Birds 'flap run' instead if flying over obstacles to save energy

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Why don't you ever see baby pigeons? For the same reason you don't see many chicks: they can't fly. It can take months for their partially developed wings and flight muscles to become airworthy, and by then the youngsters are almost fullygrown. However, long before their maiden flight, pigeon chicks probably put their developing wings to use, flapping as they run up steep branches.

Brandon Jackson from the University of Montana, USA, explains that Ken Dial and his son first noticed this strange behaviour when filming chuckar chicks negotiating obstacles: instead of flying over, the birds ran up the object flapping their wings. And when Dial discussed this behaviour with local ranchers and hunters, some described adult chukars flapping to run up cliffs. So why do adult birds flap and run up steep objects when they are perfectly capable of flying? Jackson, Dial and their colleague Bret Tobalske wondered whether pigeons might use 'flap running' to save energy, so they measured the amount of power generated by the flight muscles of flap running and flying birds and found that flap running birds use less than 10% of the energy of birds flying at the same angle. The publish their discovery in *The* Journal of Experimental Biology.

First, the team familiarised the birds with the ramps they were to ascend and trained them to fly to a perch so that they could compare the muscle power output from the flight muscle as the birds 'flap ran' and as they flew up at the same angle. Then they implanted sensors into the birds' wing and flight muscle to measure the power output and muscle activity.

Finally, the team filmed the birds as they flap ran up an almost vertical ramp (85deg) and a steep ramp at 65deg, and flew at various take-off angles to the perch.

Watching the muscle activity trace as the birds flap ran up the 65deg incline, the team could barely see any electrical activity in the flight muscle. 'We thought, "It's flapping, there must be activity," so we zoomed in on the computer screen and there was the signal, it was just over an order of magnitude smaller in amplitude,' recalls Jackson. The birds seemed to be using hardly any power to flap their wings as they ran up the slopes. And when the trio calculated the power produced by the flapping flight muscle, it was less than 10% of the power required for the bird to fly at the same angle. The flap running birds were making significant power savings in their flight muscles by flap running up slopes. The team also realised that the adults only increased their flight muscle power output by small increments as the slope angle increased.

'The basic story comes out that once you can run up a nearly vertical substrate your muscle and wings are ready to control your descent. They are ready even to fly on the level,' says Jackson. So, by building up slowly from flap running up shallow inclines to ascending steeper slopes, flap running could be an essential stage in chicks learning to fly, allowing them to build up their muscles gradually before the first take off. Jackson also adds that flap running could have been a key stage in the evolution of flight.

'At some point birds came from bipedal dinosaurs with small forelimbs that evolved into small wings,' explains Jackson. Knowing that archaeopteryx's flight muscles were probably too small to power flight, he suggests that they may have been large enough to help it flap run up steep obstacles. So, just as flap running appears to be a key stage in learning to fly, it could also have been a major breakthrough in the evolution of flight.

More information: Jackson, B. E., Tobalske, B. W. and Dial, K. P. (2011) The broad range of contractile behaviour of the avian pectoralis: functional and evolutionary implications. J. Exp. Biol. 214, 2354-2361. http://jeb.biologists.org/content/214/14/2354.abstract

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