# Do hormones dictate breeding success in birds?

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(PhysOrg.com) -- Some animals produce more offspring than others do. Hormones like prolactin and corticosterone can exercise a crucial influence on the behaviour of birds in the breeding season and therefore on their reproductive success. Scientists from the Max Planck Institute for Ornithology in Radolfzell and their colleagues at the universities of

Princeton and Edinburgh have now demonstrated that hormone levels not only play a key role during the breeding season, but already dictate, long in advance, how many eggs a breeding pair will lay, when they will lay them and how often. An animal's hormonal constitution is thus of major significance for its reproductive success, and is possibly an important driving force of evolution.

Considerable variance can be observed in the numbers of offspring produced by the members of bird species. Moreover, different individuals within a species embark on the mating and breeding processes at different times. Hormones, the minute messenger molecules that have significant effects on organisms, can assume an important control function in these processes. For example, the concentration of corticosterone increases slightly when an animal is very active, as during brood care. When the bird is exposed to sudden danger and significant stress as a result, its levels rise significantly. In this situation, functions that are not important for survival, for example reproduction, may be suppressed. In contrast, the hormone prolactin stimulates the birds to invest more in reproduction; it controls the number of eggs per clutch and the intensity of brood care.

Together with their colleagues at the University of Edinburgh, Jenny Ouyang from the Princeton University and Michaela Hau from the Max Planck Institute for Ornithology examined how hormone concentrations in individual wild house sparrows (*Passer domesticus)* before and after the breeding season correlate with reproductive success. These birds often differ significantly in terms of the number of clutches they produce, the number of eggs they lay over the course of a breeding season and how many of their young become fully fledged. Because house sparrows are faithful to their habitats, very specific studies can be carried out on individual birds over an extended period.

The scientists counted the number of eggs, clutches and fledglings for

each breeding pair. They also took regular blood samples three weeks before the beginning of breeding and during the rearing of the first clutch, both in natural situations and under artificially generated stress, to determine the corresponding concentrations of the hormones corticosterone and prolactin in the birds' blood. "We were surprised that we could predict how many offspring a breeding pair would have based on hormone levels three weeks before the breeding season," reports Jenny Ouyang. "Sparrows that had low corticosterone values before the breeding season raised the most offspring. Especially birds with low values before, but high values during the season had the highest reproductive success. They apparently invested a lot of energy in the brood." In contrast, the animals that had a very strong hormonal reaction to stress fed their young less and produced fewer offspring.

According to the scientists, prolactin plays a crucial role in the timing of laying the first egg: females with higher prolactin levels started laying earlier and had more offspring as a result. "The fact that the two parents have very similar hormonal values is also fascinating for us," adds Jenny Ouyang. "It is not yet clear whether the couples influence each other's hormonal status or whether they select partners with similar hormone levels."

The results of this study enhance knowledge about the physiological mechanisms that can dictate when a bird breeds, how many eggs it produces per clutch and how often it breeds. The hormones prolactin and corticosterone, in particular, play a more important role in the regulation of individual investments before reproduction begins than was previously assumed. If an individual's hormonal constitution can be inherited, this could provide a fundamental explanation as to why some individuals produce large numbers of offspring and are more successful than others from an evolutionary perspective.

**More information:** Jenny Q. Ouyang, Peter J. Sharp, Alistair Dawson,

Michael Quetting, Michaela Hau, Hormone Levels predict individual differences in reproductive success in a passerine bird, *Proceedings of the Royal Society B*, January 19, 2011. DOI:10.1098/rspb 2010-2490 R1