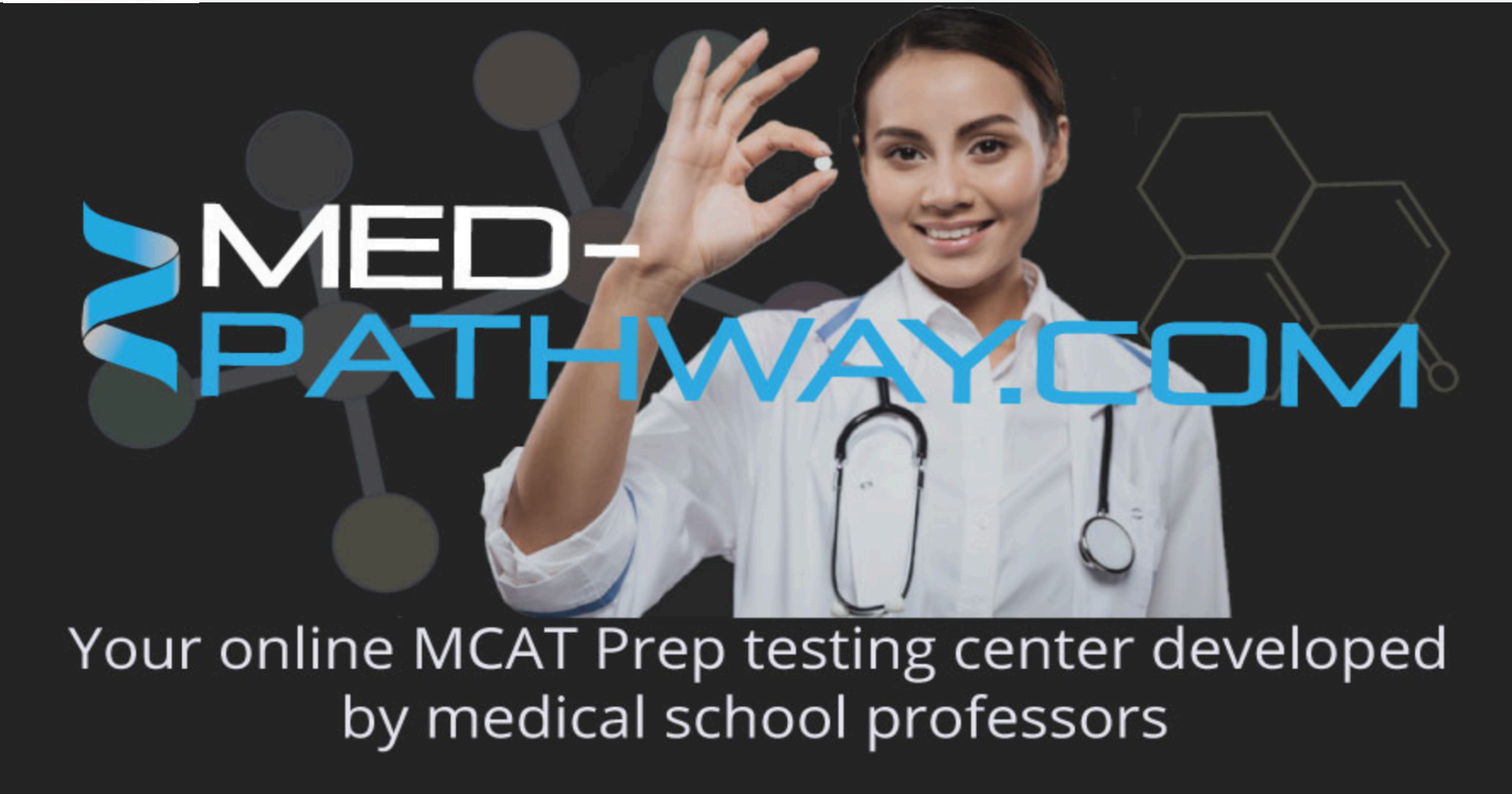
Genetic Analysis

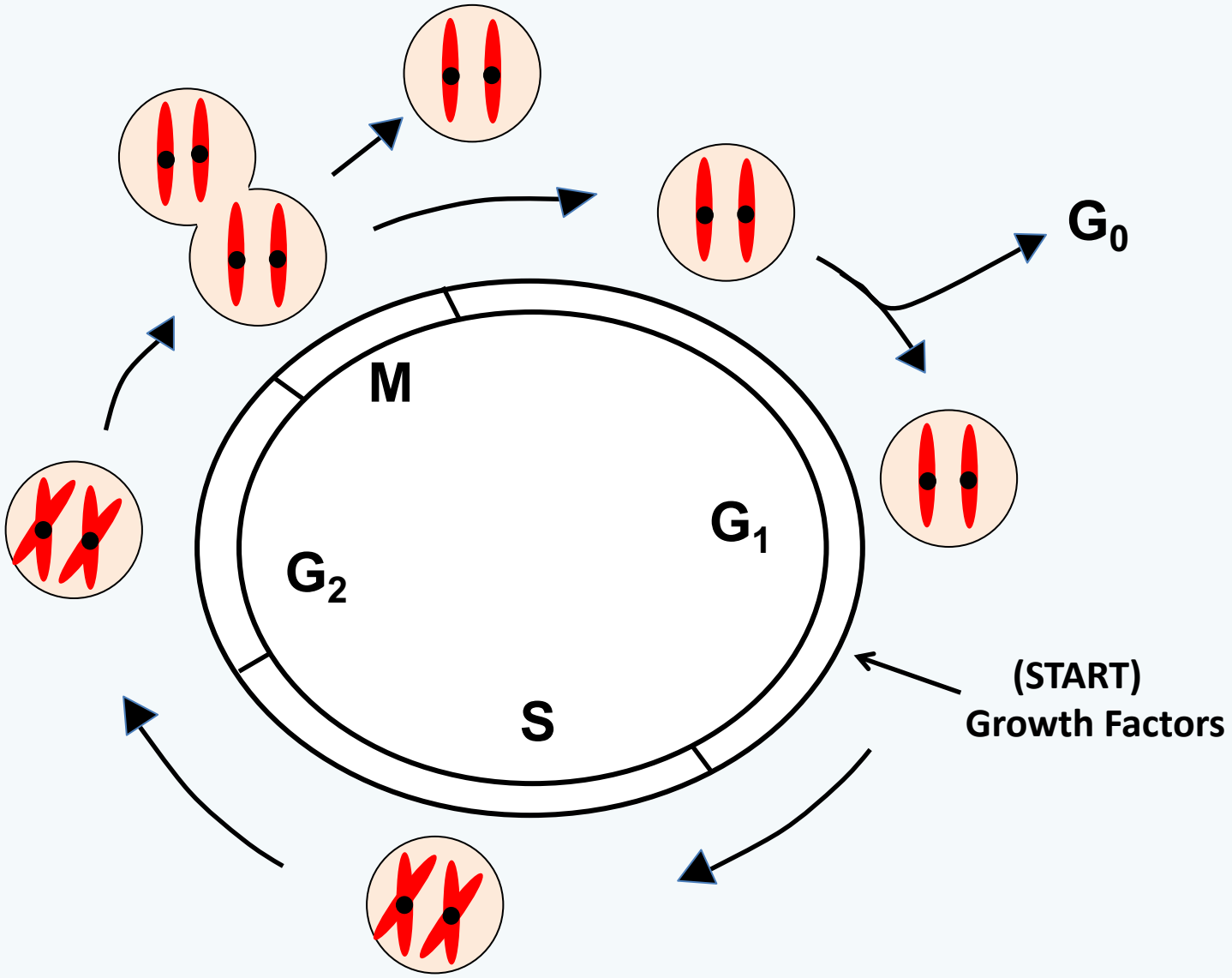
Dr. Phillip Carpenter

medpathwaymcat

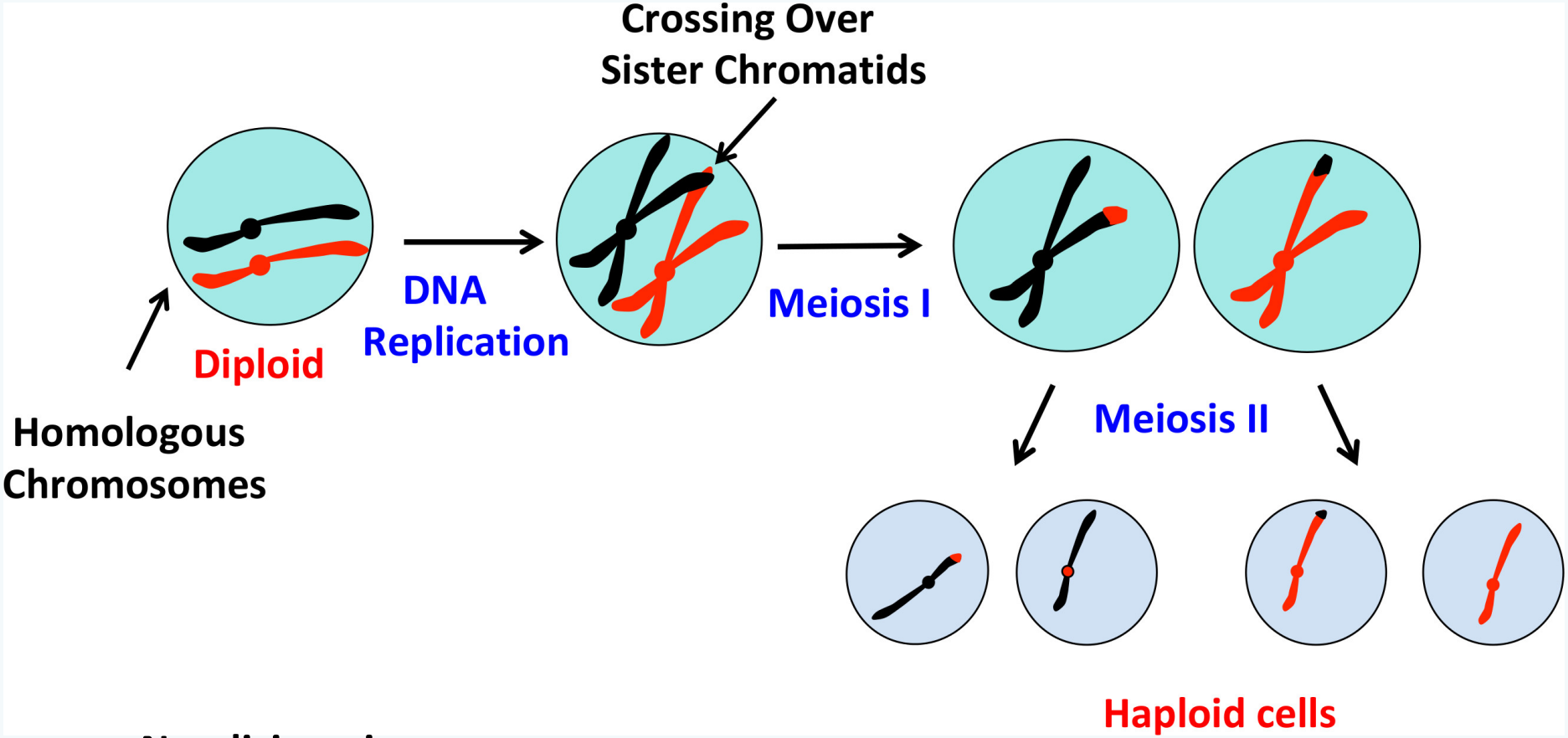
