

# The Disappearance of the Y Chromosome

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## Key points:

- Introduction
- Evolutionary history
- Implications of loss of Y chromosome on male health
- Conclusion

### Introduction

The Y chromosome is the sex chromosome fundamentally responsible for primary male sex characteristics, A few vital genes necessary for spermatogenesis(ensuring male fertility) And the SRY gene, which activates male development during embryogenesis(Leading to the development of the testes).According to recent studies, compared to its counterpart, the X chromosome, the Y chromosome has lost about 97% of its original gene content since it stopped recombining, leading to its degeneration. <sup>1</sup>

### Evolutionary history:

The Y chromosome has undergone a remarkable evolutionary transformation since its divergence from an ancestral autosome shared with the X chromosome around 300 million years ago. According to Subirni and turner differentiation between the two genes began after mutations in the SOX3 gene, giving rise to the SRY gene. The Y lost the ability to undergo recombination with the X chromosome along most of its length, a change that led to the progressive loss of genetic material due to accumulating mutations and genetic decay.<sup>2</sup> The Mammalian Y chromosome today has shrunk significantly and now retains only about a third of its original size and gene content. The Amami spiny rats gained attention 50 years ago for having lost its Y chromosome, the leading theory regarding this is that

the SRY gene migrated from the original Y chromosome to a different chromosome, similar to men with XX karyotype. Natural loss of the Y chromosome demonstrates that under certain evolutionary pressures, mammals can survive and reproduce without a

Y chromosome, challenging the long held belief that it is absolutely necessary for male development. The Amami Spiny rat provides a real world model for studying what might happen if the Y chromosome were to disappear in other species, including humans.

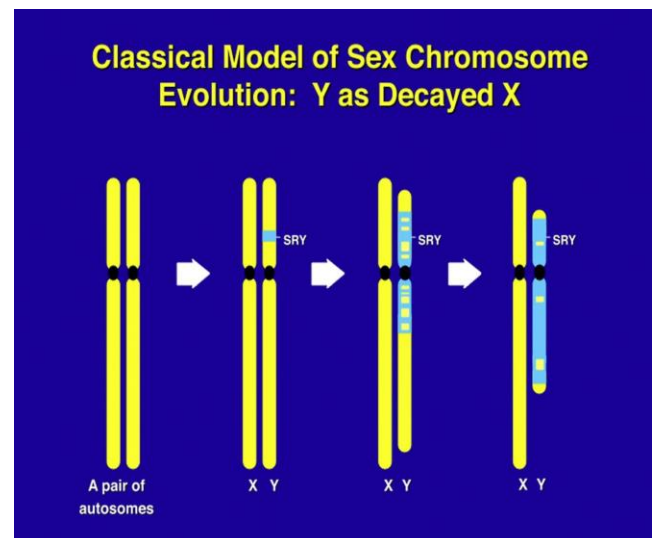


Figure 1: Y as Decayed X.

## Implications of the loss of Y on male health

Degradation of the Y chromosome can have significant consequences of male health, especially because many of the remaining genes on the Y are involved in spermatogenesis, testicular function, and immune regulation. In some men, particularly with aging, a condition known as mosaic loss of the Y chromosome can occur (LOY). Where a few blood cells lose the Y chromosome over a period of time. As documented in the LOY has been linked to An increased risk of Alzheimer's disease.<sup>4</sup> Its also linked to cardiovascular issues and an overall reduced quality of life, as loss of Y chromosome results in lower levels of testosterone, which is known to cause depression in males. Conclusion:

The Y chromosome has gone through significant changes over millions of years. While some animals have managed to survive without it, the Y chromosome in humans still plays an important role in sex determination, sperm production, and overall male health. If it were to disappear completely, it could lead to serious issues with reproduction and increased health risks for men. Understanding its function and monitoring its stability is important because its loss would not be a small or harmless change, it could have a major impact on human biology.

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