Observing

## Sort feathers according to any criteria of your choice.

Students will probably sort the feathers according to size, shape or color.
The color of a bird's feathers influences its appearance.
The size of a feather is dependent on the size of the given species and the position and function of the feather. The shape of a feather depends on the position of the feather on the bird's body and its function.

Conclusions

## Students share results of their observations of feathers and draw conclusions. How did the examined feathers differ?

**What is the structure of feathers?**

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A feather is a product of the skin (epidermis) found only in birds (and in the past in theropod dinosaurs). Like hair, feathers are composed of keratin. The rachis constitutes the axis of the feather – and on both sides of the rachis is a flat vane. The part of the rachis that is embedded in the skin (and is not flanked by vanes) is the quill or calamus. The vane appears to have a uniform structure, but in fact is constructed of thin "hairs" (barbs), which are joined together by means of fine filaments called barbules and minute hooks (barbicels), forming a uniform plane. As part of their daily preening routines, birds re-align their feathers, and comb them with their beak, thus mending torn vanes (re-attaching neighboring barbs). Birds' feathers differ in structure depending on their location on the body and their fulfilled function.

Talk

## Discuss the functions of feathers – use the differences in the structure of feathers, which students studied in the previous exercise, as a starting point.

**What functions do bird feathers fulfil?**

What functions do bird feathers fulfil?

**Down feathers:** small, with long and soft barbs bearing barbules; however, the barbules are not cross-attached. Function: they form a cover protecting against the cold, and also against high temperatures, like the thick fur of mammals. Air is trapped between the loose barbs of the feathers, which enhances insulation properties.

**Covert feathers:** groups of feathers covering other feathers, for example, flight feathers, or the ear. These are small feathers, but they are stiffer than down feathers. Their barbules are cross-attached. Function: they form an external covering of the body, hence they are often also called contour feathers. Not only do they cover all the remaining types of feathers, but they also give shape and color to birds' bodies.

**Flight feathers (remiges):** large and stiff feathers forming the lifting surface of the wing. They grow from its back edge in a defined order; their number is strictly defined (e.g., in small passerine birds: 20 flight feathers). It is feathers, above all, that enable flight (the bones and muscles of the wing are small – when we observe a bird in flight, what we see in the wing is primarily feathers)

**Tail feathers (rectrices):** feathers growing out of the rump – they form the tail, which helps a bird to steer and balance. Their number is also defined (e.g., in passerine birds: 12 rectrices).

Observing

## Students build paper airplanes and throw them in the air. They think about what features they have in common with birds' feathers.

**What features must paper airplanes possess in order to take off into the air? Do birds have any of these features?**

They are light and possess wings; the wings are flat and thin, thanks to which airplanes descend slowly. The upper limbs of birds are small, so the wing area is mainly formed by long and straight flight feathers.

**What are the characteristic features of flight feathers?**

The most important factor determining whether a bird flies is, not its weight nor its wingspan, but the flight feathers covering the wings of birds - the so-called remiges.

The characteristic features of flight feathers are, above all: lightness, rigidity, and a flat shape. An example of a flightless bird covered with feathers is the ostrich. Its body is for the most part covered in feathers that are soft and fine.