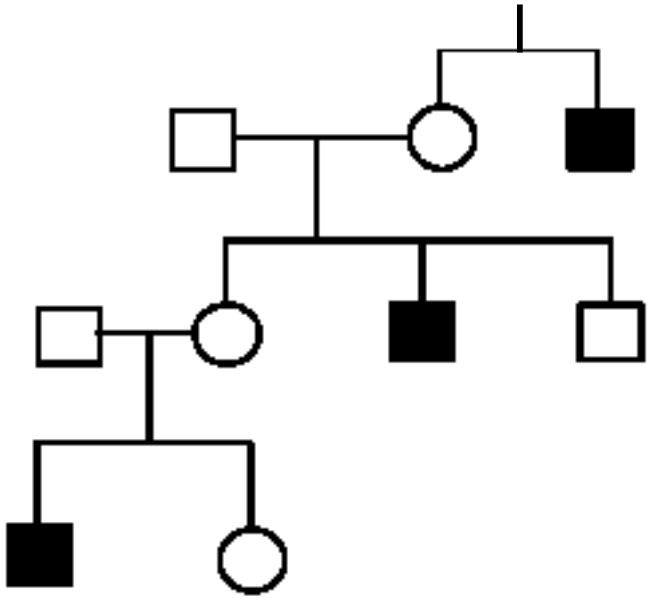
What is the most likely mode of inheritance in the pedigree shown below? Justify why it is the most likely. (10 points)



It is likely not autosomal dominant—affected individuals do not have affected parents.

It is likely not X-linked dominant—if it was, the affected male at the bottom of the pedigree would have an affected mother. He would get the X with the dominant trait from his mother

It could be X-linked recessive. The first two females shown in the pedigree could be carriers that produced affected males.

It could also be autosomal recessive—the two males marrying into the family could be carriers for the recessive trait and the first two females could also be carriers of the trait. This would explain the fact that unaffected parents are having an affected child.

In *Drosophila,* two mutations, *Stubble (Sb)* and *curled (cu)*, are linked on the third chromosome. *Stubble (Sb)* is a dominant mutation that produces short bristles and it is **lethal** when homozygous. *curled* is a recessive mutation that produces curled wings. You have a *Stubble,* normal winged female of the following genotype (where + indicates the wildtype form of each gene):

$$\frac{Sb \quad cu}{Sb^{+} \quad cu^{+}}$$

You want to choose a *true breeding* male with a genotype that will allow you to observe all of the recombinant and non-recombinant progeny of this female. *What genotype would you choose? After mating the female and your male, what will be the genotypes and phenotypes of the resulting progeny?*

The key here is that you want to be able to see all four progeny types—recombinant and non-recombinant. The other major key is that flies that are homozygous for the Sb allele are lethal so you can't use males that are homozygous for Sb. The males you want to should be of the genotype *Sb*$^{+}$ cu/ *Sb*$^{+}$ cu. This will ensure that all the progeny will look different.

The non-recombinants will be
***Sb* cu/ *Sb*$^{+}$ cu (Stubble and curled)**
***Sb*$^{+}$ cu^{+}/ *Sb*$^{+}$ cu (not Stubble and normal wings)**

The recombinants will be
***Sb* cu^{+}/ *Sb*$^{+}$ cu (Stubble and normal wings)**
***Sb*$^{+}$ cu/ *Sb*$^{+}$ cu (not Stubble and curled wings)**

You are interested in producing a genetic map of three *recessive* mutations in Drosophila.

- One mutations produces a black body (b) and it is recessive to the grey wildtype allele (b+)
- One mutation produces small wings (sw) and it is recessive to the allele for normal wings (sw+)
- one mutation produces hooked bristles (h) and it is recessive to the wildtype allele that produces normally shaped bristles (h+)

You perform the following crosses (*read through this carefully*). Assume that the wild type phenotype for a particular trait is observed except when the mutant phenotype is explicitly mentioned. You cross a homozygous small winged female with a homozygous black, hooked male. All of the F1 look wild type for the three traits. The test cross of an F1 female with a homozygous small winged, black, hooked male gave the following results in the F2:

Phenotypes	Number of Progeny
Wildtype	169 **SCO between sw and b**
black	19 **SCO between b and h**
black, hooked	301 **non-recombinant**
small winged, hooked	21 **SCO between b and h**
hooked	8 **DCO**
hooked, small winged, black	172 **SCO between sw and b**
small winged, black	6 **DCO**
small winged	304 **non-recombinant**
Total	1000

A. What were the genotypes of the parental and F1 flies? (5 points)

Homozygous small winged female parent: b+ sw h+ / b+ sw h+
Homozygous black, hooked male: b sw+ h / b sw+ h

F1 females are wild type (trans): b+ sw h+ / b sw+ h
Males are homozygous for the recessive traits: b sw h / b sw h

B. Construct a genetic map showing the order and map distances between the genes.

Gene order:
Non-recombinant chromosomes (over b sw h) : b+ sw h+ and b sw+ h
DCO chromosomes (over b sw h): b+ sw+ h (hooked) and b sw h+ (small winged, black)

The b alleles are different when you compare the DCO and the non-recombinants so it is the gene in the middle

Now we have to fill in the map distances for the following map:

sw----------b----------h

sw-b distance

RF= (169+172) + (6+8)/1000= 0.355 * 100%= 35.5%

b-h distance

RF= (19 + 21) + (6+8)/1000=0.054 * 100%= 5.4%