Digest: A replication of sexual dimorphisms in size and longevity in a simulated baboon population*

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Sexual selection, which arises when individuals of one sex compete with each other to secure mates and produce offspring, has the power to create sex differences in not only physical characteristics, but also complex life-history traits such as longevity. In species with sexual selection, males tend to have shorter life spans than females (Clutton-Brock and Isvaran 2007). A short life span means less time for reproductive opportunities, suggesting that a short life span would only be selected for if it is accompanied by a fitness benefit—or if there are fitness costs associated with long life spans.

The disposable soma theory states that aging is the cause of accumulated damage to the body’s many systems (Kirkwood 2008). An individual can repair this damage, but doing so expends energy that might be better used in behaviors that directly enhance fitness, such as competing for mates. Each species has found its own optimal trade-off between body repair and investment in other functions.

In this issue, King et al. (2017) quantitatively test whether sexual selection may underlie differences in energy allocation and therefore differences in life span between male and female savannah baboons. Baboons have sexual dimorphisms that suggest an energetic trade-off is at work: males are significantly larger; females live significantly longer. Females provide nearly all offspring care, whereas males compete for access to female mates. Males’ reproductive success depends on their ability to monopolize access to estrous females, and size confers a huge advantage when challenging and defending against other males (Plavcan and Van Schaik 1997). According to disposable soma theory, to maximize fitness, males prioritize growth and engage in repeated conflicts without expending much energy to repair their bodies, resulting in reduced longevity.

King et al. (2017) test the theory with a combination of evolutionary game theory and stochastic dynamic programming to determine optimal energetic decisions in a simulated population of baboons. Drawing on the rich baboon literature, the authors programmed a series of equations to simulate ecological and behavioral factors including sources of mortality, foraging yield, distance traveled, and fighting ability. The model succeeded in replicating sex differences in size and longevity, as well as phenomena seen in wild baboons: subadult males’ growth spurts, females’ gain and loss of weight that accompanies pregnancy and lactation, and a gradual decline in size during later adulthood among both sexes. Moreover, the model was robust to perturbations in the authors’ chosen parameters, as well as constraints on population growth.

The authors’ simulation supports the disposable soma theory but cannot exclude other explanations. For example, unlike the doubled X chromosome of females, males’ single X and Y chromosomes might be more susceptible to deleterious mutations, which could cause early mortality (Austad 2006). It has also been argued that size dimorphisms can be accounted for by natural selection, and to remain parsimonious, models should seek to explain sex differences with natural selection before invoking sexual selection (Cassini 2017). Ultimately, the correspondence between the authors’ results and real world observations is impressive, but computational limitations in their sensitivity analyses...
and theoretical conflicts mean that additional modeling and tests against other theories are required.

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