Bug Lab
(Karyotypes and Genetic Diseases)

Materials (per group)

2 pairs of scissors glue one handout (info sheet, chromosome sheet, data sheet)

Background

A karyotype is a picture of the chromosomes of a cell that have been stained so that banding patterns appear. This is best done during metaphase of mitosis. After staining, the cell is photographed through a microscope, the picture is enlarged, the chromosomes are cut from the picture, and they are arranged according to size, arm length, centromere position, and banding patterns. The karyotype that results from this procedure may be used to diagnose some genetic diseases.

This investigation uses karyotypes for a species of insect to identify four genetic diseases. Using their chromosomes, you will make karyotypes for six of these insects. One will represent a normal male, one a normal female, and one for each of the four genetic diseases.

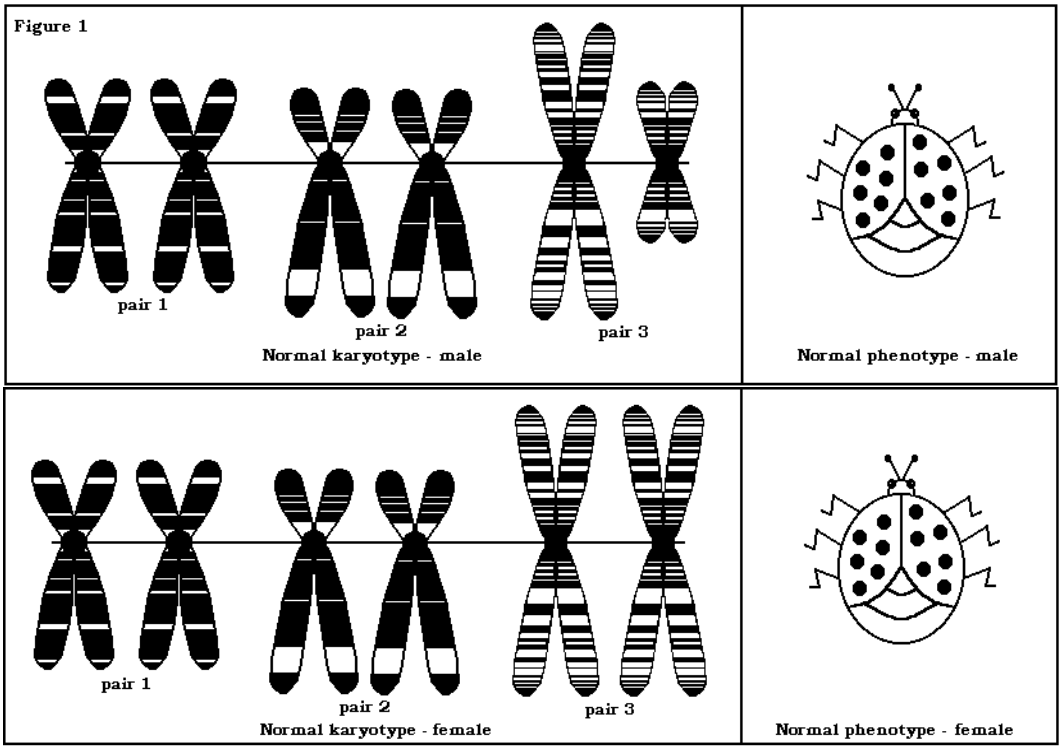
The insect species being studied has three pairs of homologous chromosomes. The first two pairs are autosomes; the last pair are sex chromosomes. Sex determination is the same as in humans (XX = a female, XY = a male).

Procedure

1. cut out the chromosomes for insect #1; pair them according to homologous chromosomes
2. glue them to the data sheet in the same order as the normal male/female (refer to Figure 1)
3. make sure the centromeres are on the line when glued to the paper
4. repeat 1 – 3 for the other five insects
5. answer the questions to determine which insects are normal and which have the four genetic diseases

Normal Karyotypes

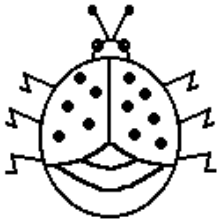
Figure 1



Disorders

Size Reduction Disorder

Figure 2

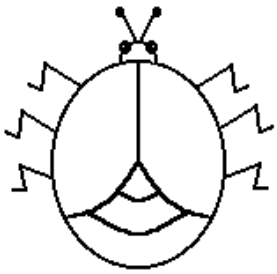


Monosomy of the 3rd pair

This disorder involves a monosomy of the third pair. An "X" chromosome is missing so that a male has only a "Y" or a female has only an "X". The result is a small male or female.

