With oxytocin, old muscles act like new

As we age, the ability of our tissues to maintain homeostasis and to repair themselves declines, eventually leading to organ degeneration and failure. Aging of muscle tissue is characterized by deficient muscle regeneration after injury and by altered muscle function and associated atrophy, known as sarcopenia. Some previous work suggests that the age-related decline in regenerative capacity of skeletal muscle can be reversed by exposing tissue from an older animal to the circulatory system of a younger animal, but the circulatory components underlying the reversal have not been identified. Now, researchers from the University of California, Berkeley, led by Irene M. Conboy, report that oxytocin can improve muscle regeneration in older mice. They show that plasma oxytocin concentration and the number of oxytocin receptors in muscle stem cells both decline with age in mice. Furthermore, administration of oxytocin to old mice restores muscle regeneration by improving the function of muscle stem cells. Conboy's team suggests that regulation of oxytocin levels could be helpful in preventing age-related declines in muscle tissue maintenance and repair, although the amount of oxytocin required to maintain healthy tissues is not yet known.

The researchers evaluated the effects of oxytocin in both young and old mice. First, they injected mice subcutaneously with oxytocin and assessed healing after muscle injury. Oxytocin administration improved muscle healing in old mice but had no effect in young mice (*Nat. Commun.* **5**, 4082; 2014). Next, they used an oxytocin antagonist to inhibit oxytocin signaling in young mice and found that blocking the effects of oxytocin markedly compromised muscle regeneration. Finally, they examined muscle development and function in knockout mice that lacked the gene encoding oxytocin. When these mice were young, their muscle mass and regenerative ability were similar to those of wild-type mice, indicating that the lack of oxytocin did not affect muscle development. But when the knockout mice reached adulthood, they showed signs of premature aging and sarcopenia.

Michael Dwyer/Alamy

Taken together, the results indicate that oxytocin supports muscle maintenance and repair and that age-related reductions in oxytocin contribute to sarcopenia. These findings suggest that treatment strategies involving the manipulation of oxytocin could be beneficial in combating muscle deterioration in the elderly. "Aging is a natural process," Conboy states in a press release, "but I believe that we can meaningfully intervene with age-imposed organ degeneration, thereby slowing down the rate at which we become progressively unhealthy."

Monica Harrington

THE SOCIAL BENEFITS OF CONCEALING ILLNESS

Animals have evolved behavioral and physiological responses, known as 'sickness behaviors,' that increase survival from infection. These behaviors, which include lethargy, somnolence and anorexia, are not caused by the infectious agent itself but are induced by the central and peripheral release of cytokines in response to a disease agent. Such behaviors are exhibited throughout the animal kingdom and have been observed in invertebrates as well as vertebrates including amphibians, reptiles, birds and mammals.

Sickness behaviors are believed to be adaptive. When sick, animals reorganize their priorities and adjust their behaviors in order to improve their chances of recovering from infection: an overall reduction in activity preserves metabolic resources that can be reallocated to fighting the infection, whereas anorexia reduces the availability of nutrients essential for bacterial growth. But sick animals must also weigh the benefits of such behavioral adjustments with the potential costs to their reproductive fitness.

In a recent issue of *Proceedings of the Royal Society B*, Patricia Lopes (University of Zurich, Switzerland) reviews studies of rats, mice, guinea pigs, zebra finches, sparrows, domestic pigs and rhesus monkeys that show how a diversity of social contexts can act as modulators of the sickness behaviors exhibited by these animals (**281**, 20140218; 2014). Across these species, animals modulate the expression of these behaviors when in the presence of mates, offspring, mothers or intruders, as well as in group-housing contexts, in order to minimize the costs to their reproductive success.

Lopes suggests that the ability to modulate symptoms of illness according to the social context appears to be adaptive. Appearing less sick might allow the animals to keep their social position in the group, preserve mating opportunities and increase the survival of the offspring that depend on them. On the other hand, not engaging in behaviors that allow the body to more easily fight infection could have damaging effects on health.

Lopes also notes that although engaging in appropriate social interactions while sick can increase individual fitness, it also creates increased opportunities for disease transmission. Furthermore, because the expression of sickness behavior can be modified in certain social circumstances, it may not always be possible for veterinarians to identify sick animals in captive animal populations. She suggests that veterinarians and animal facility managers could benefit from improved understanding of the modulation of sickness behaviors in order to improve the health and management of animals in captivity and control the spread of disease in captive populations.

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