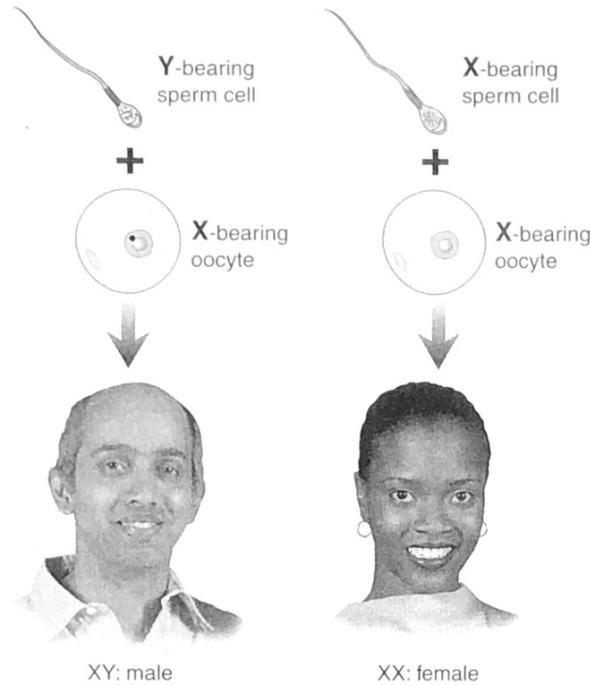


Sex Determination

The determination of the sex of an organism is controlled in most cases by the sex chromosomes provided by each parent. These have evolved to regulate the ratios of males and females produced and preserve the genetic differences between the sexes. In humans, males are the **heterogametic sex** because each somatic cell has one X and one Y chromosome. The

determination of sex is based on the presence or absence of the Y chromosome; without it, an individual will develop into a female. In mammals, the male is always the heterogametic sex, but this is not necessarily the case in other taxa. In birds and butterflies, the female is the heterogametic sex, and in some insects the male is simply X whereas the female is XX.

Sex Determination in Humans

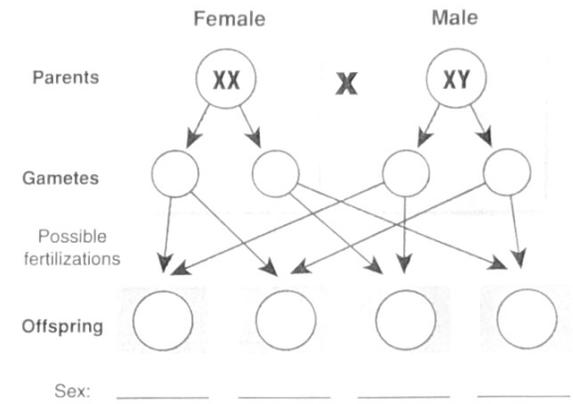


XY Sex Determination

Female: **XX** Male: **XY**

Examples: Humans (and all mammals), fruit flies (*Drosophila*), some dioecious plants (having separate male and female plants) such as kiwifruit.

In humans the female is the **homogametic sex** and has two similar sex chromosomes (XX), whereas the male is the heterogametic sex with two unlike chromosomes (XY). The primary sexual characteristics are initiated by special genes on the X chromosomes. Females must have a double dose (2X chromosomes). Maleness is determined by the presence of the Y chromosome.



Sex Determination in *Drosophila*



In *Drosophila*, maleness is determined by the ratio of X chromosomes to autosomes, not the presence of the Y chromosome. Two X chromosomes in a diploid cell produce a female fly, but one X chromosome in a diploid cell produces a male fly. The Y chromosome is not involved in determining sex, but does contain genes involved in the production of sperm in adult males. Thus XO in *Drosophila* is a sterile male, while in mammals it is a sterile female.

Temperature Dependent Sex Determination



In some vertebrate species, mostly reptiles, sex is determined by the temperature at which the eggs are incubated. In turtles, males are produced at lower incubation temperatures than females (22°C-27°C as opposed to 30°C). The hormone testosterone may be converted to estradiol at higher temperatures to produce females, but how temperature triggers gene expression and the pathway for genetic sex determination is poorly understood.

- (a) Complete the diagram above, to show the resulting gametes, genotype and sex of the offspring:

(b) Determine the probability of a conception producing a male child: _____

(c) Determine the probability of a second conception producing a female child: _____
- Explain what determines the sex of the offspring at the moment of conception in humans: _____

- Explain why many genes on the X chromosome in males will be expressed regardless of their dominance status: _____

- Estimate the ratio of males to females produced when a clutch of turtle eggs is incubated at 28.5°C: _____