Clear Wing Disorder

Figure 3

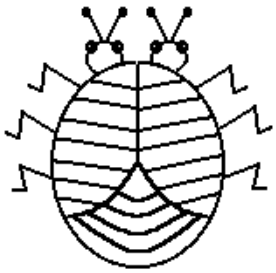


Trisomy of the 2nd pair

This disorder involves a trisomy of the second pair of chromosomes. The result is clear wings. Offspring are sterile.

Duplication Disorder

Figure 4

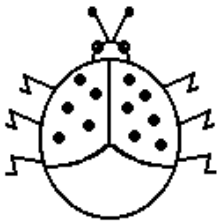


Duplication of part of the 1st pair

This disorder is a duplication of part of one of the 1st pair of chromosomes. The part duplicated remains attached to the chromosome resulting in a large chromosome. The insect has two heads, banded wings, and extra body segments.

Unsegmented Disorder

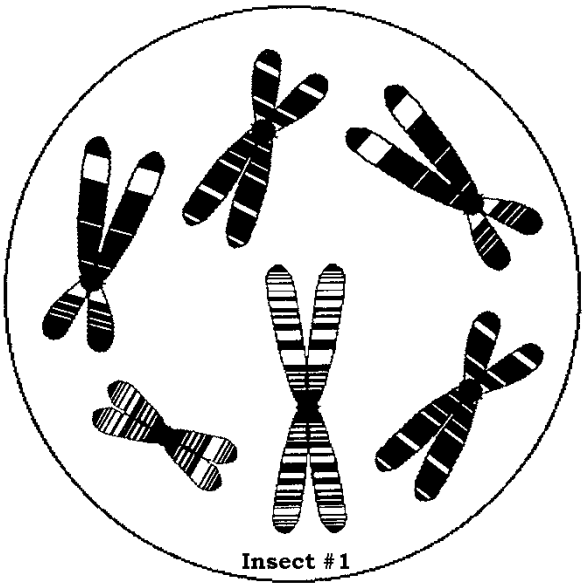
Figure 5

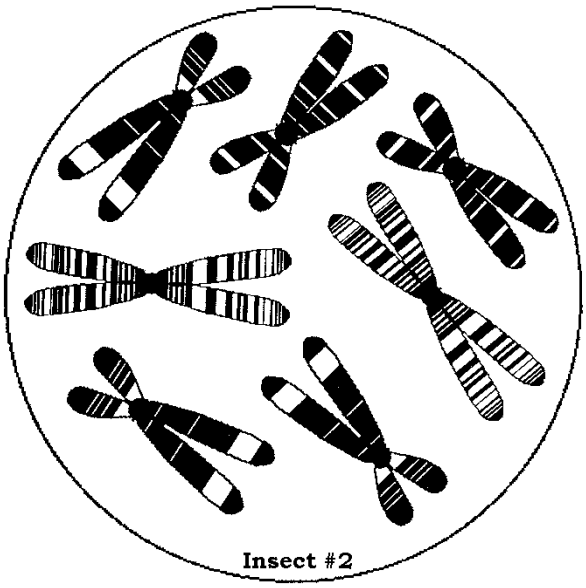


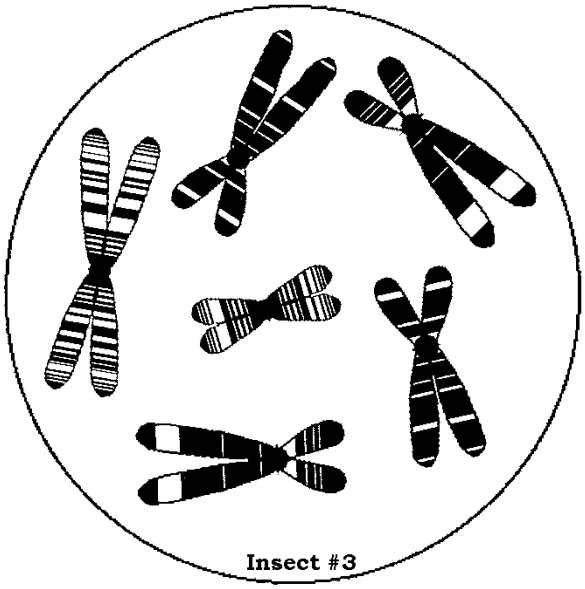
Deletion of part of an "X" chromosome

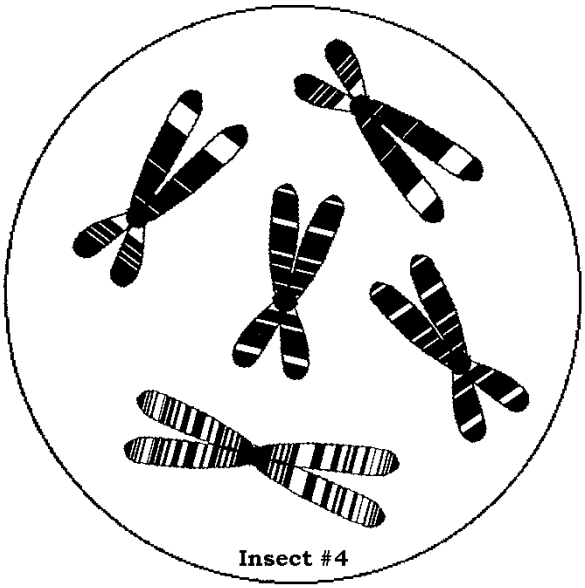