Med-pathway



The Cell Cycle & Mitosis



Meiosis

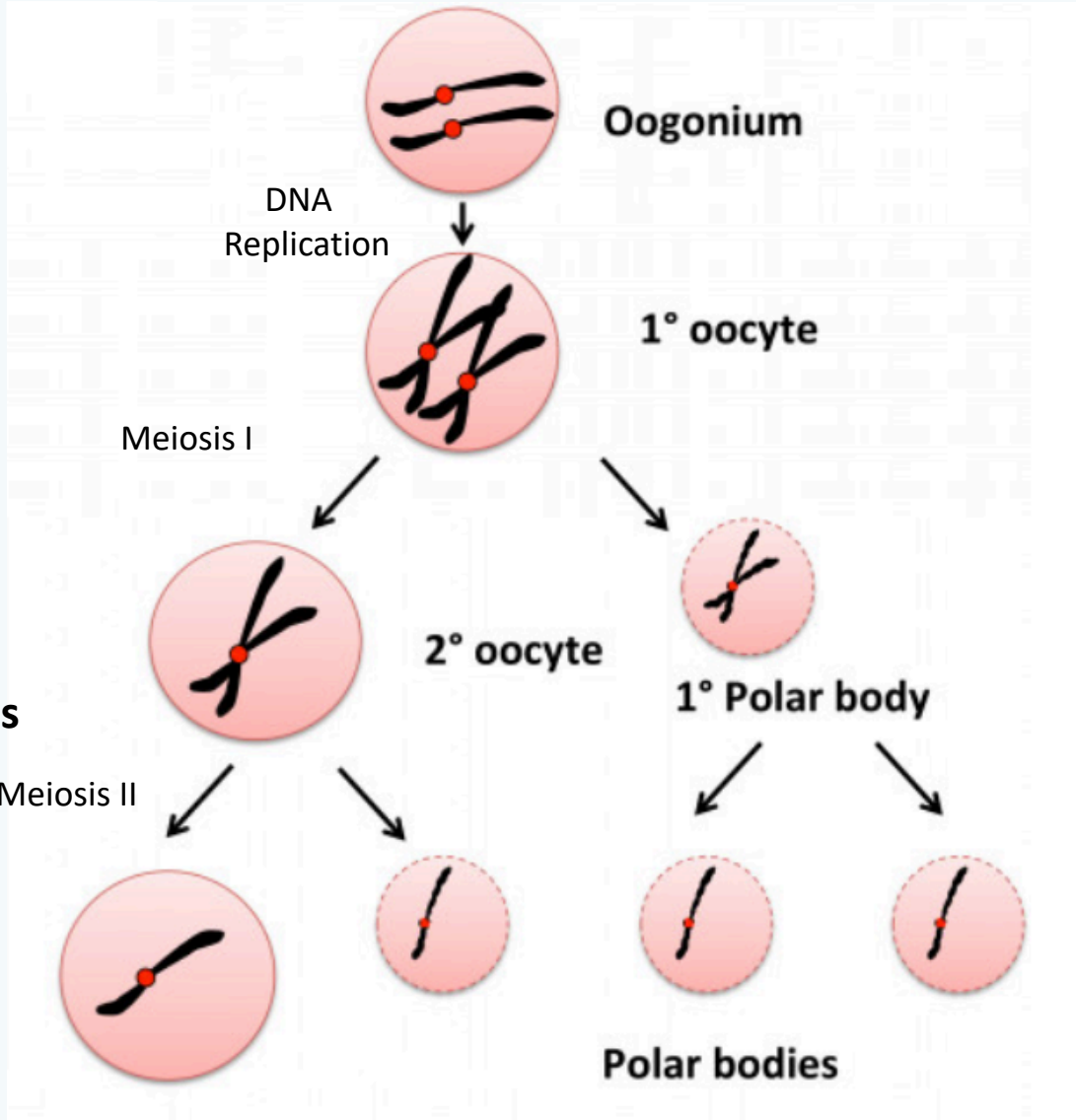


Nondisjunction =
failure to properly separate

(i.e. Spores)

