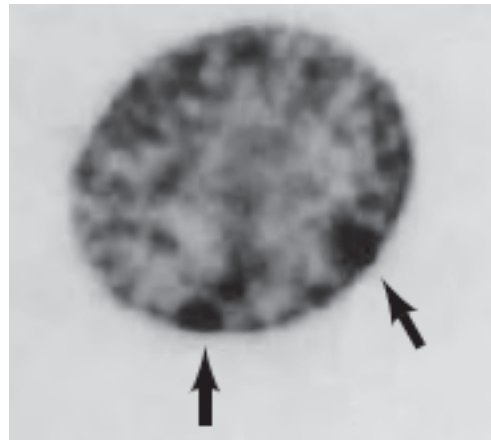


Question 1

Cheek cells are taken from a young person.



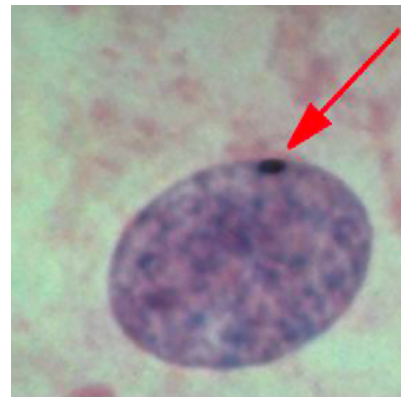
Under the microscope one observes two dark spots in the cell nucleus.

1.A What do you conclude when the person is a woman?

1.B What do you conclude when the person is a man?

Question 2

Cheeks cells are taken from a young man.



Under the microscope one observes a dark spot in the cell nucleus.

2.A What do you conclude when the person is a woman?

2.B What do you conclude when the person is a man?

Question 3

2 pt

Male : dwarf, agouti (wild type)
Autosomal recessive dwarfism
is due to absence of
growth hormone (GH)

Female : normal size, albino



X



X



Female F1

male : dwarf, albino

A dwarf, agouti male is crossed with a normal size, albino female.

The F1 are 100% agouti, normal size.

F1 females are crossed with dwarf, albino males.

3.A

Describe the phenotypes of the F2 and the relative proportions (%) of these phenotypes assuming that the Tyrosinase locus (causing albinism) and the Growth hormone locus (causing dwarfism) are on the same chromosome **28 cM** apart.

3.B

Describe the phenotypes of the F2 and the relative proportions (%) of these phenotypes assuming that the Tyrosinase locus (causing albinism) and the Growth hormone locus (causing dwarfism) are located **on 2 different chromosomes**.

Question 4

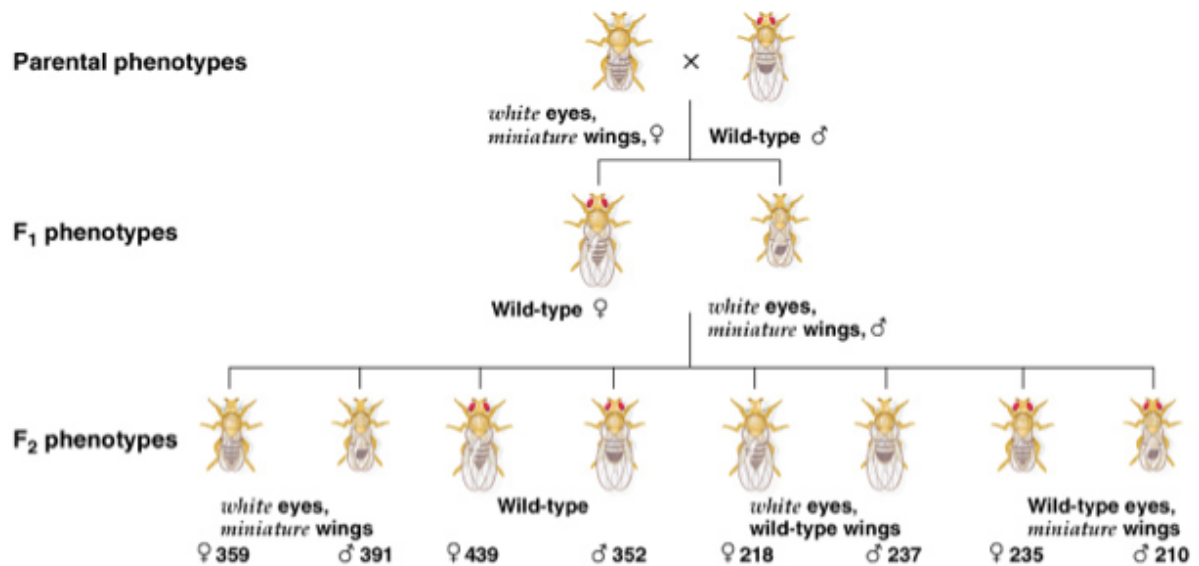
In *Drosophila*, a locus controlling the color of the eye (red / white) and a locus controlling the size of the wings (long/miniature) are both on the X chromosome.

