BLOCK 4

WINTER’S NOT SO BAD
Basic anatomic and morphologic features of birds, just as of all animals, are determined by the environment where they live and by the way they move. The most specific features of birds’ anatomy are wings, which allow them to fly. Bird’s body is almost completely covered with feathers, which have various functions:

• they enable flying,
• they form a thermal insulation layer,
• they protect against moisture and water,
• feathers’ coloring protects birds (camouflage) and plays a signaling role during the mating season.

How feathers are arranged and how they look like, so called plumage, can vary with bird’s age, sex, social status, or season of the year. The flight feathers on the wings, called remiges, create a bearing surface and are embedded in the skin covering the front limb. The primary remiges are supported by bones located in the section corresponding to mammals’ hands (bones of fingers and metacarpal bones). The number of bones in this section has been strongly reduced compared to the number of mammalian bones, as the gripping function of this limb segment is reduced. The secondary remiges are connected with the ulna bone, and the tertiary remiges, so-called humerals, are connected with humerus bone (fig. 1).

FIG. 1. THE CONSTRUCTION OF A WING. AUTHOR: MAREK KOŁODZIEJCZYK.
An important role is played also by tail flight feathers, so called rectrices, which are used as rudders and ballasts during the flight, „brake” at the time of landing, support when moving on trunks of trees, or in a decorative version during mating rituals (e.g. peacock’s feathers). Rectrices are embedded in the skin covering the so-called pygostyle, which is a bone plate formed from the vertebrae at the base of the spine.

Remiges and rectrices are important feathers belonging to the group of so-called vaned feathers. Other vaned feathers, which cover the entire body of the bird, are referred to as contour feathers and they play a significant protective role, and – thanks to the specific coloring – they also allow identification and signaling during the mating season.

Birds stand out with a very high metabolism, which means that they produce a large amount of heat. Retaining this heat in the body allows them to function efficiently even when it is very cold, i.e. in the winter. It is possible thanks to an appropriate insulation layer. This role is played by another category of bird’s feathers, so-called down feathers, which thanks to their „fluffiness” limit the exchange of heat with the environment (Fig 2).

FIG. 2. TYPES OF BIRDS’ FEATHERS. 1. REMIGE 2. RECTRICES 3. CONTOUR FEATHER 4. DOWN FEATHERS 5. BRISTLE FEATHERS. AUTHOR: MAREK KOŁODZIEJCZYK.
Feathers are an insulating layer, and birds, depending on the situation, can set them at the appropriate angle. Probably all of us are familiar with the sight of birds with strongly raised (fluffy) feathers when the temperature is low. The additional layer of air between the feathers effectively reduces heat losses. When the air is warm, the feathers closely adhere to the bird’s body; the bird starts to pant and hides into the shade or in the water. Panting increases evaporation, which cools the bird. Thanks to thermoregulation, i.e. the ability to maintain the body temperature in the optimal range, birds are active in various climatic zones and during various seasons, which, combined with the ability to fly, gives us the chance to meet them in almost all corners of our globe.

**CONSTRUCTION OF FEATHERS**

A **CONTOUR FEATHER** consists of a flexible axis, to which a vane is attached. The upper part of the axis is called a rachis, and the bottom part, which is immersed in the skin, is a calamus. The vane forms the bearing surface of the feather and consists of barbs growing from both sides of the rachis, from which the barbules grow. The barbules are connected with each other with hooklets. The system of interlocking hooklets on neighboring barbules allows the birds to quickly restore the correct arrangement of the surface of the feather if it gets distorted. Feathers grow from the skin at an acute angle and their ends are directed towards the rear of the bird.

**DOWN FEATHERS** have a thin axis and long and soft barbs whose barbules do not connect with each other. They have no hooklets, so they do not form a compact surface of the vane. They poorly conduct heat and form a layer that protects the bird from the loss of organic heat. Birds devote a lot of time to grooming their feathers; they comb them with a beak which puts hooklets on the barbules. They also distribute on feathers the greasy secretion of the uropygial gland (aquatian birds) creating a layer that protects the feathers from water and moisture. The secretion also gives the feathers flexibility and kills bacteria which may destroy the feathers. Herons, who cannot bend their neck to the side and cannot reach the uropygial glands with their beaks, have **POWDER DOWN FEATHERS**. These feathers disintegrate and create a powder, which spreads over other feathers and protects them from moisture. The powder down feathers are located mostly on the sides of the body and on the breast, because heron can easily reach these areas with its beak and legs. Additionally, the powder also gives the color (a grayish bluish coating on pigeons is just a powder). Thanks to these above-mentioned mechanisms, birds’ plumage in healthy individuals very rarely absorbs water and effectively protects them from soaking.

