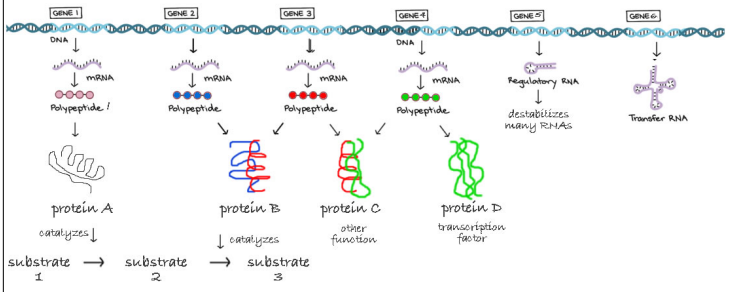
# coreBio II - genetics: Mon/Wed. 30 April 1 May2018


What types of mutations produce various effects (amorphic to neomorphic)? How might alleles of the same or different genes interact?

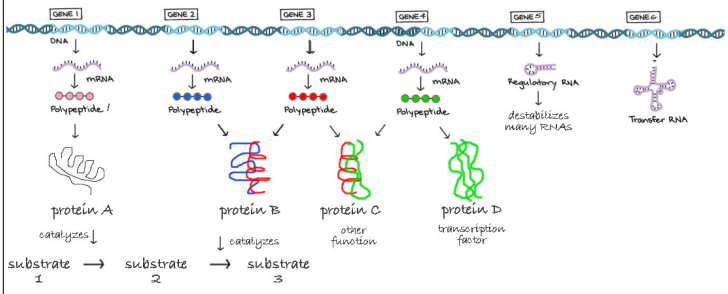



In the context of mendelian alleles, what is the value of GWAS data?

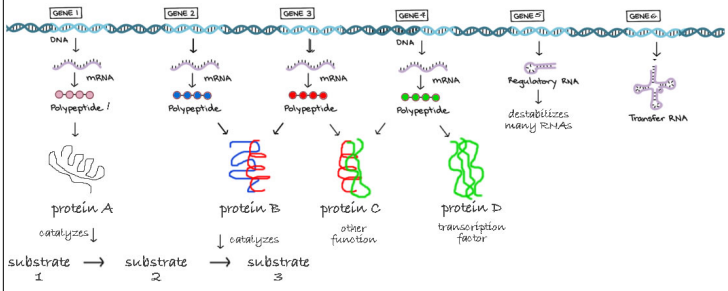
Is the expressivity and penetrance of a mendelian allele itself a trait that can be studied using GWAS?

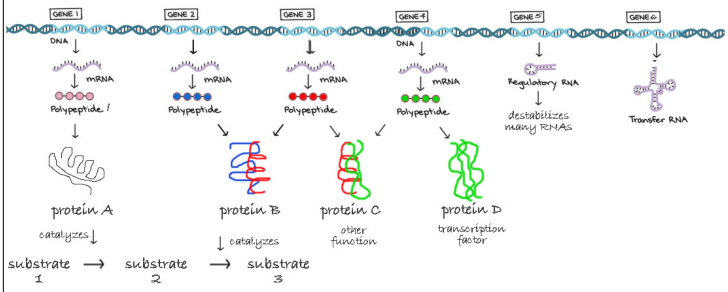
A particularly SNP is found to be absent (or present) when the phenotype associated with a "dominant" allele is missing.

Under what conditions would a mutation in gene 3 influence the level of the product of gene 2?




How could a mutation in gene 4 be neomorphic




How could a null mutation in gene 1 influence the synthesis of substrate 3.

What would happen if substrate 3 was necessary for protein D's function?