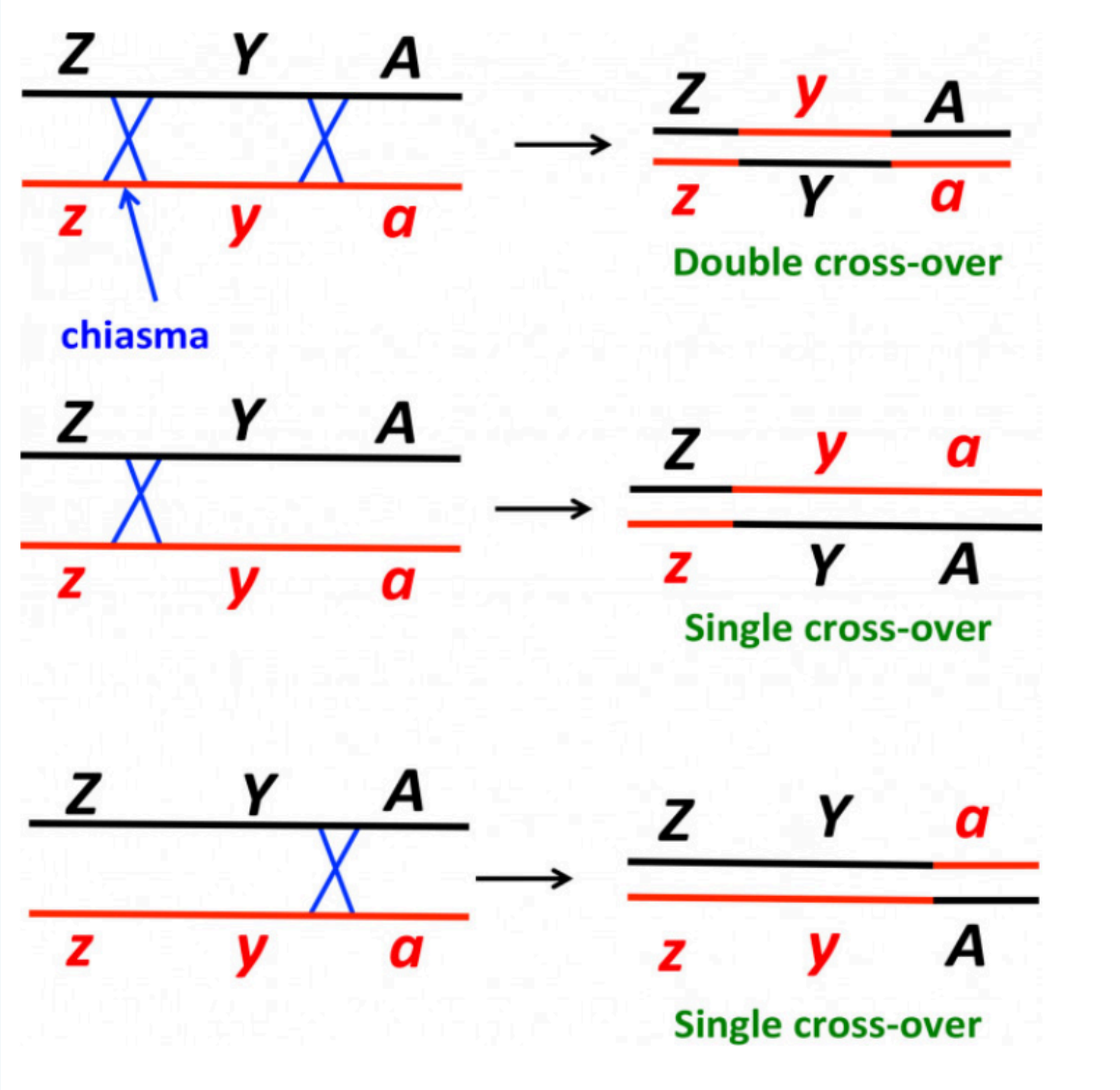
Oogenesis

Haploid;
2 chromatids
X 23 = 46 chromatids



Crossing Over

Occurs in Prophase I



Mendel

Examined inheritance of traits in peas

Discovered that traits were present in pairs of hereditary material called “alleles”

Law I: Segregation of alleles:

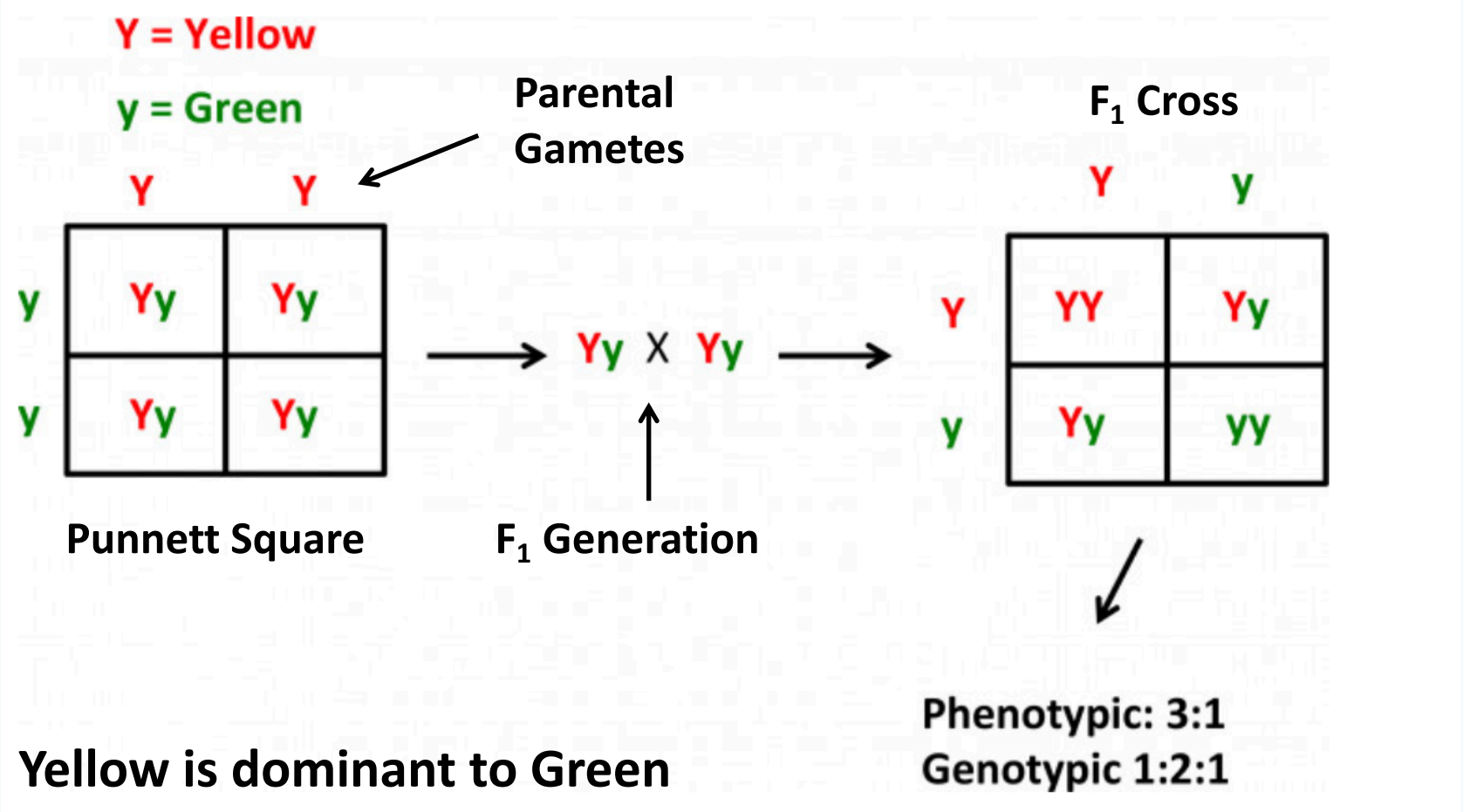
Alleles are individually transmitted from parent to offspring in a random manner

Law II: Independent assortment

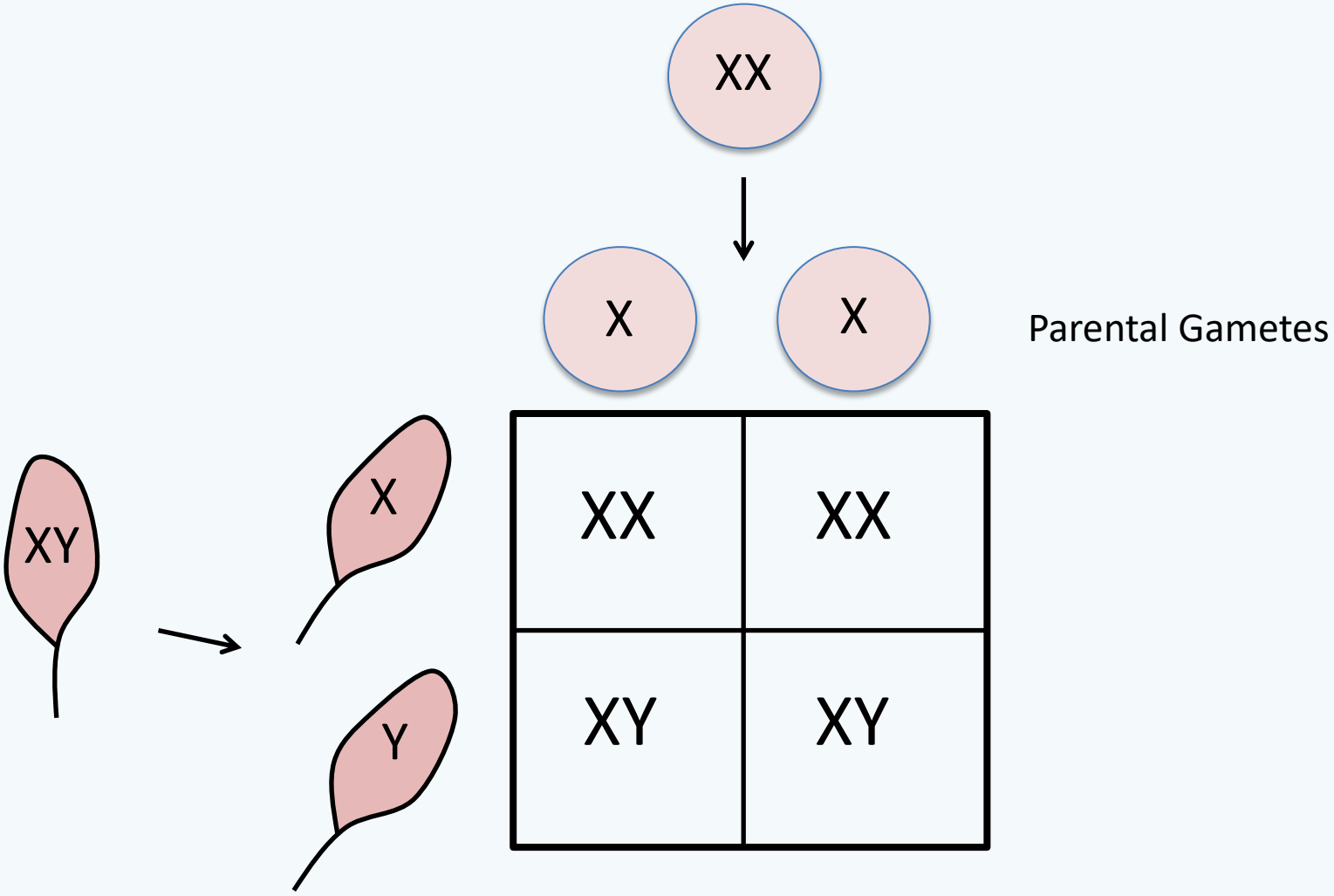
Alleles of one trait separate independently from alleles of a second trait. (Exception: Linkage of genes on same chromosome)

Predicting Crosses with Mendelian Laws

Pea Color: Yellow or Green



Sex Chromosomes



Test Cross

To determine the genotype of an unknown (i.e. Plant height: AA or Aa)
Always includes a homozygous recessive.