Swifts, nightjars and flycatchers have also bristle feathers, located on the head near the nose and eyes, which help them catch insects during the flight. They are made of bare, hard rachis and have almost no barbs.
COLORING OF FEATHERS

UColoring of birds' feathers is much diversified, due to two types of color:
• pigment colors, resulting from the presence of dyes, mainly melanin (brown and black) and lipochromes (yellow to red);
• structural colors, resulting from the microscopic structure of feathers, causing interference and refraction of light, which causes a specific color effect, and above all, the color shade which may depend on the viewing angle.

Colors of feathers on the body, wings and tail (plumage) create for each species a characteristic pattern, which is very helpful in identifying them. In many species, the plumage differs between the sexes, especially during the mating season. Also young and adult individuals can differ a lot in color.

All this certainly does not make it easier to assign the observed birds to the same species. As the coat also varies by season, identifying the species may not be easy for an untrained observer. That is why very useful are field guides and bird identification charts, which contain pictures or photos of birds in various coats together with a description of the features of their appearance important for a given season, age and gender.

Young observers should be aware of the reasons why the coloring of feathers differs. One of the reasons is the type of feather – remiges have a different color and shape than rectrices. To identify feathers, one should consider not only the color, but also the shape. Consider the shape of the vane of the feather: whether it is symmetric to the rachis or not, whether the barbules connect over the entire length of the vane, and how the top of the feather is shaped.

WHERE DO FEATHERS COME FROM?

Feathers develop in the bird’s skin just like the hair of a mammal. They are built from a protein called keratin. The feather buds appear at a very early stage of the bird’s development – many species hatch already with juvenile (down) feathers, which later on get exchanged for adult feathers. As long as a feather is growing it is nourished by the skin’s blood vessels, and after it finishes growing it becomes a dead structure. Feathers are not the only keratin body parts of birds. This group includes also beaks, claws, and plates and scales covering their legs. Keratin is hard and durable, and builds, among others, also human nails, hoofs of animals, or horns of domestic cattle.

Knowing how important and diverse is the role of feathers in a birds’ life, we realize that damage and contamination of feathers can have negative consequences for them. The most dangerous are the catastrophes of sea tankers, during which petroleum leaks into the sea water. During such catastrophes, birds die because their feathers get stuck together with petroleum
derivatives, and they get poisoned with the harmful petroleum substances which they swallow as they attempt to clean their feathers. The most vulnerable are seabirds, but also those birds which prey on coastal beaches where the petroleum accumulates. After the disaster at the entrance to the English Channel of the Amoco Cadiz tanker in 1978, about 60 million marine organisms died, including 37 thousand birds.

Feathers undergo natural wear processes (they rub off, crumble, break). For this reason, they are periodically replaced: new feathers grow in the place from which an old feather fell out. This process of exchanging feathers is called moulting. During moulting all or only some of the feathers are replaced. Often, replaced are only the large feathers of wings or tail, or small cover feathers. Birds can change their feathers twice a year (e.g. tits, finches) or (as in herons, cranes) once every two years. Usually, moulting takes place after the nesting season, before the autumn migration to wintering grounds.
This material was prepared as part of the project „We live in harmony with nature. The educational program for teachers of pre-school and primary education”. The project involved selected non-governmental organizations involved in the protection of birds associated as part of the international BirdLife International federation. In addition to the National Society for Bird Protection, which ran the project, the Spanish Ornithological Society (SEO), the Slovak Ornithological Society (SOS), the Macedonian Ecological Society (MES), the Czech Ornithological Society (CSO) and BirdWatch Ireland (BWI) were involved. The University of Gdańsk became the substantive partner of the project responsible for creating materials for teachers.

BirdWatch Ireland is a non-governmental organization with a public benefit status, dealing with the protection of wild birds and the places where they live. The aim of the Society is to preserve the natural heritage for the benefit of present and future generations. BirdWatch Ireland is the Irish partner of the global federation of bird protection societies - BirdLife International.
School Work SHEETS

BLOCK 4:
WINTER’S NOT SO BAD
## Block 4:

**THERE’S NOTHING TO BE AFRAID OF IN WINTER**

**Context:** This block can be used to think about the different temperatures during different seasons. You can collect illustrations of materials used by people for protection against cold.

