AP BIO INSTA-REVIEW

TOPIC 5.4

Non-Mendelian Genetics

IST-1.J.1

Patterns of inheritance of many traits do not follow ratios predicted by Mendel's laws and can be identified by quantitative analysis, where observed phenotypic ratios statistically differ from the predicted ratios–

a. Genes that are adjacent and close to one another on the same chromosome may appear to be genetically linked; the probability that genetically linked genes will segregate as a unit can be used to calculate the map distance between them.

AP BIO INSTA-REVIEW

TOPIC 5.4

Non-Mendelian Genetics

IST-1.J.2

Some traits are determined by genes on sex chromosomes and are known as sex-linked traits. The pattern of inheritance of sex-linked traits can often be predicted from data, including pedigree, indicating the parent genotype/phenotype and the offspring genotypes/phenotypes.

AP BIO INSTA-REVIEW

TOPIC 5.4

Non-Mendelian Genetics

IST-1.J.3

Many traits are the product of multiple genes and/or physiological processes acting in combination; these traits therefore do not segregate in Mendelian patterns.

AP BIO INSTA-REVIEW

TOPIC 5.4

Non-Mendelian Genetics

IST-1.J.4

Some traits result from non-nuclear inheritance–

a. Chloroplasts and mitochondria are randomly assorted to gametes and daughter cells; thus, traits determined by chloroplast and mitochondrial DNA do not follow simple Mendelian rules.

b. In animals, mitochondria are transmitted by the egg and not by sperm; as such, traits determined by the mitochondrial DNA are maternally inherited.

AP BIO INSTA-REVIEW

TOPIC 5.4

Non-Mendelian Genetics

IST-1.J.4

Some traits result from non-nuclear inheritance—c. In plants, mitochondria and chloroplasts are transmitted in the ovule and not in the pollen; as such, mitochondria-determined and chloroplast-determined traits are maternally inherited.

AP BIO INSTA-REVIEW

TOPIC 5.4

Cross between dihybrid and double recessive: what ratio do you expect?

A. 1:1:1:1

B. 1:2:1

C. 9:3:3:1

D. 12:3:1

AP BIO INSTA-REVIEW

TOPIC 5.4

Cross between dihybrid and double recessive: what ratio do you expect?

A. 1:1:1:1

	A	a
a	Aa	aa
a	Aa	aa

	B	b
b	Bb	bb
b	Bb	bb

AaBb = ½ x ½ = ¼

Aabb = ½ x ½ = ¼

aaBb = ½ x ½ = ¼

aabb = ½ x ½ = ¼

AP BIO INSTA-REVIEW

TOPIC

5.4

Parents:

Green, Smooth x Yellow, Wrinkled

Offspring:

Green, Smooth = 425

Green, Wrinkled = 50

Yellow, Smooth = 75

Yellow, Wrinkled = 450

How would you explain the offspring ratio differing from 1:1:1:1?

AP BIO INSTA-REVIEW

TOPIC 5.4

How would you explain the offspring ratio differing from 1:1:1:1?

The genes are linked (located on the same chromosome)

AP BIO INSTA-REVIEW

TOPIC

5.4

Parents:

Green, Smooth x Yellow, Wrinkled

Offspring:

Green, Smooth = 425

Green, Wrinkled = 50

Yellow, Smooth = 75

Yellow, Wrinkled = 450

What process explains the recombinants made?

A. Crossing over

B. Independent Assortment

C. Metabolism

D. Mitosis

AP BIO INSTA-REVIEW

TOPIC 5.4

What process explains the recombinants made?

A. Crossing over

Recall crossing over involves the non-sister chromatids exchanging genetic information. Green & Smooth is on one chromsome while Yellow & Wrinkled on the other chromosome. The two exchanged genetic information leading to the new combinations of these traits.

AP BIO INSTA-REVIEW

TOPIC 5.4

Parents:

Green, Smooth x Yellow, Wrinkled

Offspring:

Green, Smooth = 425

Green, Wrinkled = 50

Yellow, Smooth = 75

Yellow, Wrinkled = 450

Calculate the recombinant frequency

AP BIO INSTA-REVIEW

TOPIC 5.4

Parents:

Green, Smooth x Yellow, Wrinkled

Offspring:

Green, Smooth = 425

Green, Wrinkled = 50

Yellow, Smooth = 75

Yellow, Wrinkled = 450

Calculate the recombinant frequency

12.5%

Step 1:

add the recombinants

50 + 75 = 125

Step 2:

divide by the total

125/1000 = 0.125

Step 3:

multiply by 100 to get into percent

0.125 * 100 = 12.5%

AP BIO INSTA-REVIEW

TOPIC

5.4

What is the difference between linked genes and SEX linked genes?

