

Why do women go through menopause? Science offers a new solution to an old puzzle

Passing on our genes to the next generation is the key process in evolution that happens through natural selection. So why do women suddenly lose the ability to have children when they have at least a third of their lives left to live? It makes no sense, which is why it has been called a “Darwinian puzzle” – an aspect of biology that appears to be at odds with natural selection.

There are many competing hypotheses for why this may be the case, but so far there is no generally accepted theory. In our recent study we evaluated and combined two of the main hypotheses to come up with something new. We suggest that menopause started off by chance but was later driven by the opportunity it gave women to care for their grandchildren.

The two leading and most common hypotheses for the evolution of menopause, or 'post-reproductive lifespan, are the so-called 'grandmother hypothesis' and the 'reproductive-somatic mismatch hypothesis'.

In the grandmother hypothesis, females can gain benefits from stopping reproduction long before they die by helping to care for their existing children (or grandchildren) instead of producing more, which helps their descendants to survive. Alternatively, benefits can come from taking over the childcare duties of their grandchildren, meaning their children are able to have more offspring than they could otherwise. Of course, both their children and grandchildren will carry their genes.

Previous work has suggested that sons staying at home with their mothers, while daughters disperse to new groups, might promote the menopause in a mother by altering the number of relatives surrounding her as she ages. Consider an ancestral woman who leaves home to marry into a new family. At first, she doesn't have any relatives in her new tribe, but as she gets older her sons stay in her tribe, marry, and start to have children. She is now surrounded by relatives and benefits from ceasing to have children herself and focusing on helping her sons with the grandchildren.

On the other hand, the mismatch hypothesis suggests that there is no adaptive benefit to menopause. So how then can a trait evolve if there is no benefit? The answer, according to the mismatch idea, is that the best option for an animal is to finish all of its potential reproduction and childcare around the time it dies. However, just in the same way that car parts wear out at different rates, some body parts can also wear out faster than others. When the reproductive system wears out first, it will lead to menopause as a by-product. It could therefore be a result of us living longer – it is possible that many of our ancestors didn't live long enough to experience menopause as we do.

Our results suggest that both mechanisms have had influence. Whether or not the females of a

species stop reproducing early seems to be down to chance, following the mismatch hypothesis. However, once some period of menopause exists in a species, the tendency of sons to remain close to home does seem to provide a benefit to females. The grandmother hypothesis predicts that longer periods of menopause will evolve in a species when females live away from their birth place, which was exactly what we found in the data. There is some evidence that this in turn leads to a longer proportion of post-reproductive lifespan and also leads to a larger proportion of the population experiencing menopause.

Our new research therefore unites previously competing ideas by giving an order in which the two ideas act under a scenario we've called "non-adaptive origins followed by evolutionary tinkering".

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Publication

[Patterns of philopatry and longevity contribute to the evolution of post-reproductive lifespan in mammals.](#)

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