ANTON CRONE

not so bird-brained

The density of neurons in birds' brains is much higher than in mammals' brains. As a result, the most intelligent birds, such as crows and large parrots, have forebrains with as many neurons as primates' forebrains, which explains their prodigious ability to solve puzzles.

It is generally assumed that relative brain size is a useful measure of cognitive ability. Support for this hypothesis comes from the greater frequency of behavioural innovations, such as exploiting novel food resources and using tools, in birds with relatively large brains. And this trait has direct evolutionary benefits. Among bird species introduced into new habitats, those with relatively large brains are more adaptable and more likely to establish new populations. Similarly, resident species tend to have larger brains than migrants, at least in part because they have to be more creative to find food in winter.

Factors correlated with relatively large brains in birds include long-term social bonds and protracted parental care. This supports the notion that social interactions are key drivers of the evolution of brain size, but it also might reflect the high cost of brain development. A recent study by Michael Griesser and colleagues (doi: 10.1073/pnas.2121467120) proposed that only chicks that receive extensive parental support can afford to develop large brains, because there is a lag before they benefit from enhanced cognitive abilities. This might explain why species with altricial chicks (hatched helpless and requiring significant parental care) generally have larger brains than those with precocial chicks.

A new study by Abraão Leite and colleagues (doi: 10.1111/ibi.13292) indicates that within passerines, variation in relative brain size can be explained in part by nest architecture. It has already been shown that birds with well-built nests have larger and more complex cerebellums than birds that build simple platform nests. Leite tested whether passerines that make more intricate nests have relatively larger brains than birds that make simple cup nests.

Interestingly, they found that whether a nest was enclosed or not was poorly correlated with brain size. Rather, the mode of attachment was more important. Birds that built nests attached laterally to vegetation or cliff walls typically had larger brains than those whose nests were only supported basally by the ground or vegetation. And birds that suspended their nests, such as weavers, had the largest brains overall. Other factors that influenced brain size in more than 450 species examined were migratory status and habitat structure; migrants had smaller brains than residents, and birds living in open habitats had smaller brains than those in dense or semi-open habitats.

The results make sense; it requires more skill to establish the first attachment points when constructing a laterally supported or suspended nest than it does to build a nest supported from below. However, one has to be cautious when interpreting these results. Relative brain size is only a crude measure of brain capacity. Different abilities reside in different parts of the brain, and ideally we should be comparing the relative size of those parts of the brain responsible for specific abilities. Unfortunately, it is difficult to obtain such data from a wide range of bird species.

Despite these findings, birds with relatively small brains are not necessarily intellectually challenged. Hummingbirds have tiny brains, both absolutely and relatively, yet they are one of only three bird lineages that learn their songs (together with parrots and the oscine passerines). Hummingbirds also have impressive spatial memories and are able to remember the location of food sources after a single visit. Although some birds struggle with simple cognitive tests, we probably should think twice before condemning someone for being 'bird-brained'!

PETER RYAN

ABOVE Weaving intricate nests and suspending them indicate a larger brain in bird species such as the Southern Masked Weaver.