

Task 1

Predicting Trait Inheritance

In this task, you will design a species, determine its genetic variation, and predict the genetic inheritance pattern.

 Estimated time to complete: 60–90 minutes

Part A: Design a Species

If you could genetically engineer any species of organism, what would it be? Would it be a unicorn? A dog-cat hybrid? Your own personal pet giant? Choose any species—real or not—that your imagination desires!

Write a paragraph describing your species, what it looks like, and where it lives. Think of any inherited traits the species has that might help it survive in its environment. Thinking of these traits now can help you come up with allele combinations in the next step. Now describe your species in the answer space.

Answer:

Characters used: 0 / 15000

Part B: Determine Trait Variation in the Species

For this modeling activity, assume that your species reproduces sexually. This assumption implies that it inherits half of its chromosomes from its mother and half from its father. Recall that in sexual reproduction, individuals inherit homologous pairs of chromosomes—one from the father and one from the mother. This arrangement allows for two alleles for every gene. The alleles can be dominant or recessive. You will model three traits controlled by three gene types on homologous chromosomes. Your genes should have these patterns of inheritance:

Trait 1: Simple dominant/recessive inheritance

Example: In pea plants, YY and Yy genotypes will yield yellow pea pods, but inherited yy will yield green pea pods.

Trait 2: Co-dominance

Co-dominance occurs when there's more than one dominant allele and they express equally.

Example: Human blood type is co-dominant. I^A (type A blood), I^B (type B), and i (O blood) are controlled by A and B dominant alleles. If a person inherits A and B alleles, they'll have AB blood. O blood is caused by two recessive alleles.

Trait 3: Incomplete dominance

Incomplete dominance occurs when there is more than one dominant gene, but the expression of both genes creates a blending of traits.

Example: RR = red flowers, WW = white flower, but RW = pink flowers.

Come up with your three traits and the possible inherited phenotypes. Here's an example:

Trait	Phenotype 1	Phenotype 2	Phenotype 3	Phenotype 4
Seed Color (simple/dominant recessive)	Yy and YY (yellow seeds)	yy (green seeds)	N/A	N/A
Flower Color (co-dominance)	$I^R I^R$ and $I^R i$ = red flowers	$I^W I^W$ and $I^W i$ = white flowers	$I^W I^R$ = red/white speckled	ii = yellow flowers
Pod Shape (incomplete dominance)	PP = long, balloon-shaped pods	FF = flat, narrow pods	PF = long, flat pods	N/A

To get started, think about the traits your species needs to help it survive in its environment. Come up with variations of these traits. You can include neutral traits (variations that won't affect the organism's survival), and beneficial traits (variations that would give the organism a better chance for survival). You can even include harmful genes or genes that could cause genetic diseases. Fill in the chart with the traits you chose and the possible inherited phenotypes.

Answer:

Trait	Phenotype 1	Phenotype 2	Phenotype 3	Phenotype 4

Characters used: 53 / 15000

Part C: Choose the Genotype of the Parents

You will use Punnett squares to predict the probability that two parents of your species will pass a particular trait to their offspring. Each parent has two alleles for a particular gene, one on each homologous chromosome.

To prepare to make the Punnett squares, write down the genotypes of the parents for the three traits you'll be predicting.

Example:

Mother: YyI^RiPF

Father: YyI^WiPF

Answer:

Characters used: 0 / 15000

Part D: Make Punnett Squares

Now fill in three Punnett squares, one for each trait.

Answer:

Father's Alleles

Mother's Alleles

Trait:	M	m
M		
m		

Father's Alleles

Mother's Alleles

Trait:	M	m
M		
m		

Father's Alleles

Mother's Alleles

Trait:	M	m
M		
m		

Characters used: 130 / 15000

Part E: Evaluate the Results

Question 1

Evaluate the possible genotypes the offspring could inherit for traits 1, 2, and 3. Use percentages to explain the probability that an offspring will inherit each possible genotype.

Answer:

Characters used: 0 / 15000

Question 2

Would any of these genotypes affect your species' survival in its natural habitat?
Explain why or why not.

Answer:

The

Characters used: 3 / 15000

Question 3

Use your Punnett squares to explain why traits that aren't present in either parent could show up in the offspring or in future generations of the offspring.

Answer:

Characters used: 0 / 15000