

Sex Determination System

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Development of sexual characteristics



A sex-determination system is a biological system that determines the development of sexual characteristics in an organism. Two sexes are present in most sexual organisms. Because of the sexual chromosome differences the sex determination.

SEX DETERMINATION AND SEX CHROMOSOMES

I. The Chromosome Theory of Inheritance and Sex Linkage

- A. Sutton and Boveri's chromosome theory of inheritance proposed in 1902—Genes are located on chromosomes
- B. Just previous to this (end of 19th century) biologists had discovered that half of all sperm cells carry a structure called an X body.
- C. In 1905 the X bodies were determined to be chromosomes—X chromosomes.
- D. Then the Y chromosome was also discovered in 1905.
- E. Together the X and Y chromosomes are known as the sex chromosomes.
- F. All other chromosomes are called autosomes.

G. Systems of sex chromosomes

1) XX-XO system (S H 5)

- (a) Female—XX
- (b) Male—X
- (c) Occurs in some insects like grasshoppers

2) XX-XY System (S H 5)

- (a) Female—XX (homogametic sex)
- (b) Male XY (heterogametic sex)
- (c) Occurs in *Drosophila*, mammals and some plants

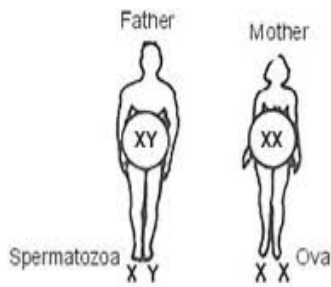
3) ZZ-ZW System(S H 5)

- (a) Female—XY (heterogametic sex)
- (b) Male—XX (homogametic sex)
- (c) Occurs in birds, butterflies and some fishes

4) X-Y-XY System(S H 5)

- (a) Occurs in organisms with alteration of generations (e.g., liverworts and vascular plants)
- (b) Male gametophytes—Y
- (c) Female gametophytes—X
- (d) Sporophytes—XY

H. Morphology and pairing of X and Y

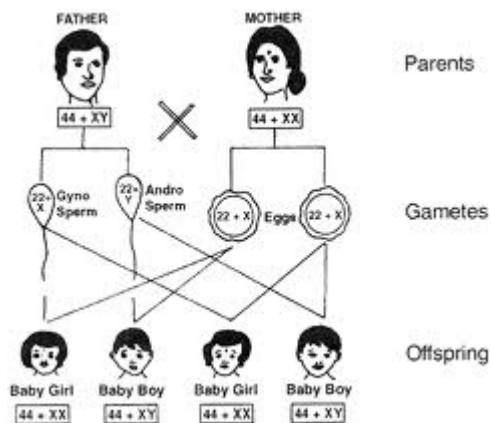


- 1) Each type of sex chromosome has two regions
 - (a) Pairing region
 - (i) During synapsis of meiotic prophase I, the pairing regions combine
 - (ii) Some genes occur in these pairing regions
 - (iii) These genes exhibit X-and-Y linkage
 - (b) Differential region
 - (i) Differential regions do not pair during synapsis
 - (ii) Differential region genes are either
 1. X-linked
 2. Y-linked
 - (iii) Any gene X or Y chromosome is said to be sex linked.

I. Sex determination in Drosophila

- 1) Sex is determined by the ratio of the number of X chromosomes to number of autosomal sets
- 2) Scheme
 - (a) $X/A = 1.0$ —female
 - (b) $X/A = 0.5$ —male
 - (c) $X/A > 1.0$ —metafemale
 - (d) $X/A < 0.5$ —metamale

J. Sex determination in humans



- The presence or absence of the Y chromosome determines sex

- XX determines the female and XY determines the male.

Sex Determination

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