SEX DETERMINATION-II

The existence of polyploid and aneuploid individuals makes it possible to test whether the Y chromosome is male determining. For example, a person or a fruit fly that has all the proper **autosomes** (44 in human beings, 6 in *Drosophila*), but only a single X without a Y would answer our question.

If the Y were absolutely male determining, then this **XO individual** should be **female**.

If the sex-determining mechanism is a result of the number of X chromosomes, this individual should be **a male**(XO).

But the actuality is as:

Chromosomal make up	Drosophila	Human
XO	Male	Female

Genic Balance in Drosophila

When geneticist Calvin Bridges, working with *Drosophila,* crossed a triploid (3n) female with a normal male, he observed many combinations of autosomes and sex chromosomes in the offspring. Bridges suggested in 1921 that sex in *Drosophila* is determined by the balance between (ratio of) autosomal alleles that favor maleness and alleles on the X chromosomes that favor femaleness. An **autosomal set** (A) in *Drosophila* consists of one chromosome from each autosomal pair, or three chromosomes.

When the X:A ratio is 1.00, as in a normal female, or greater than 1.00, the organism is a female. When this ratio is 0.50, as in a normal male, or less than 0.50, the organism is a male. At 0.67, the organism is an **intersex**. **Metamales** (X/A = 0.33) and **metafemales** (X/A = 1.50) are usually very

weak and sterile. The metafemales usually do not even emerge from their pupal cases.

A **sex-switch** gene has been discovered that directs female development. This gene, **Sex-lethal** (*Sxl*), is located on the X chromosome. (It was originally called *femalelethal* because mutations of this gene killed female embryos.)

Apparently, *Sxl* has two states of activity. When it is "on," it directs female development; when it is "off," maleness ensues. Other genes located on the X chromosome and the autosomes regulate this sex-switch gene. Genes on the X chromosome that act to regulate *Sxl* into the on state (female development) are called **numerator elements** because they act on the numerator of the X/A genic balance equation. Genes on the autosomes that act to regulate *Sxl* into the off state (male development) are called **denominator elements**. Geneticists have discovered four numerator elements—genes named *sisterless-a, sisterless-b, sisterless-c,* and *runt*. *Sxl* "counts" the number of X chromosomes; it turns on when two are present. It counts by measuring the level of the numerator genes'protein product. If the level is high, *Sxl* turns on, and the organism develops as a female. If the level is relatively low, *Sxl* does not turn on, and development proceeds as a male.