Cross to a homozygous recessive (aa),
Any recessive trait in the unknown will be revealed
in the phenotype of the F_1 progeny.
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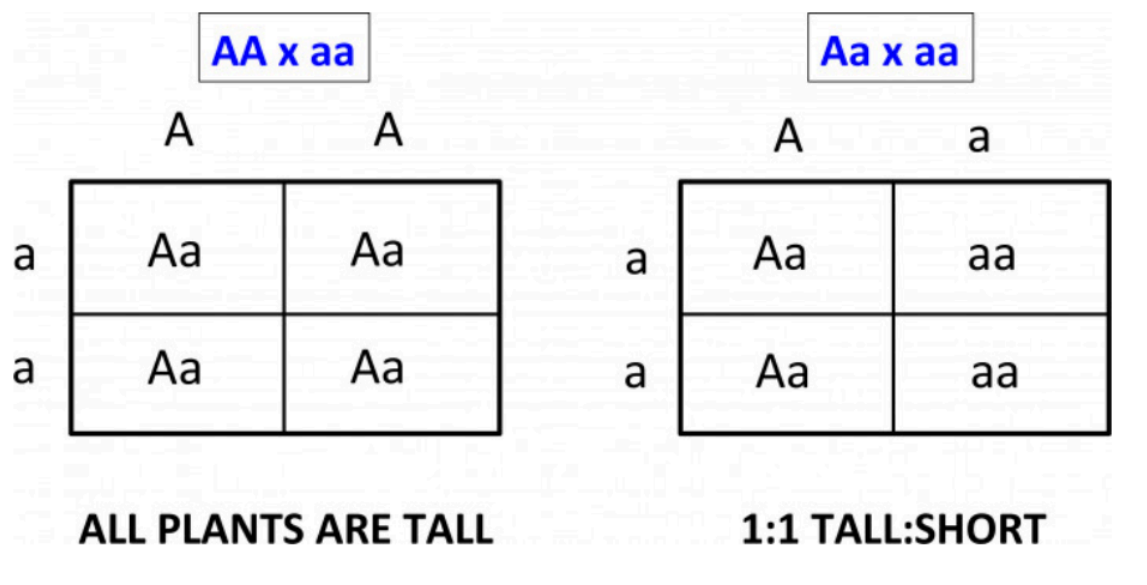
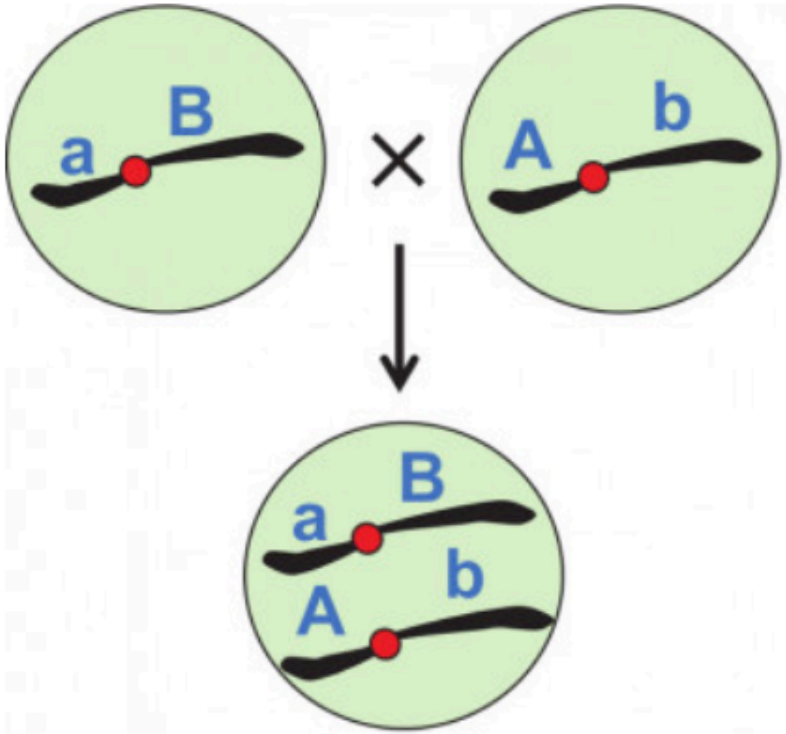