This disorder is due to a deletion of a segment of an "X" chromosome of the 3rd pair. The result is an "X" chromosome that is shorter than normal. The insect is reduced in size and has no body segmentation.

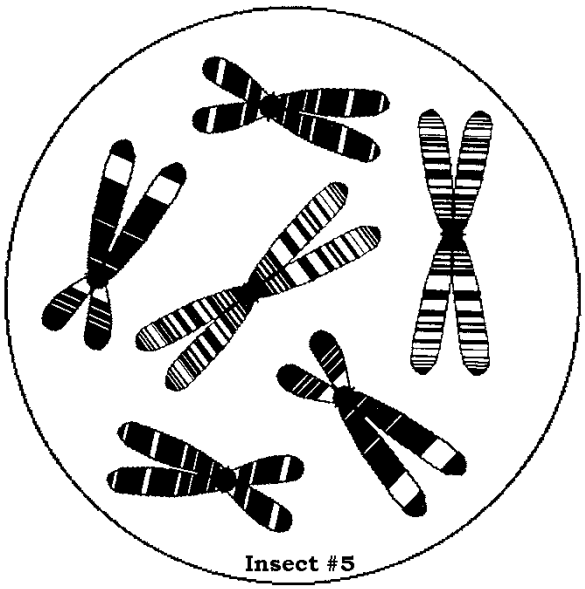
Insect Chromosomes

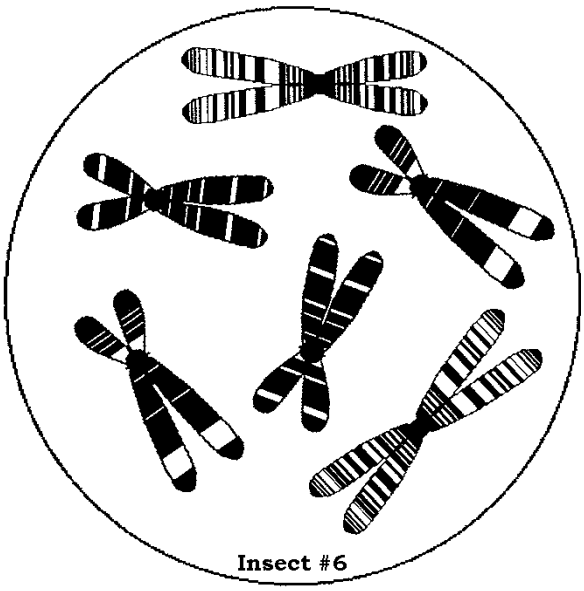












Name _____ Date _____ Period _____

Bug Lab – Data Sheet

Glue the centromeres to the lines.

Insect #1	Insect #2
_____ **Condition:**	_____ **Condition:**

Insect #3	Insect #4
_____ **Condition:**	_____ **Condition:**

Insect #5	Insect #6
_____ **Condition:**	_____ **Condition:**

Identify which insects have these 6 conditions by writing the names of the conditions on the lines at the bottom of the boxes: ***Normal Male***, ***Normal Female***, ***Size Reduction***, ***Clear Wing***, ***Duplication***, ***Unsegmented***