SEX DETERMINATION

The sex of an organism usually depends on a very complicated series of developmental changes under genetic and hormonal control. However, often one or a few genes can determine which pathway of development an organism takes. Those switch genes are located on the **sex chromosomes,** a heteromorphic pair of chromosomes, when those chromosomes exist.

But, sex chromosomes are not the only determinants of an organism's sex. The ploidy of an individual, as in many hymenoptera (bees, ants, wasps), can determine sex; males are haploid and females are diploid. Allelic mechanisms may determine sex by a single allele or multiple alleles not associated with heteromorphic chromosomes; even environmental factors may control sex. For example, temperature determines the sex of some geckos, and the sex of some marine worms and gastropods depends on the substrate on which they land.

Sex Chromosomes

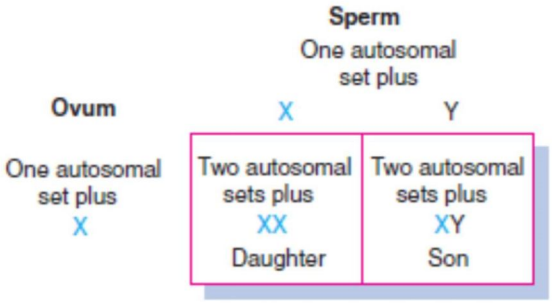
Basically, four types of chromosomal sex-determining mechanisms exist:

1. XY mechanisms : as in human beings or fruit flies, the females have a homomorphic pair of chromosomes (XX) and males are heteromorphic (XY).
2. ZW mechanisms: In the ZW case, males are homomorphic (ZZ), and females are heteromorphic (ZW).
3. XO mechanisms: the organism has only one sex chromosome, as in some grasshoppers and beetles; females are usually XX and males XO.
4. Compound chromosomal mechanisms: several X and Y chromosomes combine to determine sex, as in bedbugs and some beetles.

that the chromosomes themselves do not determine sex, but the genes they carry do. In general, the genotype determines the type of gonad, which then determines the phenotype of the organism through male or female hormonal production.

The XY System

The XY situation occurs in human beings, in which females have forty-six chromosomes arranged in twenty three homologous, homomorphic pairs. Males, with the same number of chromosomes, have twenty-two homomorphic pairs and one heteromorphic pair, the XY pair. During meiosis, females produce gametes that contain only the X chromosome, whereas males produce two kinds of gametes, X- and Y-bearing.



For this reason, females are referred to as **homogametic** and males as **heterogametic**. In people, fertilization has an equal chance of producing either male or female offspring. In *Drosophila*, the system is the same, but the Y chromosome is almost 20% larger than the X chromosome.

Figure Chromosomes of Drosophila

Since both human and *Drosophila* females normally have two X chromosomes, and males have an X and a Y chromosome, it seems impossible to know whether maleness is determined by the presence of a Y chromosome or the absence of a second X chromosome.