Complementation



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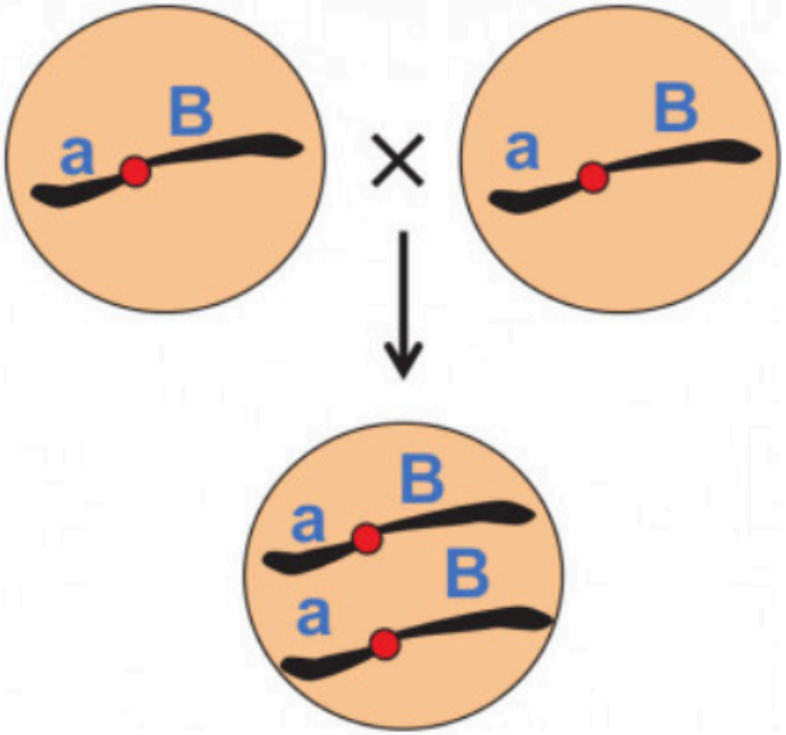
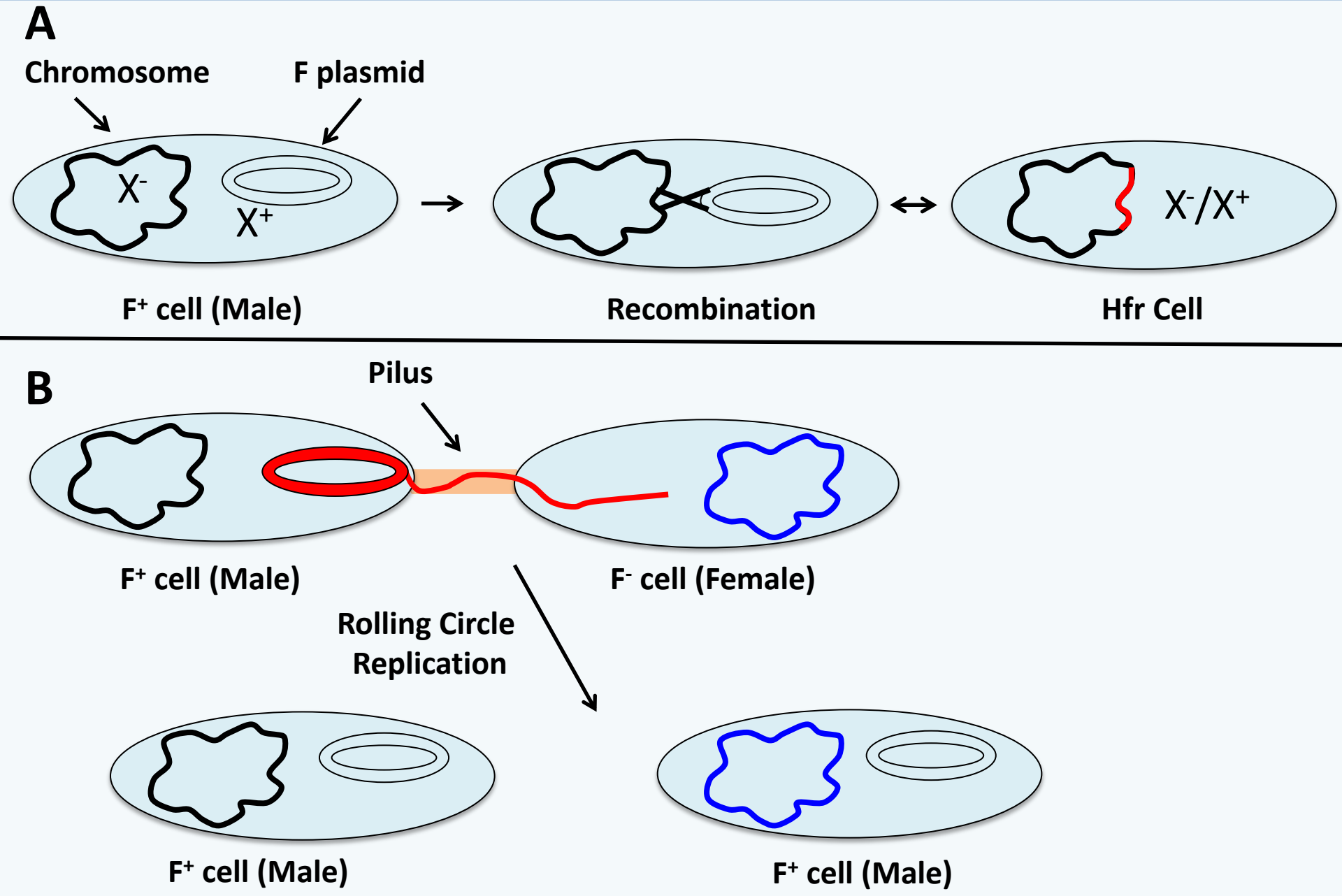
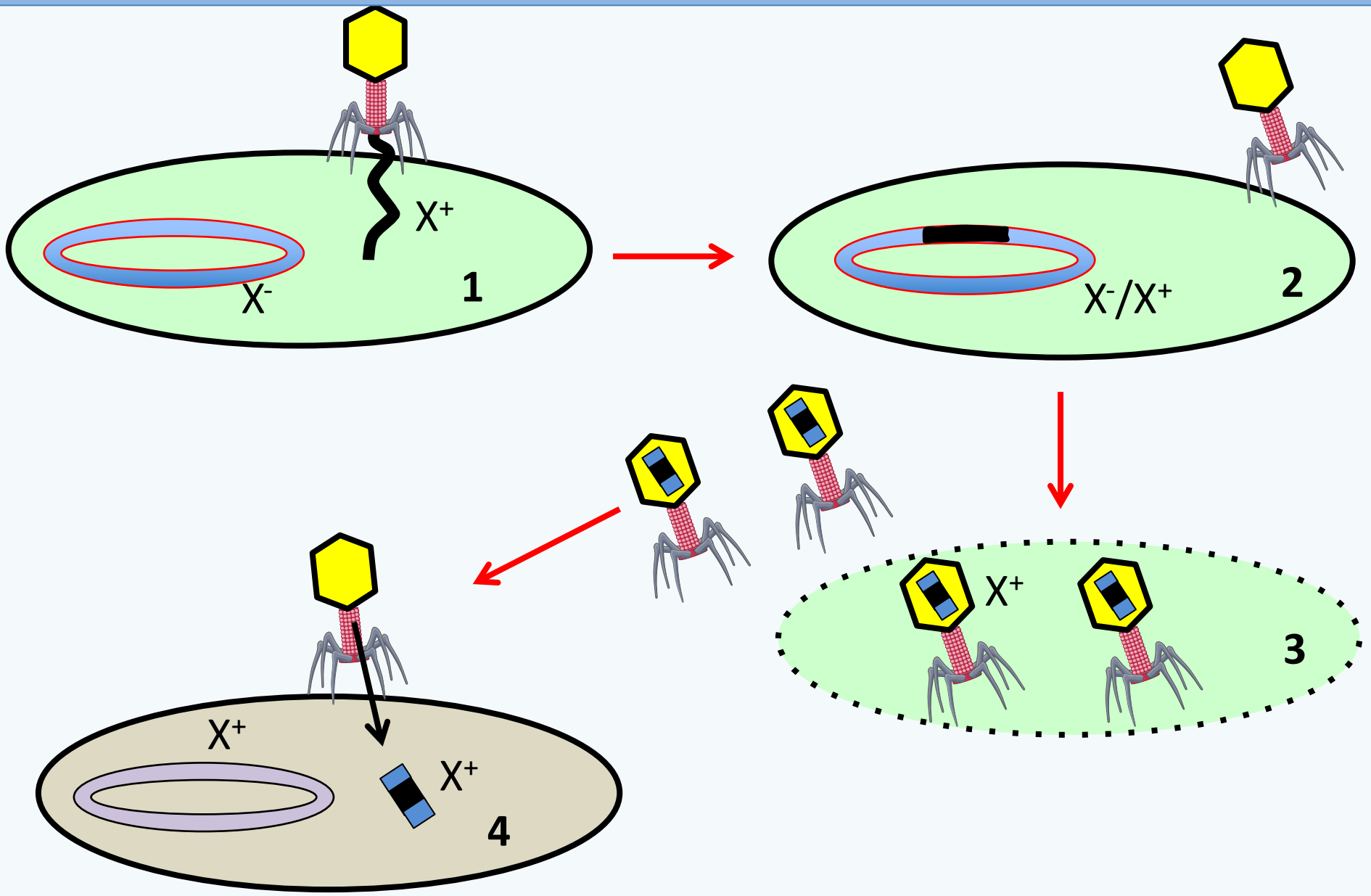


Non-complementation

Bacterial Partial Diploids



Specialized Transduction



Beyond Dominance & Recessiveness

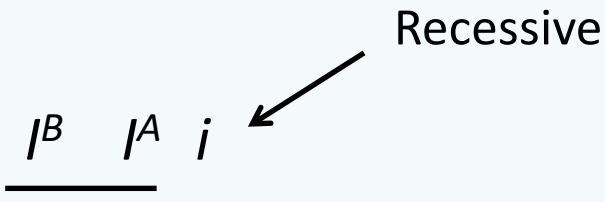
Genotype	Phenotype
$LDL\text{-}R^{+/+}$	120 mg/dL
$LDL\text{-}R^{+/-}$	400 mg/dL
$LDL\text{-}R^{-/-}$	700 mg/dL

Haploinsufficiency

RR = Red
WW = White
RW = Pink

Incomplete dominance (Blended)

Co-dominance (ABO Blood Type)



Each expressed regardless of status of other allele

More Complex Inheritance Patterns

Penetrance: Probability that a person with a genotype will express the corresponding phenotype

Pleiotropy: Gene alteration induces many aspects of phenotype

Polygenism: Traits influenced by numerous genes

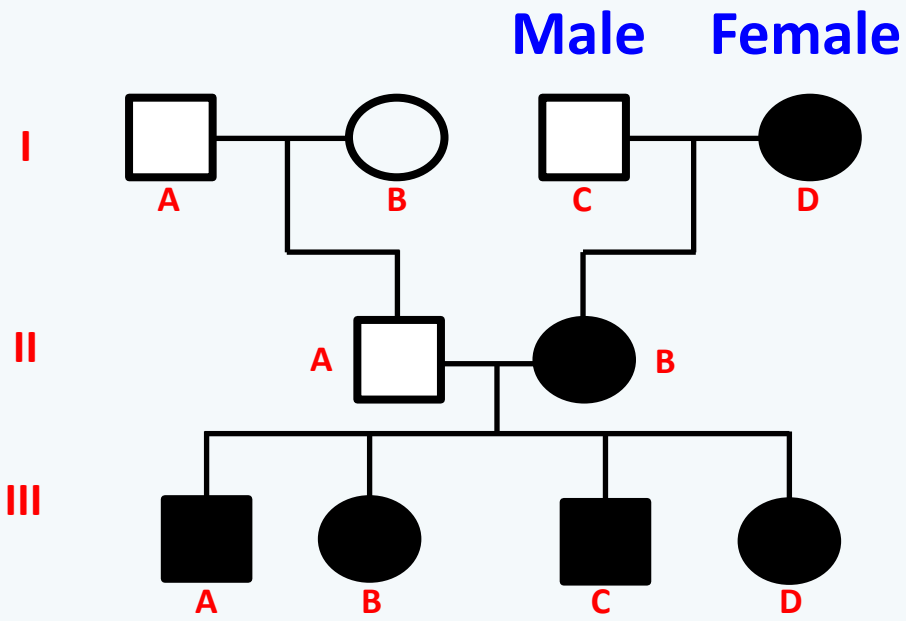
Epistasis: Interactions between genes where expression of one is dependent upon another

