Studies in Spermatogenesis (1905), by Nettie Maria Stevens

By: Cox, Troy

Keywords: chromosomal sex determination

Studies in Spermatogenesis is a two volume book written by Nettie Maria Stevens, and published by the Carnegie Institution of Washington in 1905 and 1906. In the books Stevens explains the research she conducted on chromosomal sex determination in the sperm and egg cells of insect species while at Bryn Mawr College, near Philadelphia, Pennsylvania. Studies in Spermatogenesis described early examples of chromosomal XY sex determination.

Studies in Spermatogenesis described research on the generation of sperm cells (spermatogenesis) and their role in the fertilization of egg cells. Like much of the work conducted in genetics at the beginning of the 1900s, Stevens's research was influenced by two events at the turn of the twentieth century. The first was the rediscovery of Gregor Mendel's theories of inheritance in the late 1890s that revitalized the field of genetics. Mendel, who worked in Europe in the mid nineteenth century, developed a law of heredity that provided a framework to explain how a parent could transfer traits to its offspring, even though researchers couldn't describe the the genetic materials that carried these traits. From 1902 to 1903 Walter Sutton at the University of Kansas, under the supervision of Theodor Boveri in Würzburg, Germany independently worked to identify this unknown genetic material. Sutton and Boveri concluded that chromosomes, the rod-shaped structures located inside the nucleus of every cell, are the genetic material of inheritance, providing a matter for Mendel's Laws.

In 1902 McClung published "The Accessory Chromosome--Sex Determinant?" In this article, McClung theorized that an odd number of chromosomes found in insects from some species formed a basis of sexual determination by which an extra chromosome caused cells to differentiate differently than normal. McClung's hypothesis influenced Stevens's work as each insect she studied for chromosomal sex determination in Lawrence, Kansas.

Prior to Stevens's work, two theories emerged to explain sex determination. The first attributed the effect to environmental conditions, which according to some researchers caused the developmental fates of the embryo. The second ascribed sex determination to the internal factors of organisms, such as the cytoplasm or nucleus of the egg. Stevens's research was part of the internalist approach, and she focused on chromosomal differences in sperm cells. Stevens's research on the chromosome contained in sperm cells stemmed from research on accessory chromosomes conducted a few years earlier by Clarence Erwin McClung, a former teacher of Sutton, at the University of Kansas in Lawrence, Kansas.

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Studied in Spermatogenesis has two parts. Part I, published in 1905, begins with a reference to McClung's theory of accessory chromosomes and states the need to further investigate the theory as a potential sex determination mechanism. Stevens next introduces five insects previously unstudied for sex determination: termite (Zoötermopsis angusticollis), sand cricket (Stenopelmatus), German cockroach (Blattella germanica), mealworm (Tenebrio molitor), and aphid (Aphis oenotherae). Stevens describes the methods used to microscopically view the testes of each insect. Stevens details her results for the individual stages of spermatogenesis and for the presence or absence of accessory chromosomes for each insect. The results also reference figures that are present at the end of the book, providing visual representations of the results. Stevens concludes each section with a summary of the important observations made for each particular insect. Part I concludes with a general discussion of each insect in relation to McClung's hypothesis and reiterates the importance of the findings in Tenebrio molitor, namely that in both somatic and sex cells, one particular chromosome was smaller in male cells than the corresponding chromosome in female cells.

In Part II of Studies in Spermatogenesis, published in 1906, Stevens further discusses her studies on XY sex determination. Stevens focuses on beetles, specifically the species Tenebrio molitor. Stevens searched for similar sexual differentiation mechanisms in species similar to T. molitor to confirm sex determination by a distinct chromosomal element. She identifies nineteen species belonging to eight different families in which sex determination is identified by a small chromosomal element similar to T. molitor.

Stevens devotes a much of Studies in Spermatogenesis to her work with the mealworm by describing both the germ cells.
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