DNA and X and Y Chromosomes

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Object is a digital image that represents how DNA partly constitutes a Y-chromosome. Image shows different parts of an unbroken strand that begins with the smallest parts on the left side of the image, and eventually forms the Y-chromosome on the right side of the image, so that the chromosome looks like a kite with a long tail. On the left side of the image, a DNA double helix is enlarged to reveal the paired nucleotides within. The width of the helix is 2 nanometers. As the helix continues to the right, it bends downwards, and it gets smaller and seemingly further way from the viewer. It starts to wrap around sets of histones, each histone represented as an orange ball. The sets of histones clump together to form a row of larger orange balls, a row called the nucleosome that is visible at 10 nanometers. The nucleosome continues to the right of the image, eventually forming rows of three groups of nucleosome balls with DNA coiled around them. Those rows are called the tight helical fiber, visible at 30 nanometers. The fiber bends upwards in the image, spinning itself into the supercoil visible at 200 nanometers. The supercoil continues upwards in the image, getting smaller and seemingly further away from the viewer, until it connects with the Y-chromosome, which is visible at 1,400 nanometers and is the supercoil bunched up to form the structure of the chromosome, which has two chromatid arms to form its bottom and one on its top. For comparison, next to the Y-chromosome is an X-chromosome, which has to chromatid arms on top and two on bottom, all of which are longer than those of the Y-Chromosome. In the bottom right part of the image is an inset box, which represents an animal cell that is colored teal. A scale bar indicates that the cell is 100 micrometers in diameter. A portion of the cell is cut away to reveal the nucleus within. A red box around a portion of the nucleus indicates that the chromosomes exist in the nucleus.

Y-chromosomes exist in the body cells of many kinds of male animals. Found in the nucleus of most living animal cells, the X and Y-chromosomes are condensed structures made of DNA wrapped around proteins called histones. The individual histones bunch into groups that the coiled DNA wraps around called a nucleosome, which are roughly 10 nano-meters (nm) across. The histones bunch together to form a helical fiber (30 nm) that spins into a supercoil (200 nm). During much of a cell's life, DNA exists in the 200 nm supercoil phase. But when DNA replicates itself, supercoils condense further into visible chromosomes with diameters of about 1400 nm. The X- and Y-chromosomes carry the genetic information that determines the sex of many types of animals. The Y-chromosome contains a gene called the sex-determining region Y, or the SRY gene in humans. If a fertilized egg, called a zygote, has the SRY gene, the zygote develops normally into an adult organism with male sex traits. Zygotes without the SRY gene develop to have female traits. Zygotes with Y-chromosomes but mutated SRY genes can develop into adult organisms that have female traits.