16
  - Sex influenced characteristics
    - Autosomal genes expressed differently
      - higher penetrance in one sex
      - Example: goats and presence of beard
        - B^b dominant in male & recessive in female goats
- 17
  - Extreme form of sex-influenced inheritance
    - Sex limited characteristics
      - Autosomal genes only expressed in one sex
      - Zero penetrance in other sex
      -
    - Cock feathering is autosomal recessive
- 18
  - Cytoplasmic inheritance
    - Organelle DNA (usually maternal)
- 19
  - Genetic Maternal Effect
    - Determined by GENOTYPE of mother
      - Substances in egg cytoplasm impact development
- 20
  - Genomic imprinting
    - Level of expression depends on maternal or paternal inheritance.
      - Prader-Willi syndrome
        - Lack paternal chromosome 15 arm
      - Angelman syndrome
        - Lack maternal chromosome 15 arm
      -
    - Epigenetics
      - Reversable changes that influence trait expression
- 21 **5.8 environmental effects**
  - Norm of reaction
  - Temp-sensitive allele
  - phenocopy

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