A small vortex on the wing makes the elegance of birds' flight

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The alula feathers, the thumb-like structure, on both wings are well visible. Credit: Keith Bannister

One mystery of birds' flight is solved! The elegance of birds' flight, their seemingly effortless aerial turns and the softness of their landing, have been envied by many people. From countless observations, it has been known that the birds use a small group of feathers, called "the alula", a thumb-like structure that is present at the bend of the wing, in slow and steep flight such as landing. Why do they use it? How the tiny feathers can help them land softly?

A recent article published in *Scientific Reports* says that the secret is a small vortex of air that is formed at the tip of the alula feathers. This study was conducted by a research team of biologists and mechanical engineers at the Seoul National University. The researchers were interested in the flight of magpies. They started with observing magpies in the aviary when the birds moulted the alula feathers. "It's not that they cannot fly without the alula." says Dr. Sang-im Lee, the first author of the paper. "But with the alula they seem to turn more easily".

Then the researchers moved on to the wind tunnel experiments where they visualized the movement of tiny particles around magpie wings. Here they observed that a tiny vortex from the alula tip presses the air flow over the wing and makes the air flow better attached to the wing surface. "For the wing to fly better, the air has to move closer to the wing. Although the alula is small, it creates enough vortex to prevent the air flow from being detached from the wing." says Dr. Jooha Kim. Measurements of the forces acting on wings in the wind tunnel proved that indeed the presence of the vortex from the alula helps the birds in flight.

There have been several other attempts to reveal the role of the alula in birds' flight. But this is the first time that the researchers found the evidence that the effect of the alula is due to a small vortex formed at the tip of the alula feathers.

"Nature is full of vortices, and the animals and plants use them wisely. The role of the alula in avian flight is just one example." says Dr. Haecheon Choi, the corresponding author of the paper. The authors aim to apply the way that the alula works in designing a device that enables the air vehicles to turn better and more efficiently.

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