Baldness vs brown hair

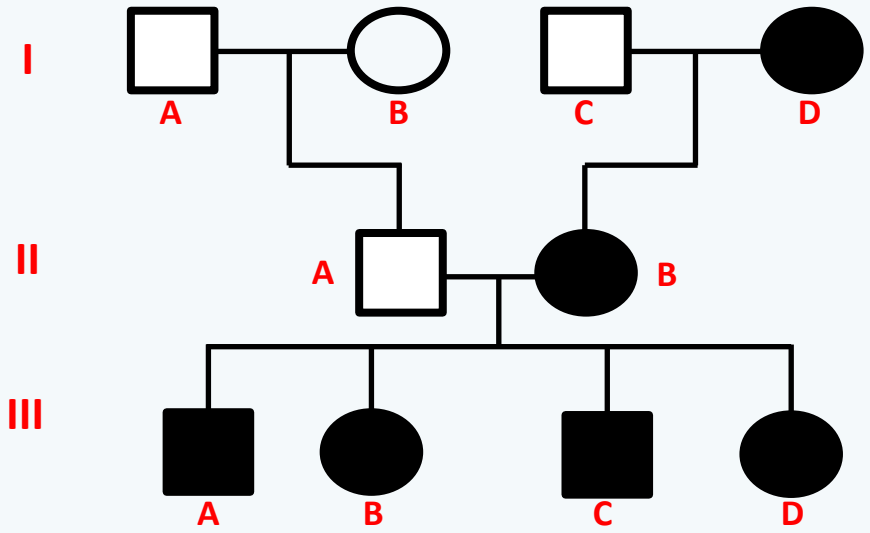
Pedigrees: Understanding Inheritance Patterns

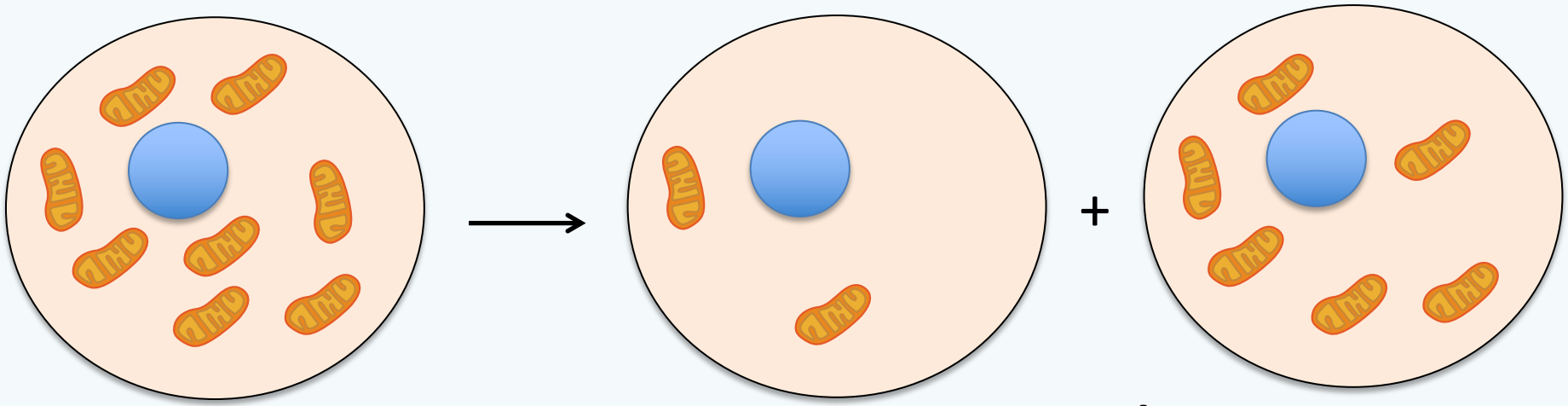
1. Autosomal dominant: Sex Independent, AA^D expresses phenotype (A^DA^D is lethal)
2. Autosomal recessive: Sex independent, skips generations
3. Mitochondrial: Rare, Affected mothers pass on trait to males/females
4. X-linked Dominant: XX^D
5. X-linked recessive: Skips generation, mostly affects males
6. Y-linked: Males only, inherited from affected father

What type of inheritance?



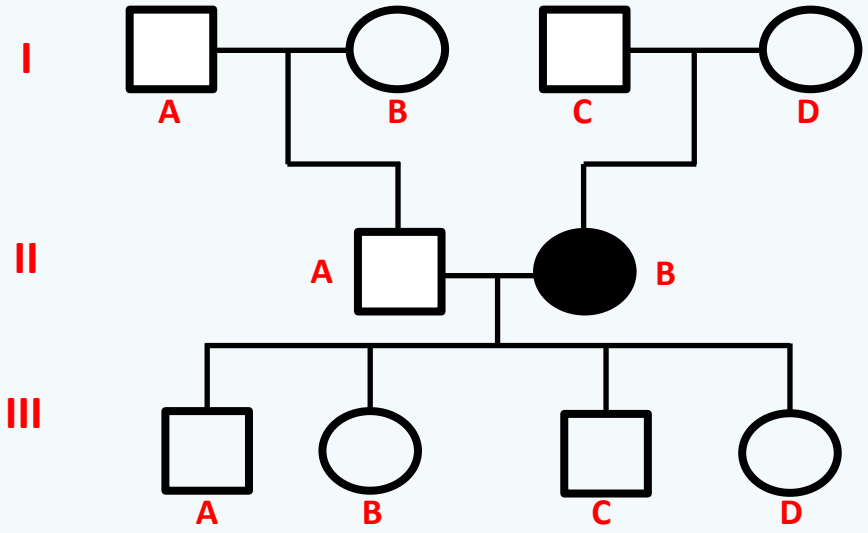
Mitochondrial Inheritance



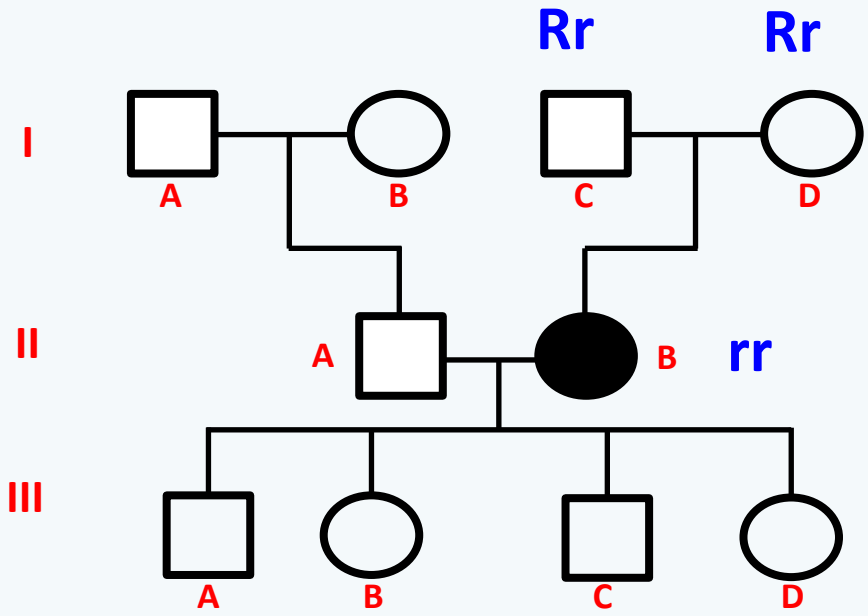


Heteroplasmy

What type of Inheritance?