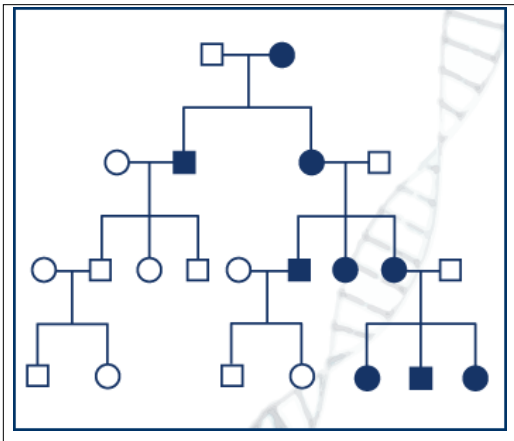
1) Gene Basics
    a. Promoters and Enhancers
    b. Eukaryotes / prokaryotes
    c. RNA to Protein
        i. intron removal
    d. Mutations
        i. Where do mutations come from
        ii. Muller's Morphs
            1. Amorphic - hypomorphic - Hypermorphic
            2. Antimorphic
            3. Neomorphic
2) Reproduction (meiosis)
    a. Prokaryotic Lifecycle
    b. Eukaryotic life cycle
        i. haploid / diploid
        ii. what it means to be a Dominant allele
    c. Mendelian Genetics
        i. Meiosis
        ii. Linkage and recombination
        iii. haplotype (size as a function of generations between individuals)
        iv. Chi Square (effects of small numbers on analysis of pedigree)
        v. Crossing over
            1. Genetic Interactions
        vi. sex determination (XY system only)
            1. sexual dimorphism
            2. X-inactivation
    d. Non-mendelian genetics
        i. maternal effects (mitochondria from mom)
        ii. Imprinting (which allele, maternal or paternal, is expressed)
        iii. genetic anticipation (effects of parent, worsen or lessen effect)
        iv. co-dominance
        v. modifiers (expressivity and dominance) - see GWAS

3) Other Important things
    a. CRISPR-Cas9
    b. GWAS (when is it useful, what is a SNP)

**Q1.** How are non-mendelian traits different from mendelian ones; how would you recognize / distinguish them?

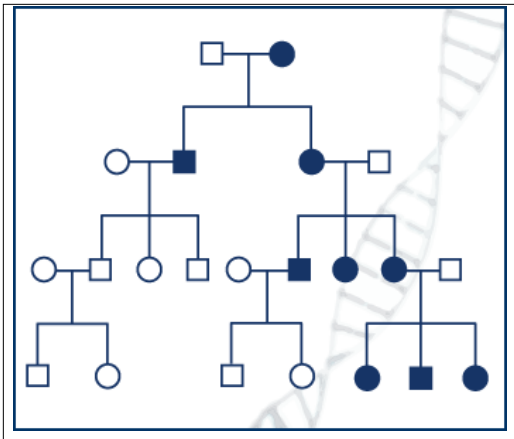
**Q2**. How does the inheritance of mitochondria lead to maternal inheritance? What would happen if mitochondria did not have their own genomic DNA?

**Q3**. Describe the "life-cycle" of imprinting - where and when does it occur, what are its effects. What would happen if imprinting were not erased?



What type of inheritance is displayed here (M or non-M) and why do you say so?

answer on the next slide!!!



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maternal

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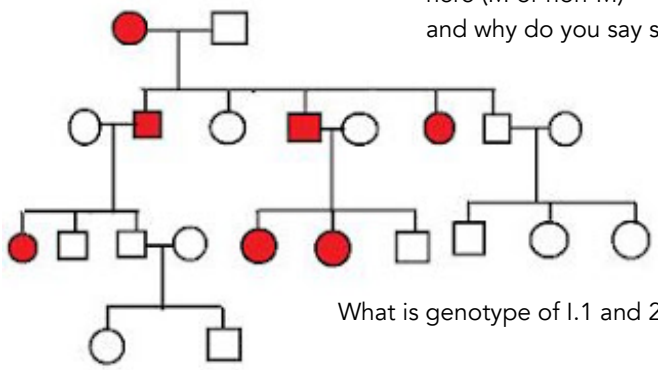
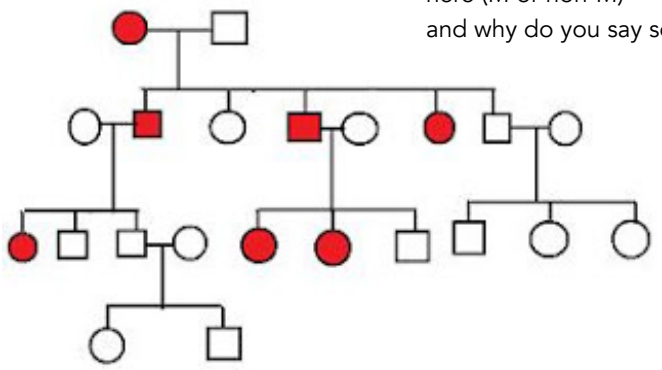