AP BIO INSTA-REVIEW

TOPIC 5.4

What is the difference between linked genes and SEX linked genes?

Traditionally, the linked will be on an autosome (non-sex chromosome) while the sex-linked is on a sex chromosome.

There's two sex chromosomes (X & Y). The Y chromosome has the SRY gene which leads to "male characteristics". So, if the allele is on a sex chromosome we say it's sex linked.

AP BIO INSTA-REVIEW

TOPIC 5.4

A mutation in the mitochondrial DNA is from

A. Father

B. Mother

C. Both parents

D. Neither random occurrence

AP BIO INSTA-REVIEW

TOPIC 5.4

A mutation in the mitochondrial DNA is from

B. Mother

The egg has all of the organelles for the zygote. This includes the mitochondria. If the mitochondria has a genetic issue, then that issue will occur in all of the offspring.

AP BIO INSTA-REVIEW

TOPIC

5.4

How would you recognize mitochondrial genes on a pedigree?

AP BIO INSTA-REVIEW

TOPIC 5.4

How would you recognize mitochondrial genes on a pedigree?

Affected mother and ALL of the children are affected

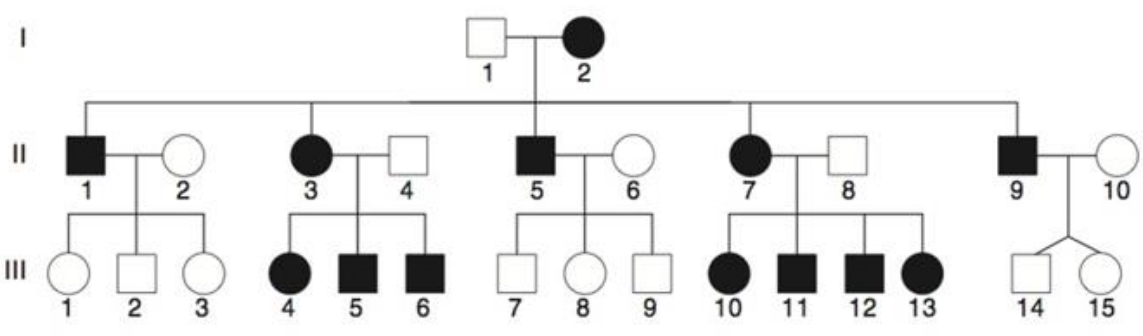

Figure 5.9 **Inheritance of mitochondrial genes.** Mothers pass mitochondrial genes to all offspring. Fathers do not transmit mitochondrial genes because sperm only very rarely contribute mitochondria to fertilized ova. If mitochondria from a male do enter, they are destroyed.

AP BIO INSTA-REVIEW

TOPIC

5.4

What is the expected ratio of dihybrid in a test cross?

A. 1:1:1:1

B. 1:2:1

C. 9:3:3:1

D. 9:3:4

AP BIO INSTA-REVIEW

TOPIC 5.4

What is the expected ratio of dihybrid in a test cross?

A. 1:1:1:1

	A	a
a	Aa	aa
a	Aa	aa

	B	b
b	Bb	bb
b	Bb	bb

AaBb = ½ x ½ = ¼

Aabb = ½ x ½ = ¼

aaBb = ½ x ½ = ¼

aabb = ½ x ½ = ¼

AP BIO INSTA-REVIEW

TOPIC

5.4

What does it mean if genes are linked?

AP BIO INSTA-REVIEW

TOPIC 5.4

What does it mean if genes are linked?

Two genes are located close together on the same chromosome

This will traditionally lead to the two traits being inherited together

AP BIO INSTA-REVIEW

TOPIC 5.4

If genes are linked, how would this affect the 1:1:1:1 ratio from testcross?

A. Linkage will not affect the predicted ratios

B. More parentals (>50%)

C. More recombinants (>50%)

D. Ratio follows 9:3:3:1

AP BIO INSTA-REVIEW

TOPIC 5.4

If genes are linked, how would this affect the 1:1:1:1 ratio from testcross?

