THE EVOLUTION OF ENDURANCE RUNNING IN HORSES

Castiglione et al.[1] published a paper describing how horses evolved exceptional endurance due to a surprising genetic twist.

A mutation in the KEAP1 gene, which would normally stop the production of a crucial protein, instead gets recoded into a functional version with an extra cysteine residue. This rare genetic “read-through” boosts the horse’s NRF2 antioxidant response, helping cells resist damage from reactive oxygen species (ROS) generated during intense exercise. As a result, horses can produce ATP faster and more efficiently, powering their muscles and enhancing their ability to perform sustained, high-intensity activities. This molecular advantage allowed horses to thrive as endurance animals, evolving from small, dog-sized ancestors into the powerful runners.

Similarly, humans evolved to be excellent endurance runners, a trait crucial to early survival strategies like persistence hunting. This evolutionary pressure triggered a cascade of changes:

- Loss of body fur to allow better cooling through sweating,
- followed by darkening of the skin to protect against UV radiation, effectively replacing the protective role of fur.

These changes not only enabled efficient heat regulation during long-distance running but also had profound effects on human physiology, skin biology, and even social behaviors.

1. https://www.science.org/doi/10.1126/science.adr8589