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Nestling odour modulates behavioural response in male, but not in female zebra finches

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Studies investigating parent offspring recognition in birds led to the conclusion that offspring recognition is absent at the early nestling stage. Especially male songbirds were often assumed to be unable to discriminate between own and foreign offspring. However, olfactory offspring recognition in birds has not been taken into account as yet, probably because particularly songbirds have for a long time been assumed anosmic. This study aimed to test whether offspring might be recognised via smell. We presented zebra finch (*Taeniopygia guttata*) parents either the odour of their own or that of foreign nestlings and investigated whether the odour presentation resulted in a change in the number of head saccades, i.e. the rapid horizontal turning of the head, with which birds scan their environment and which can be used as a proxy of arousal. Our experiment indicates that male zebra finches, in contrast to females, differentiate between their own and foreign offspring based on odour cues, as indicated by a significant differences in the change of head saccadic movements between males receiving the own chick odour and males receiving the odour of a foreign chick. Thus, it provides behavioural evidence for olfactory offspring recognition in male zebra finches and also the existence of appropriate phenotypic odour cues of the offspring. The question why females do not show any sign of behavioural response remains open, but it might be likely that females use other signatures for offspring recognition.

In birds, the lack of a detectable behavioural difference against extra pair young or intraspecific brood parasites has led to the conclusion that parents, and particularly males, lack the ability to discriminate against non-related offspring, at least at an early developmental stage of the chicks^{1,2}. Whereas nestling discrimination against inter-specific brood parasites has been shown in a few species, such as the large-billed Gerygone (*Gerygone magnirostris*) or the superb fairy-wren (*Malurus cyaneus*)^{3,4}, evidence for nestling discrimination against intraspecific brood parasites or against extra pair young is lacking. However, the absence of a behavioural differentiation, e.g. the lack of evidence for a preferential feeding of own offspring or for a reduced survival of fostered offspring¹, does not necessarily imply the absence of offspring recognition. For example, in male Siberian Jay (*Perisoreus infaustus*), aggression towards intruders correlates with the genetic distance between intruder and breeder⁵, indicating that male jays are in general able to assess relatedness of conspecifics. Nevertheless, males did not show a behavioural difference between fostered, i.e. unrelated, and own offspring⁵. Similar results are also found in other birds species, in which individuals recognise kin in certain circumstances, for example during winter flocks⁶, but do not show any sign of kin discrimination in the nest. The apparent lack of discrimination raises the question whether own offspring can not be recognised at the nestling stage. This would be in contrast to other vertebrate taxa, in which mothers recognise their offspring immediately after birth^{7–12}, based on olfactory cues. While offspring recognition in mammals is mainly based on olfactory cues, this aspect has been largely ignored as a potential mechanism for birds.

Only recently it has been demonstrated that newly hatched zebra finch hatchlings recognise their parents by olfactory cues¹³, leading to the question whether avian parents, like mammals¹⁴, are also able to recognise their offspring by smell. Though, the use of olfactory cues has been neglected in this respect, Cohen (1981) demonstrated that parents of ring doves fed artificially scented squabs less frequently than control squabs, resulting in a remarkably lower survival rate of the scented squabs¹⁵. The author also proved that the reduction in parental care was indeed due to olfactory cues. To our knowledge there is only one other study which investigated whether olfactory cues are used in nestling recognition¹⁶. In this study, spotless starling (*Sturnus unicolor*) mothers were tested for their ability to recognise their offspring based on olfactory cues. The authors presented females in a cage with two choice chambers their own chick odour and the odour of foreign chick. Females did not show any

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