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Editorial

Molecular Basis of Sex Determination in Humans as Compared to the Honey Bee and Birds

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In a human male, 22 pairs of autosomes, 1 X chromosome, 1 Y chromosome are present, which actually form primary spermatocytes, and the process of spermatogenesis produces sperm. In a human female, 22 pairs of autosomes, 2 X chromosomes are present, and the process of oogenesis produces three polar bodies and one ovum.

In human, the Y chromosome plays an important role in sex determination in humans. SRY gene helps to produce TDF, which helps to accelerate the production of testes. Besides this Tfm gene is present on the X chromosome, which also helps in the production of testosterone. The mutation of the Tfm gene causes testicular feminization. Testicular cord formation is done by two genes, namely, SOX9 and FGF9. In human females, Rspo1 helps to regulate the Wnt/β- catenin pathway. Foxl2 gene is present in the ovary and plays an important role in follicle formation, activation, and ovarian development. Steroidogenic axis development and stem cell development are done by Dax1 gene. Mutations of Dax1 gene (orphan nuclear receptor) cause adrenal hypoplasia.

An explicit sexual dimorphism is exhibited in avifauna. Sex determination in honeybees and birds differs significantly from humans. In humans X chromosome and the Y Chromosome are present, while in birds, it is Z chromosome and the W chromosome. Male birds are homogametic because all sperm of male birds carry 100% Z chromosome. But in the case of females, they are heterogametic because 50% ova contain Z and 50% contain W. In the sex determination of birds, ZZ conditions while one Z is associated with bar body formation. In the Z chromosome, the presence of the DMRT1 gene indicates, the species will be male. DMRT1 gene is an important gene that promotes the formation of the testis. The presence of FET1 gene in the W chromosome indicates the species will be female.

Haplodiploid sex determination is observed in the honey bee, where males are haploid and females are diploid. In the honey bee, 16 chromosomes are present, so the fertilized egg has 32 chromosomes and the unfertilized egg has 16 chromosomes. In the honey bee, Csd genes play an important role, and these genes contain more than 20 alleles. The Csd gene has a splicing factor that helps to regulate sex determination of female honey bees. The Fem protein controls the Amdsx gene, which assists sex determination in honey bees. The csd, fmn, Amdsx genes cascade enciphers a protein which have Arg- Ser rich region. Besides this Fem protein supports embryonic female honey bee development.