B. More parentals (>50%)

If the two genes are linked, they are located on the same chromosome. This means that when the organism inherits one gene, they would also inherit the other gene. This means we would expect mostly parentals (trait combinations that are the same as the parent chromosome)

AP BIO INSTA-REVIEW

TOPIC

5.4

How do you solve for the recombination frequency?

AP BIO INSTA-REVIEW

TOPIC 5.4

How do you solve for the recombination frequency?

$$\frac{Number\ of\ Recombinants}{Total\ Number}\ x\ 100$$

AP BIO INSTA-REVIEW

TOPIC 5.4

With linked genes, how do recombinants form?

A. Crossing over

B. Independent assortment

C. Random fertilization

D. Transformation

AP BIO INSTA-REVIEW

TOPIC 5.4

With linked genes, how do recombinants form?

A. Crossing over

The two traits are found on the same chromosome. Crossing over will allow for the chromosomes to exchange genetic infomration between non-sister chromatids.

AP BIO INSTA-REVIEW

TOPIC 5.4

If a male (AMAB) is affected by a sex-linked trait, which parent passed it on?

A. Father

B. Mother

AMAB – assigned male at birth

AP BIO INSTA-REVIEW

TOPIC 5.4

If a male (AMAB) is affected by a sex-linked trait, which parent passed it on?

B. Mother

The male would have inherited its Y from its father and its X from its mother. Thus, if the trait is sex-linked, the mother would pass it on to her sons.

AP BIO INSTA-REVIEW

TOPIC 5.4

Which organelle contains DNA?

A. Chloroplast

B. Mitochondria

C. Nucleus

D. All of the above

AP BIO INSTA-REVIEW

TOPIC 5.4

Which organelle contains DNA?

D. All of the above
(Chloroplast, Mitochondria & Nucleus)

The nucleus contains the DNA for the cell.

The mitochondria/chloroplast are prokaryotic cells with a single circular strand of DNA.

AP BIO INSTA-REVIEW

TOPIC

5.4

Mitochondrial inheritance follows the ____

A. Egg

B. Sperm

AP BIO INSTA-REVIEW

TOPIC 5.4

Mitochondrial inheritance follows the ____

A. Egg

The egg contains the organelles for the zygote. This means that mitochondrial inheritance follows the egg since the mitochondria is inherited from the mother.

AP BIO INSTA-REVIEW

TOPIC

5.4

In a pedigree and determining mode of inheritance...

A. A dominant trait is found in every generation

B. A dominant trait will skip generations

C. A dominant trait is only found in males

D. A dominant trait that is found in all offspring of affected females

AP BIO INSTA-REVIEW

TOPIC 5.4

In a pedigree and determining mode of inheritance...

A. A dominant trait is found in every generation

The dominant trait is unable to be masked by a recessive trait. This means that we will see if occur in every generation.

AP BIO INSTA-REVIEW

TOPIC

5.4

In a pedigree and determining mode of inheritance...

A. A recessive allele is found in every generation
B. A recessive trait can be seen with unaffected parents
C. A recessive trait is only found in females
D. A recessive trait is found in all offspring of affected father

AP BIO INSTA-REVIEW

TOPIC 5.4

In a pedigree and determining mode of inheritance...
B. A recessive trait can be seen with unaffected parents

Recessive traits are able to hide their expression. This means that it can be observed as two unaffected parents with an affected offspring.

AP BIO INSTA-REVIEW

TOPIC

5.4

Mitochondrial inheritance seen in pedigree as...

A. Affected male and all offspring are affected
B. Affected female and all offspring are affected
C. Affected mother only passing on to daughters
D. Affected mother only passing on to sons

AP BIO INSTA-REVIEW

TOPIC 5.4

Mitochondrial inheritance seen in pedigree as...

B. Affected female and all offspring are affected

Due to the mitochondria being inherited by the egg, this would be seen as an affected mother with ALL of their offspring also affected.

AP BIO INSTA-REVIEW

TOPIC 5.4

If males and females are equally likely to be affected

A. The trait is autosomal

B. The trait is sex-linked

AP BIO INSTA-REVIEW

TOPIC 5.4

If males and females are equally likely to be affected

A. The trait is autosomal

If males and females are equally affected, the trait is autosomal. Both organisms have two alleles so they have two opportunities to obtain a recessive allele.