

Why men (and other male animals) die younger: It's all in the Y chromosome

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Credit: Chris F from Pexels

According to popular theory, men live shorter lives than women because they take bigger risks, have more dangerous jobs, drink and smoke more, and are poor at seeking advice from doctors.

But research by scientists at UNSW Sydney suggests the real reason may

be less related to human behaviour and more to do with the type of [sex chromosomes](#) we share with most animal [species](#).

In a study published today in *Biology Letters*, researchers from UNSW Science's School of Biological, Earth and Environmental Sciences analysed all available academic literature on sex chromosomes and lifespan—and they tried to establish whether there was a pattern of one sex outliving the other that was repeated across the animal kingdom.

Unguarded X hypothesis

Specifically, they wanted to test the 'unguarded X hypothesis' which suggests that the Y chromosome in heterogametic sexes—those with XY (male) sex chromosomes rather than XX (female) sex chromosomes—is less able to protect an individual from harmful genes expressed on the X chromosome. The hypothesis suggests that, as the Y chromosome is smaller than the X chromosome, and in some cases absent, it is unable to 'hide' an X chromosome that carries harmful mutations, which may later expose the individual to health threats.

Conversely, there is no such problem in a pair of homogametic chromosomes (XX), where a healthy X chromosome can stand in for another X that has deleterious genes to ensure those harmful genes aren't expressed, thus maximising the length of life for the organism.

First author on the paper and Ph.D. student Zoe Xirocostas says that after examining the lifespan data available on a wide range of [animal species](#), it appears that the unguarded X hypothesis stacks up. This is the first time that scientists have tested the hypothesis across the board in animal taxonomy; previously it was tested only within a few groups of animals.

"We looked at lifespan data in not just primates, other mammals and

birds, but also reptiles, fish, amphibians, arachnids, cockroaches, grasshoppers, beetles, butterflies and moths among others," she says.

"And we found that across that broad range of species, the heterogametic sex does tend to die earlier than the homogametic sex, and it's 17.6 percent earlier on average."

Birds, butterflies and moths

Interestingly, the researchers observed this same pattern in the classes of animals possessing their own unique pair of sex chromosomes that are the reverse of all other animals. In birds, butterflies and moths, it is the male of the species that has the homogametic sex chromosomes (denoted by ZZ) while the female has the heterogametic [chromosomes](#) (ZW). Female birds, butterflies and moths were usually found to die earlier than their [male counterparts](#), giving credence to the unguarded X hypothesis—although strictly speaking, it's an unguarded Z in this case.

But while this study confirms that the unguarded X hypothesis is a reasonable explanation for why one sex outlives the other on average, there was one statistic that emerged from the data that took Ms Xirocostas by surprise.

"We found a smaller difference in lifespan between the males and females in the female heterogametic species compared to males and females in the male heterogametic species," she says. "In species where males are heterogametic (XY), females live almost 21 percent longer than males. But in the species of birds, butterflies and moths, where females are heterogametic (ZW), males only outlive females by 7 percent."

Simply put, heterogametic males (XY) die sooner than heterogametic females (ZW) when compared to the opposite sex in their species. Does

this mean there is something still fundamentally life-shortening about being a male member of any species?

Ms Xirocostas thinks this could be the case, and lists side effects of sexual selection, the degree of Y chromosome degradation and telomere dynamics as possible explanations for this surprising trend.

"I was only expecting to see a pattern of the homogametic sex (XX or ZZ) living longer, so it came as an interesting surprise to see that the type of sex determination system (XX/XY or ZZ/ZW) could also play a role in an organism's longevity."

Ms Xirocostas says future studies of this phenomenon should test a hypothesis raised in the paper that the difference in lifespan between sexes is proportional to the difference in chromosome length between sexes, which could help us further understand the factors affecting ageing. But for now, she believes, the unguarded X hypothesis stands.

More information: Zoe A. Xirocostas et al. The sex with the reduced sex chromosome dies earlier: a comparison across the tree of life, *Biology Letters* (2020). [DOI: 10.1098/rsbl.2019.0867](https://doi.org/10.1098/rsbl.2019.0867)

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