Why Males and Females Differ in Size: Unpacking the Evolution of Body Size in Tetrapods

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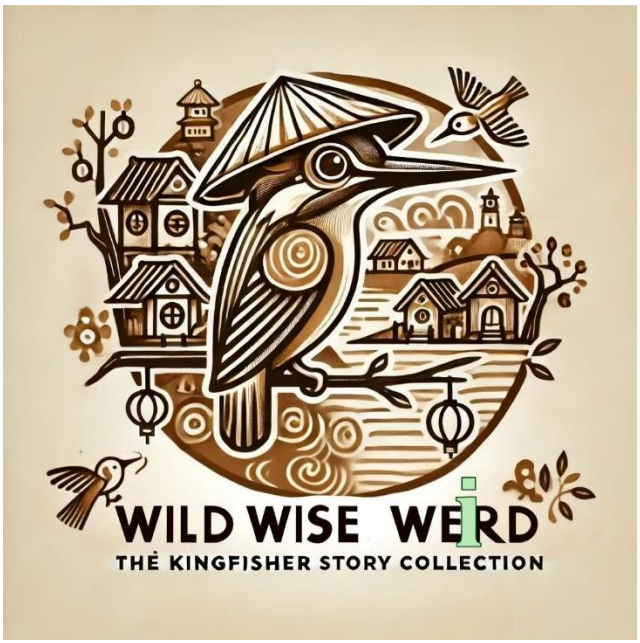

> “Kingfisher believes he isn’t asking for too much, really; all he wants is to have Owl’s deft brushstrokes render his look more aesthetically pleasing. He wants the portrait to present a stronger, bolder, and even more spirited Kingfisher. A more muscular body, sharper eyes, and a slightly smaller but still sharp beak. For sure, every feature that is deserving of the King Bird title.”
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> In “The Most Beautiful Bird”; *Wild Wise Weird* [1]

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Why are male lions larger than females, while in some frog species, females significantly outweigh their male counterparts? This phenomenon—known as sexual size dimorphism (SSD)—is common across the animal kingdom [2,3]. A new global study published in *Nature Ecology & Evolution* sheds light on the evolutionary origins of SSD by analyzing body size changes in over 11,000 tetrapod species, including mammals, birds, amphibians, and reptiles [4].

The researchers discovered that directional changes in body size across evolutionary time are central to understanding present-day SSD patterns. Notably, size changes occurred more frequently in males than in females, even in species where females are the larger sex. This finding suggests that males often experience stronger evolutionary pressures on body size—likely driven by sexual selection, such as competition for mates or mate choice dynamics.

However, the evolutionary trajectories of SSD are far from uniform. Amphibians typically display female-biased SSD, with females being, on average, 75% heavier than males. In contrast, mammals more commonly exhibit male-biased SSD, where males are approximately 13% heavier than females. Birds and squamates (lizards and snakes) show more balanced or variable patterns.

To disentangle the mechanisms behind these trends, the researchers employed a sophisticated statistical approach—the Fabric model—which tracks sex-specific evolutionary changes in size [5]. Their analyses revealed that different groups evolved SSD through distinct pathways. For example, in mammals, female-biased SSD often arises from a reduction in male size, whereas in amphibians, male-biased SSD tends to result from an increase in male size. These findings highlight that SSD can evolve through size increases, decreases, or a combination of both across sexes, emphasizing the diverse selective pressures shaping body size evolution in animals.

These findings challenge long-standing assumptions that SSD arises solely from selection acting on one sex. Instead, the study reveals that both males and females frequently undergo evolutionary changes in body size—sometimes in opposing directions or to differing degrees—leading to the wide variety of SSD observed across species. While female body size is often shaped by fecundity selection, where larger females may enhance reproductive output, changes in male size appear more commonly driven by competitive pressures associated with mating success.

This research underscores the complex interplay between natural and sexual selection in shaping evolutionary outcomes. The evolution of SSD is not governed by a singular mechanism but rather emerges from a dynamic combination of ecological, behavioral, and reproductive factors acting asymmetrically on each sex. By illuminating these nuanced evolutionary pathways, the study enriches our understanding of the nature that may have implications for humans—emphasizing that the diversity of life forms we observe today is a product of intricate, sex-specific responses to the fundamental forces of survival and reproduction [6].

References

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