What is genotype of I.1 and 2

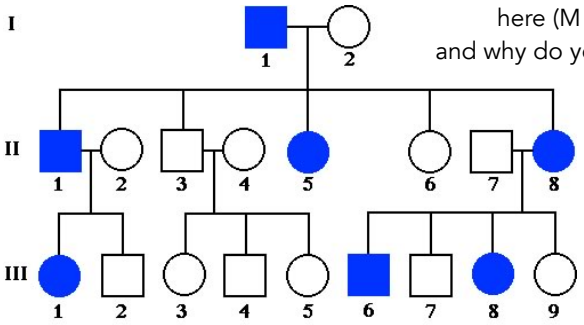
answer on the next slide!!!

What type of inheritance is displayed here (M or non-M) and why do you say so?



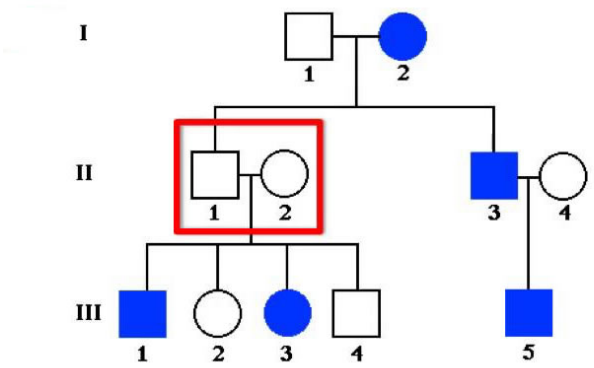
X-linked dominant

What type of inheritance is displayed here (M or non-M) and why do you say so?




What type of allele determines the trait? (dominant / recessive)

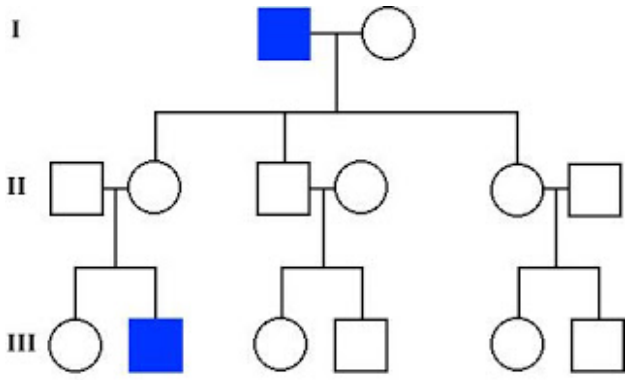
answer on the next slide!!!




Is this a dominant or recessive trait (filled in symbols)?
What are the phenotypes of II.1 and II.2

If II.1 and II.2 have a fifth child, what is the probability that it will have the trait?

Is the gene on the X or an autosome?




answer on the next slide!!!