<table>
<thead>
<tr>
<th>DETAILED PROBLEMS</th>
<th>WHAT IS THE STRUCTURE OF A BIRD’S FEATHER? WHAT TYPES OF FEATHERS ARE THERE? HOW DOES ENVIRONMENTAL POLLUTION AFFECT BIRDS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor observations and experiments</td>
<td>Go for a walk on a winters day. Watch birds. Pay attention to:</td>
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<tr>
<td></td>
<td>• plumage colours and colour distribution,</td>
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<td>• colour of feathers in males and females,</td>
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<td></td>
<td>• birds with ruffled feathers and birds that are preening.</td>
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<td></td>
<td>If it is windy, take flags or ribbons attached to sticks with you. Use them to see where the wind comes from. See how birds position themselves relative to the wind.</td>
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<tr>
<td>Indoor observations and experiments</td>
<td>Feathers are characteristic growths of the epidermis in birds. Carry out a thorough inspection of their structure (4/A/1 and 4/A/2). Use feathers collected during the summer moult.</td>
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<td></td>
<td>With younger children, look at feather colours. Using a feather atlas (4/A/3), older children can identify which birds they come from.</td>
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<td></td>
<td>Use this short video to think about the function of feathers <a href="https://www.youtube.com/watch?v=Y2yeNoDCcBg">https://www.youtube.com/watch?v=Y2yeNoDCcBg</a>. Let the children match feathers to their respective locations on a model of the bird’s body.</td>
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<td></td>
<td>Check whether feathers can protect (4/A/4) a bird from winter cold.</td>
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<td></td>
<td>Bird feathers are perfectly adapted to their functions. They are light-weighed, facilitate flight and dry fast. However, they might lose their properties in a polluted environment. Have a look at features of bird feathers together with children (4/A/5).</td>
</tr>
<tr>
<td>Art and graphomotor tasks</td>
<td>The children can make drawings using feathers as brushes. Use a colour ink or poster paint, diluted to the density of cream.</td>
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<td></td>
<td>You can use feathers to create fairy birds. Use a paper model of the bird’s body or make it out of plasticine. Legs can be formed using bent paper clips.</td>
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<td></td>
<td>If you want to look at the structure and types of feathers more thoroughly, make a bird’s model.</td>
</tr>
<tr>
<td>DETAILED PROBLEMS</td>
<td>HOW ARE BIRD FEATHERS BUILT AND WHAT ARE THEIR TYPES? WHAT IS THE IMPACT OF ENVIRONMENTAL POLLUTION ON BIRDS?</td>
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<tr>
<td><strong>Language and writing tasks</strong></td>
<td>Bird feathers (from geese) used to be writing tools. Try to write with feathers. Use natural feathers and feathers with sharpened ends. Prepare an exhibition Feathers not only for flying, showing results of the classroom observations and experiments. Let children talk about their observations.</td>
</tr>
<tr>
<td><strong>Maths tasks</strong></td>
<td>Use feathers to count their types: how many flight, contour and down feathers there are? Which are more numerous? How much? Using a tape, measure the length of feathers of various bird species. Depending on the age of the children, sort them shortest to longest or classify them according to their length in centimetres. Use the lightness of feathers in weighing games (4/A/6).</td>
</tr>
<tr>
<td><strong>Games and competitions</strong></td>
<td>Use the time of winter games in open air to play the Bird’s quiz - a revision of bird names. Take a ball or a sack with pea with you. Participants stand in a circle and throw the ball to one another. The child that catches the ball says a name of a bird. You can introduce additional conditions, e.g. only the birds that stay for the winter, only the birds that winter in warm areas, only colourful birds, only the birds with an “a” in their name, etc.</td>
</tr>
<tr>
<td><strong>Additional information for teachers</strong></td>
<td>For pupils interested in natural sciences, you can elaborate the topic by comparison of feathers with other epidermal growths (such as claws, scales, hair or beak).</td>
</tr>
</tbody>
</table>
WHAT KIND OF FEATHERS DO BIRDS HAVE?

What we will need:
- Different feathers, at least several for each child
- a magnifying glass
- a feather atlas

Tasks and questions:
- Watch the different feathers carefully.
- Look at their colour and structure.
- Order them according to your own ideas.
- What different kinds of feathers can you distinguish?

- Draw some examples of the feathers.

Think of the following aspects:
Do all feathers have the same structure?
What could be the reason for this?
WHY DO BIRDS HAVE FEATHERS?

Your presumptions:

What you will need:
- flight or tail feathers
- a magnifying glass (optional)

Tasks and questions:
- Look at the feathers carefully.
- Weigh them in your hand.
- Toss them and observe how they fall down.
- Wave the feather. What do you feel?
- What will happen if you pull the vane of the feather? Can you fix it again?

Think of the following aspects:
- Where are primaries and flight feathers located? What are they for?
- Check your presumptions and watch the movie
  https://www.youtube.com/watch?v=Y2yeNoDCcBg
- Why do birds have feathers? Which of your presumptions were right?
ATLAS OF THE EASIEST TO DISTINGUISH BIRD FEATHERS

Bird feathers can be found throughout the year. Some of them are easy to recognize due to their color and pattern.