Autosomal Recessive



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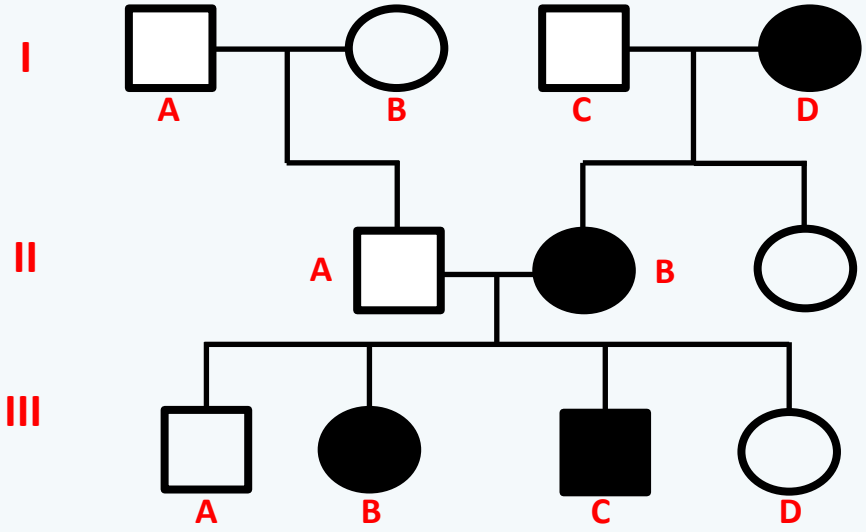
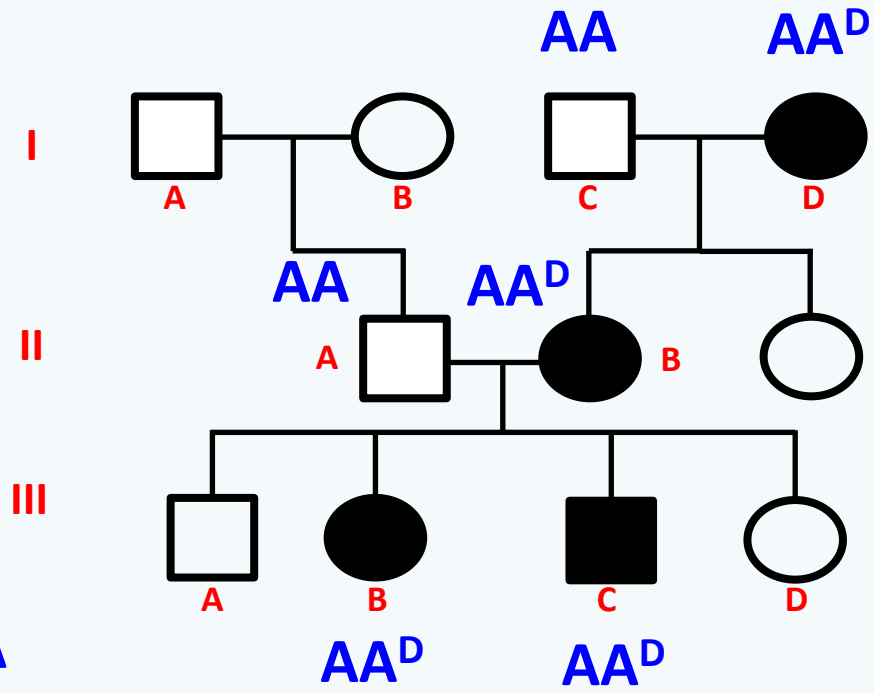


Autosomal Dominant



	A	A
A	AA	AA
A^D	AA^D	AA^D

Rules of Probability

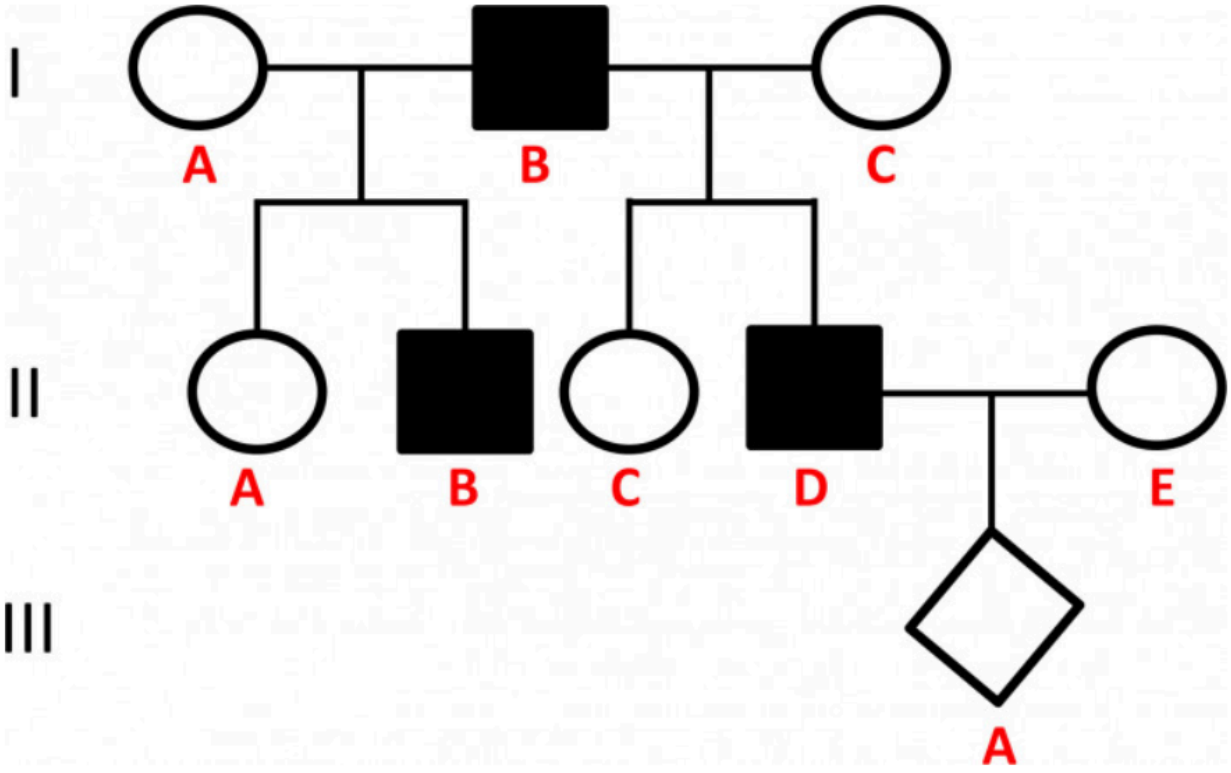
Rule of Multiplication: Probability of two events happening is the product of each event: $P = P(A) \times P(B)$

Rule of Addition: Probability of either of two events happening

$P = P(A) + P(B) - P(A) \times P(B)$

Pedigree Problem

A pedigree was constructed to understand the nature of transmission of a newly identified genetic disease. What is the probability that IIIA will be born with the disease?



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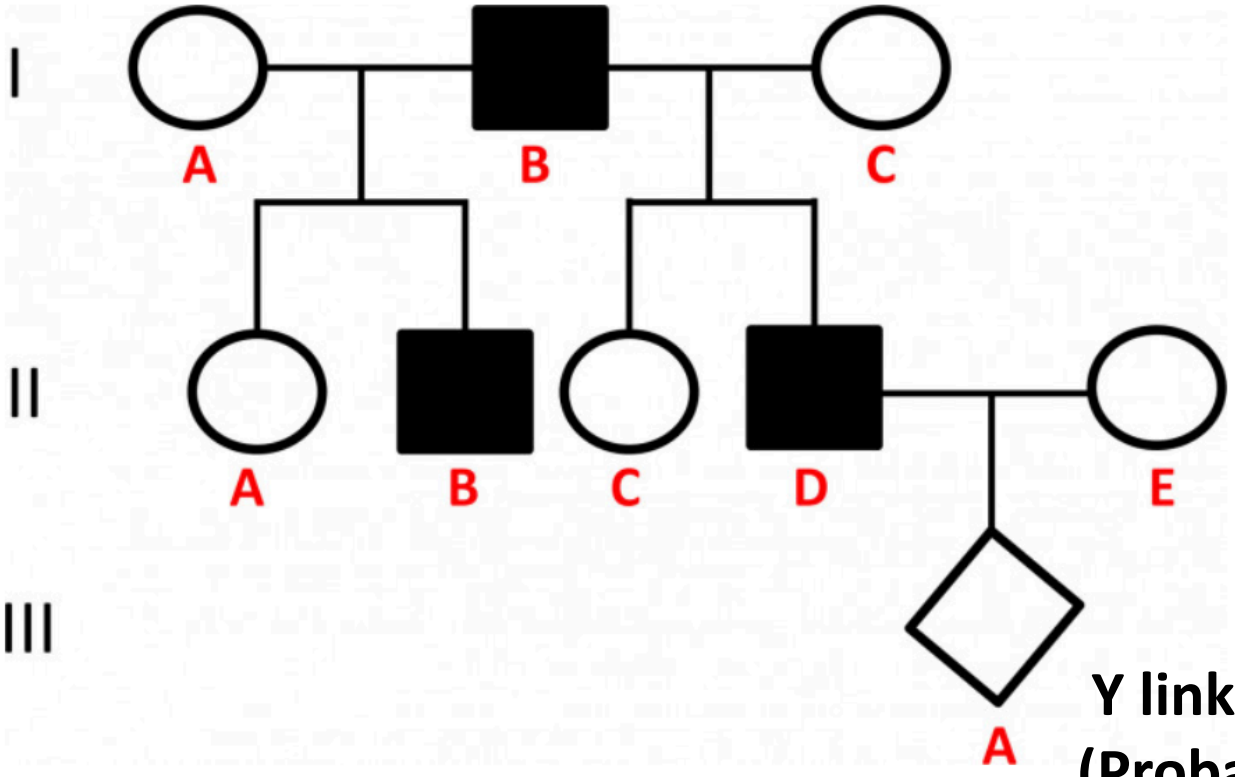


