IMPROVED DNA REPAIR IN LONG-LIVED BOWHEAD WHALE

A study on the bowhead whale, the second-largest mammal and one of the longest-lived (>200 years), shows that extreme longevity can result from exceptionally efficient and accurate DNA repair (1). Bowhead cells exhibit enhanced homologous recombination and non-homologous end joining, highly faithful double-strand break repair, and markedly reduced mutation accumulation. A key player is CIRBP, which is expressed at unusually high levels and promotes DNA-end protection and precise repair. Instead of eliminating damaged cells through apoptosis, bowheads preserve them by repairing DNA, limiting genomic instability, inflammation, and cancer risk.

This complements findings in the naked mole-rat (2; see earlier post), where evolutionary changes in cGAS boost homologous recombination and delay aging. Although the molecular solutions differ, both species converge on the same principle: improved DNA repair extends health span and delays aging. By contrast, elephants use a different strategy — multiple TP53 copies — to enhance apoptosis.

The study also addresses Peto's paradox: large, long-lived animals were expected to accumulate more mutations (since many arise during DNA replication), yet whales display lower mutation rates, showing that exceptional genome maintenance can solve this paradox.

Overall, these convergent findings reinforce the concept that the progressive accumulation of mutations is a central driver of aging.

1. https://www.nature.com/articles/s41586-025-09694-5
2. https://www.ncbi.nlm.nih.gov/pubmed/41066557