



Snips and Snails, Puppy-dog Tails, X and Y... What really makes a Man?

CLARISSA GARDNER

Ever heard of the nursery rhyme “What are Little Boys Made Of?”? There was a time when it was the go-to explanation parents could give their inquisitive children when asked the awkward question about... um... certain private body parts. However the curiosity, for some, doesn't end in childhood. The science of what makes a boy or a girl is still a very popular area of biology, with a lot of focus on what makes a man a man, because of this mysterious thing called a Y chromosome.

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CORRESPONDENCE:

c.gardner@se12.qmul.ac.uk

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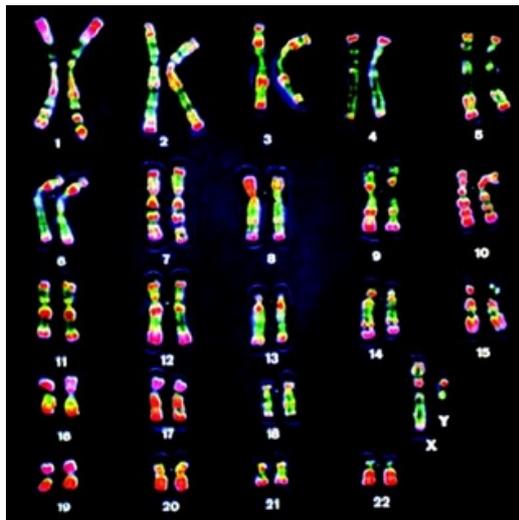


Image: 22 Chromosome Pairs and the XY Sex Chromosomes in Males. © CNRI/SCIENCE PHOTO LIBRARY



Once Upon a Time...

We all know that humans contain 23 pairs of chromosomes with one pair from mum and the other from dad. One of those pairs determines whether you are a male or female and these are known as sex chromosomes. Women have XX sex chromosomes whereas men have XY sex chromosomes.

In the early stage of human development in males, it takes approximately 8 weeks for genes on the Y chromosome to trigger a series of biological events that override female development. While there is

still research interest into the control of this process, recent work has gone into identifying the origin and evolution of the Y chromosome in mammals. What events led to the Y chromosome looking and behaving so differently to the other chromosomes?

The New Verse...

An article published, in Nature last year, outlines the work of scientists at the Centre for Integrative Genomics at the University of Lausanne, Switzerland. They traced the evolution of the Y chromosome across 15 major classes of mammals including placental mammals (mammals like us that give birth), marsupials (such as kangaroos) and monotremes (egg-laying mammals, including the platypus). To compare the evolution of the Y chromosome they looked at the evolution of the W chromosome in birds, where female birds are ZW and males are ZZ.

They identified three separate origins of the Y chromosome in mammals. The Y chromosome in marsupials and placental mammals originated from non-sex chromosomes (autosomes) in their common ancestor approximately 180 million years ago. Monotremes have multiple X and Y chromosomes, with the first of the 5 Y chromosomes independently originating approximately 180 million years ago. The W chromosome originated approximately 140 million years ago in the ancestor of birds and mammals and shares some similarities with the monotreme sex chromosomes.

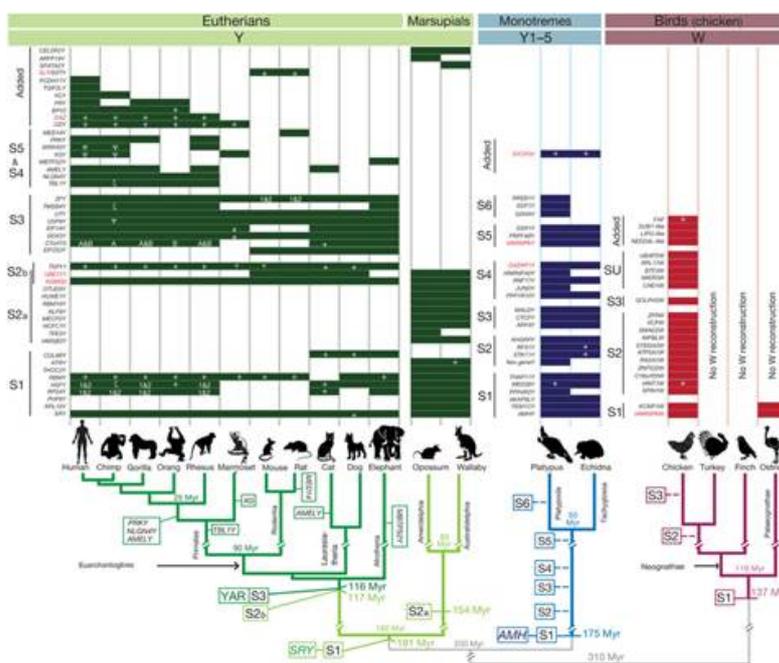


Image: The evolution of the Y chromosome across 15 major classes of mammals, and birds. CREDIT: Cortez et al, 2014.

The fact that the Y chromosome is full of repetitive DNA has made it difficult to analyse, which makes studies such as these very important because they show that it is possible to obtain information from this mysterious chromosome.

The End...?

The origin and evolution of the Y chromosome provides scientists with a better understanding of how

determining the sex of an individual has changed across different animal types as well as provided information about which genes are responsible for particular phases of sexual development. Although, after reading this, the next time a child asks you “What makes a boy a boy?” or “What makes a girl a girl?” you might just want to stick with the nursery rhyme!

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Diego Cortez. "Origins and functional evolution of Y chromosomes across mammals." *Nature*, 2014: 508; 488–493. doi: [10.1038/nature13151](https://doi.org/10.1038/nature13151)

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