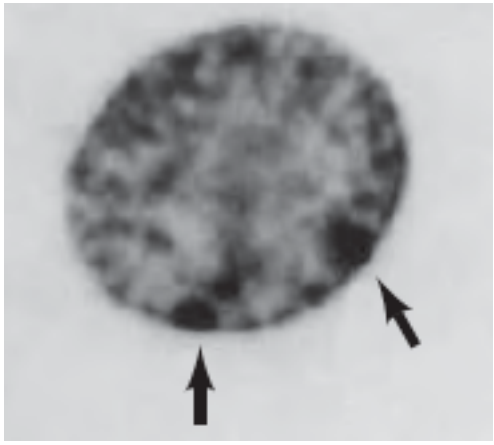
Question 1
Cheek cells are taken from a young person.

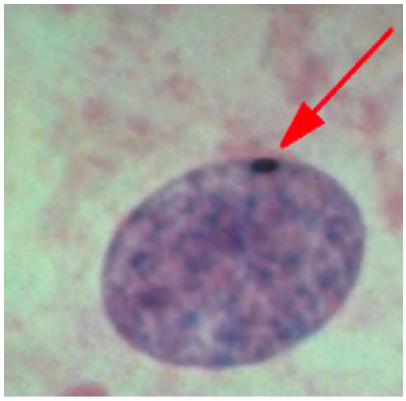


Under the microscope one observes two dark spots in the cell nucleus.

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.

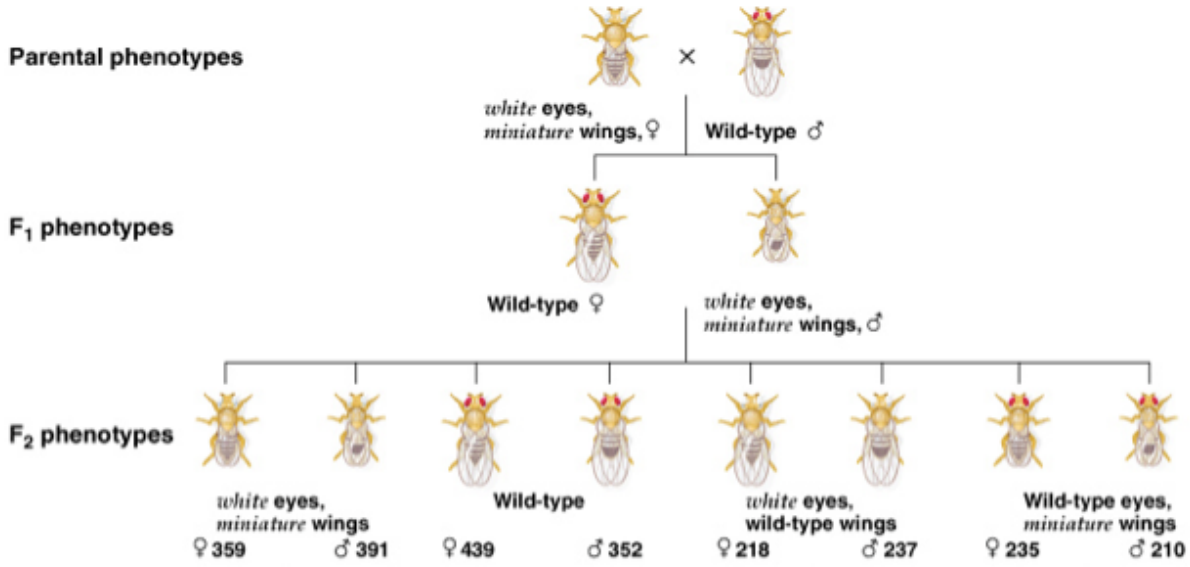
3.A
Describe the phenotypes of the F2 and the relative proportions (%) of these phenotypes assuming that the Tyrosinase locus (causing albinism) and the Growth hormone locus (causing dwarfism) are on the same chromosome **28 cM** apart.

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.

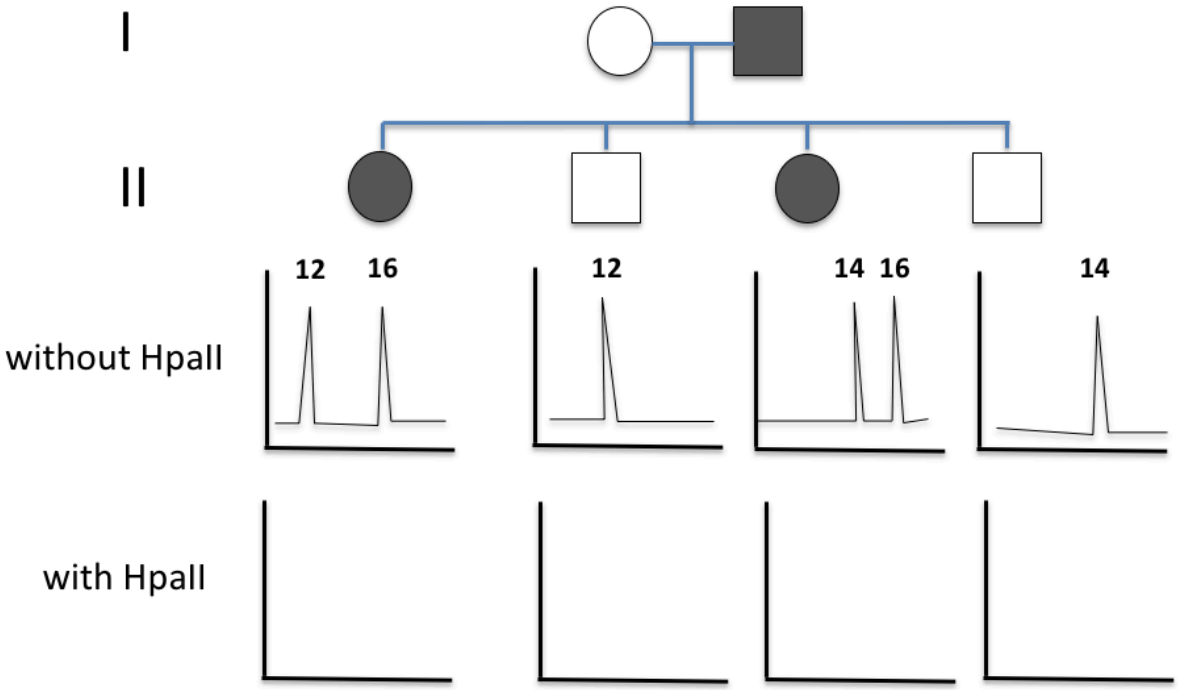
A white eyes, miniature wings female is crossed with a wild-type male.
In the F1, all females are wild-type whereas all male show white eyes and miniature wings.
On crosses F1 female with F1 males.
The phenotypes in the F2 are indicated.



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.