

Press release**Max-Planck-Institut für Ornithologie****Dr. Sabine Spehn**

11/28/2018

<http://idw-online.de/en/news706895>Research results
Biology
transregional, national**Great tits detox at the expense of a lower life expectancy**

Some males of great tits that faced higher energetic costs during their reproductive phase upregulated the concentration of an enzyme important for detoxifying free radicals. Together with other physiological reactions like the loss of weight and a higher level of stress hormones, harder-working birds compensated higher energetic demands in a way that had no direct consequences for their offspring or their own survival. This is what researchers of the Max Planck Institute for Ornithology have found. However, birds with a higher concentration of the enzyme had a lower overwinter survival. This seems to be the physiological key mediating the trade-off between reproduction and survival.

The reproductive investment of parents consumes a lot of resources and energy and therefore might affect the survival of the individuals. The underlying physiological processes that mediate this trade-off between reproductive investment and survival, however, are still being discussed. Researchers of the Max Planck Institute for Ornithology in Seewiesen have now designed a study to test two potential mediating systems. One is the endocrine system, especially stress hormones that mobilize short-term energy resources in the body to support the increased metabolic needs. The second is the redox system, counterbalancing high concentrations of reactive oxygen species that cause oxidative stress and damage cells. An increase in metabolic rate leads to the increase of an enzyme called GPx, which is directly involved in detoxifying intra-cellular hydrogen peroxides.

In their study, Stefania Casagrande and Michaela Hau from the Max Planck Institute for Ornithology in Seewiesen increased the workload of some parenting males by clipping three feathers on each wing. This treatment is comparable to the increased flight costs the birds have during molt. The feathers regrew within a few weeks. Despite the treatment, males were still able to maintain their initial number of feeding trips to the nest and the researchers were able to study the physiological effects on an individual level.

The researchers found that feather-clipping had no effect on the reproductive success or survival of the treated males. However, it induced changes in three physiological parameters: Five days after the treatment, the feather-clipped males had lost three percent of their body mass compared to control males and were more likely to upregulate both, the level of stress hormones and the concentration of the enzyme GPx in the blood. "The loss of weight was a response of the body to the increased level of the stress hormones", explains first-author Stefania Casagrande. "It had no effect on the nest visit rates of the individuals and they survived as well as the other birds". However, birds that upregulated the concentration of the enzyme GPx were less likely to survive the next winter. "Treated birds were more likely to upregulate the concentration of this enzyme in the blood, but this happened naturally also in some untreated birds", says Casagrande. So mounting a strong antioxidant defense seems to be a costly process. "Male great tits found different ways to cope with the metabolic challenge of reproduction, but the 'detox' strategy had consequences related to long-term-survival", summarizes Michaela Hau, research group leader in Seewiesen.

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Original publication:

Casagrande Stefania & Hau Michaela 2018. Enzymatic antioxidants but not baseline glucocorticoids mediate the reproduction–survival trade-off in a wild bird. *Proceedings of the Royal Society B*, online November 28, 2018 (<http://dx.doi.org/10.1098/rspb.2018.2141>)



Males of great tits facing higher energetic costs during their reproductive phase loose weight and upregulate the concentrations of stress hormones and an enzyme important to detoxify free radicals
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