Flying II.

Most bird species are able to fly

The separation of the coordinated movements of the forelimbs and hind limbs was a precondition for the development of bird flight. New neural connections between the forelimbs and the tail were also needed to coordinate their movements. Several functions had to develop and evolve that allowed flight while maintaining movement on the ground, water and in water.

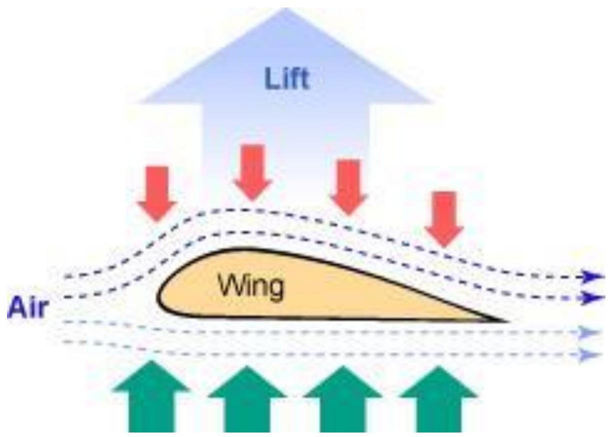
Assumptions on the evolution of flight:

- They jumped from higher places, from trees, gliding like the mammalian "flying" squirrels that still exist today. This ability then evolved and, using the initial energy, later became active flight.
- The feathers of the avian dinosaurs were not initially used for flight, but later evolved to allow true flight.
- Wing-assisted incline running (WAIR): the Ttheropoda dinosaurs could use their wings to run up steep slopes and tree trunks. Over time, this may have evolved into flight.
- The swooping proavis model assumes that birds are descended from predatory dinosaur ancestors. They jumped on their prey from a higher position, from ambush, using their hind limbs.

Proavis is a presumed extinct species that evolved between the non-flying Teheropod dinosaurs and birds.

A little physics

By varying the wing profile, the bird influences the air flowing faster over its wing, which has less pressure (red arrows) than the slower air flowing under its body (green arrows). The bird uses the resulting lift to fly.



Source: https://askabiologist.asu.edu/how-do-birds-fly

Mute swan (Cygnus olor) taking off

Source: https://pixabay.com/photos/swan-bird-flying-swan-water-7167802/

Methods of take-off:

Jumping from a great height: e.g. storks (Ciconiidae), swallows (Hirundinidae) jump from a higher place, so the speed they gain from falling is sufficient to take off. Bats (Chiroptera) are similar, but they "fall".

Run-up: Many birds, especially larger birds, gain the initial energy for flight by running up and, when they have reached sufficient speed, they can use their wings to take to the air. Swans and pelicans, for example, take off in this way.

Stationary flight

Soaring: The bird's flight speed matches the speed of the wind blowing in the opposite direction, so it can hover in place, allowing it to observe the terrain below. Some birds of prey regularly hunt in this way.

Rotary wing flight: which can also be used in still air. The wing describes a lying figure-eight in flight, e.g. in hummingbirds (Trochilidae).

Swooping: The bird flaps its wings backwards like an arrow, reducing surface drag.

Stopping, landing: the bird tilts its body so that the swirling air slows it down, spreading its tail and wings. A few flapping wing flaps complete the landing. Waterfowl, for example, also use outstretched legs to ski on the water to reduce speed.

White stork *(Ciconia ciconia)* arriving home

Source: https://pixabay.com/hu/photos/g%C3%B3ly%C3%A1k-madarak-%C3%A1llat-g%C3%B3lyaf%C3%A9szek-1598322/

Penguins (Spheniscidae) are flightless on land but **fly underwater** with their narrow, rigid wings. Their wings cannot fold, they can only twist, move up and down or back and forth.

Flight with motionless wings

Gliding flight: Birds, taking advantage of the upward flow of warm air, can rise and hover.

A **streamlined body** is essential for efficient flight.

Many migratory birds fly at altitudes of thousands of metres. Near the ground, the air is twice as dense as at altitudes of up to 5-6000 m. At this altitude, birds need half as much energy to overcome the drag, yet only a few species ascend to such high altitudes.