

# Pair bonding reinforced in the brain

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The song of the zebra finch seems to have evolved from a simple system for innate calls. Credit: MPI f. Ornithology/ S. Seltmann

In addition to their song, songbirds also have an extensive repertoire of calls. While the species-specific song must be learned as a young bird, most calls are, as in the case of all other birds, innate. Researchers at the Max Planck Institute in Seewiesen have now discovered that in zebra finches the song control system in the brain is also active during simple communication calls. This relationship between unlearned calls and an area of the brain responsible for learned vocalisations is important for

understanding the evolution of song learning in songbirds.

Almost half of all bird species are [songbirds](#). Only they have the ability to learn complicated vocal patterns which are described generally as song. Several studies prove that the songs of songbirds serve mainly to select a partner and defend a territory. In the temperate zones of the Northern hemisphere, usually only the male birds sing.

However, all birds, both male and female, have calls - including species such as the [zebra finch](#), where the female never sings. Apart from a few exceptions, the calls do not have to be learned and are used for communication purposes.

They are mostly associated with a specific purpose as in the case of [alarm calls](#) and contact calls, for example. The songbird's song is of great interest for neurobiologists as it is controlled by a network of nuclei in the forebrain. Neuroscientists study this network to investigate general rules that determine how the [brain](#) controls behaviour.

Using specially designed methods to record song and brain activity, a team of researchers at the Max Planck Institute for Ornithology in Seewiesen has now found the neuronal basis of unlearned call communication. The researchers developed ultra-light microphone transmitters which they attached with rubber bands to the backs of zebra finch couples like rucksacks. They also attached a wireless recording system to the males to measure [brain activity](#).



The researchers record the song of the birds with microphone transmitters weighing 0.6 grams. Credit: MPI f. Ornithology/ Trost

Thanks to this miniature telemetry technology, the animals could move freely in groups in large aviaries so that the scientists were able to continuously register the animals' entire behavioural repertoire. In their experiment, the researchers concentrated on so-called "stack" calls. They discovered that these calls mainly promote cohesion between males and females within bonded pairs. "Constant contact with a partner is important, as the zebra finches live in large social groups," says Lisa Trost, co-author of the study.

Surprisingly, not every call produces an answer in the partner, which initially presented the researchers with a problem during the analysis. They determined that a call from a partner only qualifies as an answer if it is made within two seconds. "We were thus able to create a matrix that clearly showed that almost without exception the two partners exchange calls with one another, which underlines the important social component

of this 'stack' call," says Andries Ter Maat, lead author of the study.

When the researchers analysed the activity in an area of the brain that is important for the production of song – an area known as nucleus RA – they found a clear correlation between its activity pattern and the occurrence of the "stack" call. "This connection between an innate call and the activity of a brain area important to learned vocalisations suggests that during the evolution of songbirds, the role of the [song](#) area in the brain changed from being a simple vocalisation system for innate calls to a specialised neural network for learned songs," concludes Manfred Gahr, coordinator of the study.

**More information:** Andries Ter Maat, Lisa Trost, Hannes Sagunsky, Susanne Seltsmann, Manfred Gahr , Zebra finch mates use their forebrain song system in unlearned call communication , *PLoS One*, Volume 9, Issue 10, e109334

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