This feather was lost by the Jay.

This feather was lost by the Great Spotted Woodpecker.

This feather was lost by the Sparrowhawk.

This feather was lost by the Woodpigeon.

This feather was lost by the Blackbird.

This feather was lost by the Mute Swan.
### ATLAS OF THE EASIEST TO DISTINGUISH BIRD FEATHERS

<table>
<thead>
<tr>
<th>Feather Image</th>
<th>Description</th>
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<tbody>
<tr>
<td></td>
<td>THIS FEATHER WAS LOST BY THE</td>
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<tr>
<td></td>
<td>SPARROWHAWK.</td>
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<td>THIS FEATHER WAS LOST BY THE</td>
</tr>
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<td></td>
<td>MALLARD.</td>
</tr>
</tbody>
</table>

**THIS FEATHER WAS LOST BY THE SPARROWHAWK.**

**THIS FEATHER WAS LOST BY THE MALLARD.**
DO BIRDS FEEL THE COLD?

Your presumptions:

What you will need:
• 2 plastic bottles with caps
• warm (but not hot) water
• a string or a tape

Tasks and questions:
• Fill both bottles with water.
• Close the bottles carefully. Check the temperature, is it the same in both bottles?
• What will happen if we would wrap one of the bottles with a down pillow and put both of them outdoors for a while?

Think about the following aspects:
• Do feathers protect from coldness? Is that important for birds?
• Do feathers also protect from heat? How would you check this?
ARE FEATHERS RESISTANT?
I. CAN THE FEATHERS GET WET?

What we will need:
- a tray
- water
- feathers (remiges, coverts)
- a small piece of textile
- a paper towel

Tasks and questions:
- Put on a tray the feathers and the piece of textile. Pour water over it. What will happen? Will the feathers and the textile absorb the water?
- Will the feather and the textile dry up if you rub it with the towel?

Think the following aspects over:
- Do you have any idea what happened? What could be the significance for birds out of it?
- Can birds fly during rain? Why?
- Can feathers get damaged?

What we will need:
- a tray, 3 cups filled with water, 2 feathers, a pipette, oil, protective gloves, dishwashing liquid

Tasks and questions:
- Fill a cup with water. Immerse in it two feathers. Take them out and look at them carefully.
- Put on the protective gloves. Add to the water a couple of oil drops. Immerse the feathers in the liquid. How does the oil look on the surface of the feathers? ……
- Try to remove the oil from the feather using carefully the paper towel. Have you managed to clean the feather?
- Prepare two cups, one with hot and the other one with cold water.
- Wash the first feather in cold water, the other one in hot water. Check if the feathers got clean?
- Will you manage to remove the oil from the feather if you will add some dishwashing liquid to the water?

Think the following aspects over:
- What do you think what happened? What is the significance out of it for birds?
- What happens when ducks swim on contaminated water?
- How can we prevent such situations? Why is it so important to care about the environment?
ARE FEATHERS RESISTANT?

II. CAN FEATHERS GET DAMAGED?

What you need?

• Tray
• 3 cups with water
• 2 feathers
• Dropper
• Oil
• Protective gloves
• Dish soap

Tasks and questions:

1. Pour water into the cup. Immerse 2 feathers in it. Pull out and watch carefully.
2. Put on protective gloves. Add a few drops of oil to the cup with water. Dip the feathers in it. What does oil do on the surface of the feather?
3. Will it be possible to clean the feather by gently pulling it through a towel
4. Prepare 2 cups with water (hot and cold).
5. Rinse the first feather well in cold water and the other one in warm water.
   Check if I have cleaned the oil?
6. Will it be possible to remove the oil if you add a few drops of liquid to the water ....

Consider:

• What do you think happened? What does this mean for birds?
• What happens when ducks float on contaminated ponds?
• How can we prevent such situations? Why is it important to care for the environment?
LET'S PLAY A GAME: WEIGHTING

What we will need:
- a coat hanger
- some stringed bags
- 1 plastic cup for drinks 0,25 ml
- chicken feathers
- oat flakes
- any other products
- clothes pegs

Tasks and questions:

1. Put into the stringed bag one cup of bird feathers. Close the bag.  
   - Put into the second bag one cup of oat flakes. Close the bag precisely.  
   - What will happen if you attach the two bags on opposite sides of the coat hanger with spins? How can you explain this?

   Repeat the weighting with other products. Observe and draw conclusions.  
   - How would you order the products in respect of their weight?

Consider:

- What does the saying mean: light as a feather?
- What is heavier 1 kg of feathers or 1 kilogram of flour?
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