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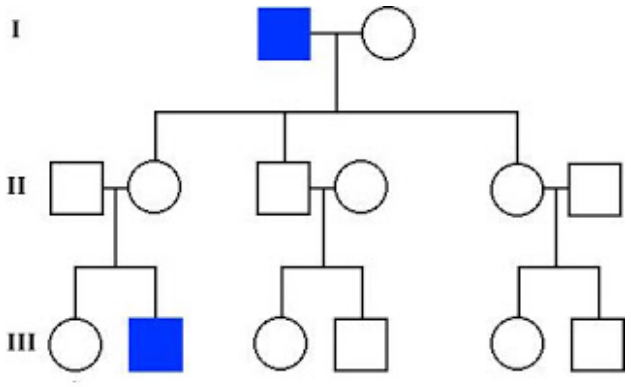
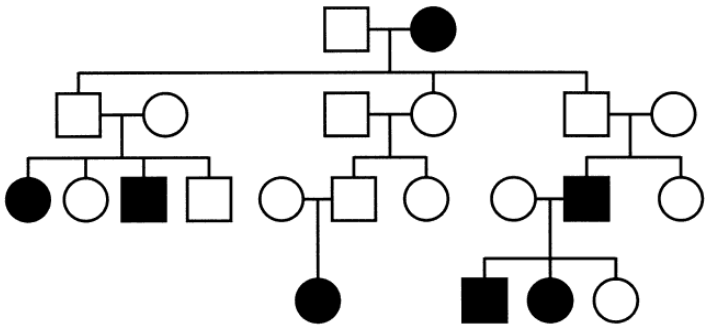



x-linked recessive

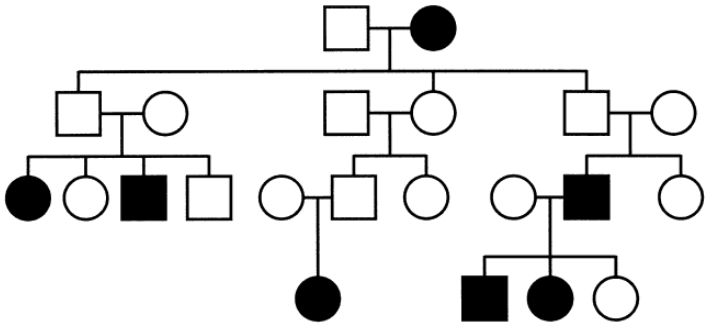
What type of inheritance is displayed here (M or non-M) and why do you say so?



answer on the next slide!!!

do the terms dominant / recessive apply to imprinted genes?

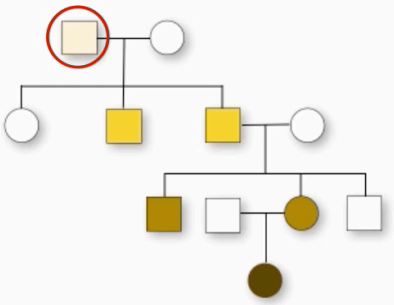
What type of inheritance is displayed here (M or non-M) and why do you say so?



maternal imprint (maternal allele not expressed)

## Anticipation

what is "wrong" with this diagram, if anything?



gets worse in male (first) then in female…

**Q4**. How would you describe what happens when an allele displays genetic anticipation? In what sense are such alleles sexually dimorphic?

**Q5**: Why are sex-linked genes (in mammals) non-mendelian?

**Q6**: What kinds of effects can the appearance of a mutation in the soma have on the organism? How is inactivation of the X-chromosome in female mammals like a mutation, how is it different?

**Q7**: What types of methods can be used to determine whether a gene is expressed in a particular tissue or cell? What are their strengths and limitations.

**Q8**. How is the evolution of a cancer like the evolution of antibiotic resistance in a bacteria? how is it different?

**Q9**. Be able to draw a pedigree over three generations of various mendelian and non-mendelian alleles.

**Q10**. How well can (must) a trait be defined, versus how well can its genetic influences be determined. Why is exome data not always adequate for a GWAS study (what genomic information is in exomic sequence, what is missing?

**Q11**. How might non-exomic variation influence a trait?

**Q12**. Why do you need to have large numbers of people for a GWAS study.

**Q13**. What are the issues around DIY genetic engineering? How you design the genetic modification of an adult tissue, what would you need to do, and how would it depend upon the natur of the gene product?

Final will be cumulative
review midterms 1 and 2

**Thursday** 11:15 review session
(either my office or Porter B415 - if there is an over-flow)