A white eyes, miniature wings female is crossed with a wild-type male.

In the F₁, all females are wild-type whereas all male show white eyes and miniature wings.

On crosses F₁ female with F₁ males.

The phenotypes in the F₂ are indicated.



From the data calculate the genetic distance between the 2 loci on the X chromosome.

Question 5

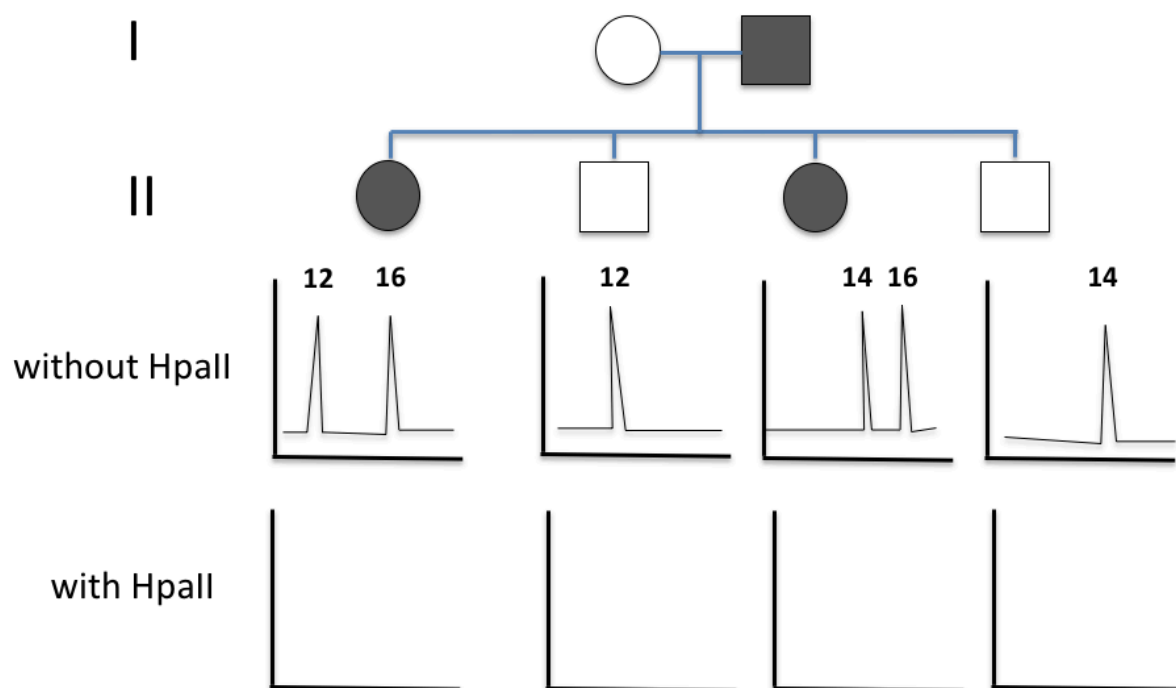
A couple has 2 daughters and 2 sons. The father is colorblind (does not distinguish green from red), the mother distinguishes green from red.

Their 2 sons distinguish red from green but their 2 daughters are colorblind!

According to textbooks, colorblindness is transmitted by the X chromosome:

- males are colorblind when their X chromosome is mutated
- carrier females (1 X chromosome mutated) are not colorblind;
- homozygote females (2 X chromosomes mutated) are colorblind.

The family presented here is exceptional.



The HUMARA assay has been done for all 4 children.

Results without digestion by HpaII are given.

Genotype of the mother: _____

Genotype of the father: _____

Is the mother carrier for colorblindness?

YES

NO

Draw the most likely results of the HUMARA assay with digestion by HpaII before the PCR.
Explain your reasoning.