Y linked Disease: P = 0.5
(Probability of being a male)

Population Genetics

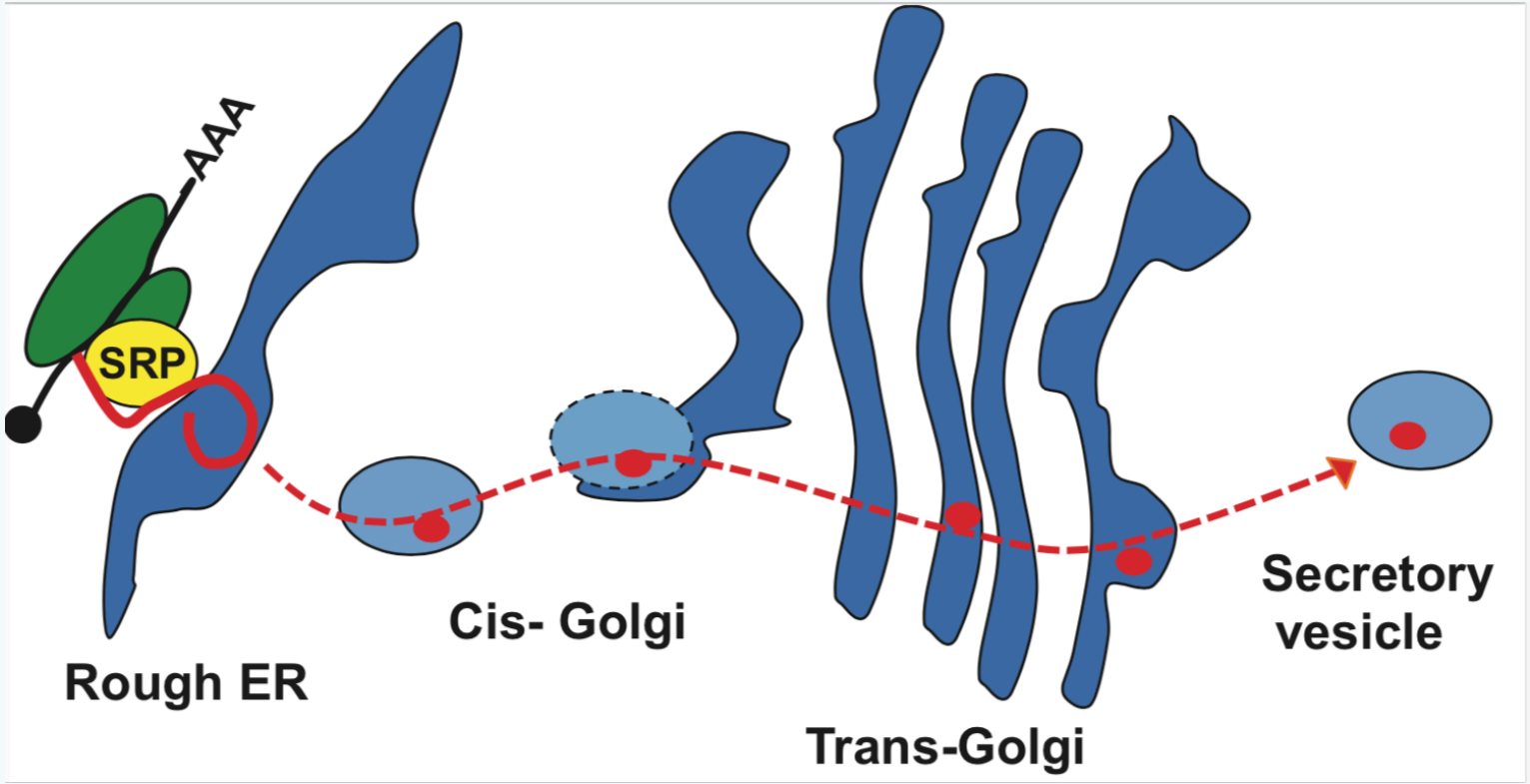
Gene Pool = Sum of genes in population

Hardy Weinberg: Frequency of alleles in population is constant provided that:

1. **No net migration**
2. **No mutation**
3. **No natural selection**
4. **Random mating occurs**
5. **Population is large**

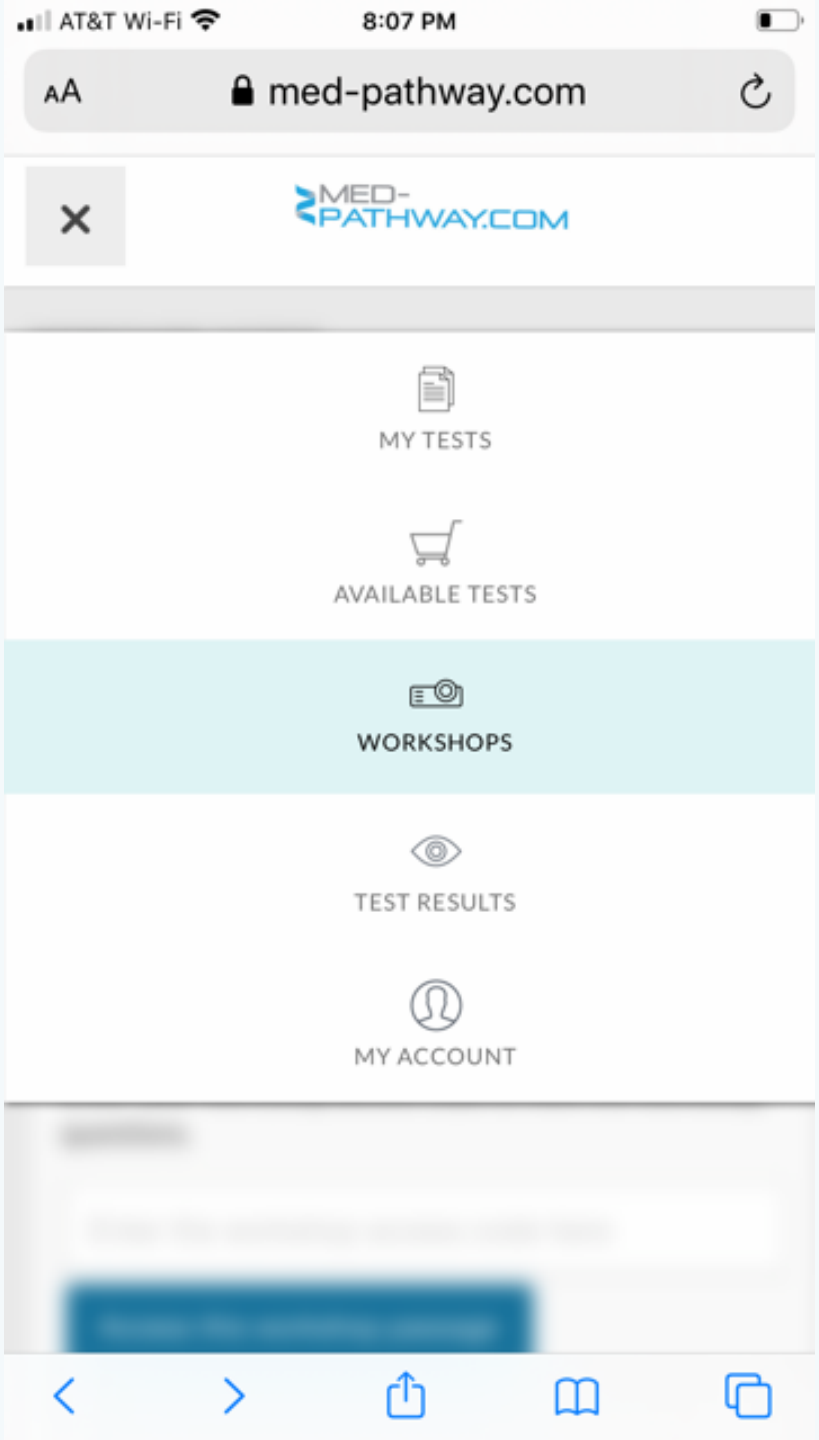
Total # alleles: $p + q = 1$ or $p^2 + 2pq + q^2 = 1$
p and q = frequency of dominant,
recessive alleles, respectively

Genetics of Yeast Secretory Pathway



Yeast: exist in haploid or diploid states

Temperature sensitive mutants: Permissive & Non-permissive states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AA
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MED-PATHWAY.COM
MY TESTS
AVAILABLE TESTS
WORKSHOPS
TEST RESULTS
MY ACCOUNT