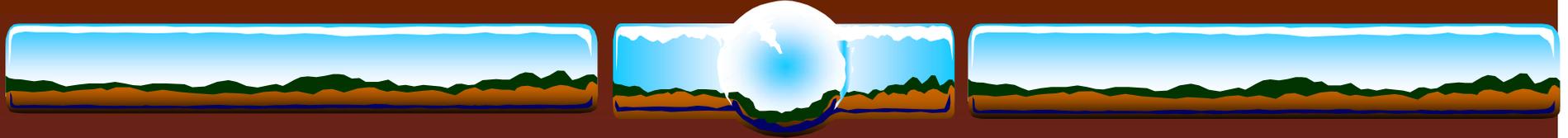


Woodpecker Tail Feathers

Image removed for copyright reasons.

See http://content.ornith.cornell.edu/UEWebApp/images/BIM_040302_00356F_L.jpg

Tiffany Lee

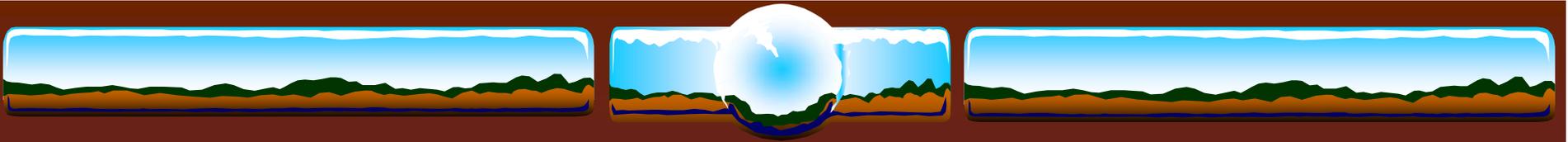


What makes them special?

- ❖ The woodpecker requires a lot of force to bore a hole through the bark and wood of a tree.
- ❖ When pecking, they place their tail against the tree to brace themselves.
- ❖ The tail feathers of a woodpecker are especially stiff so that they can act as a brace.

Image removed for copyright reasons.

See http://content.ornith.cornell.edu/UEWebApp/images/BIM_040302_00356F_L.jpg

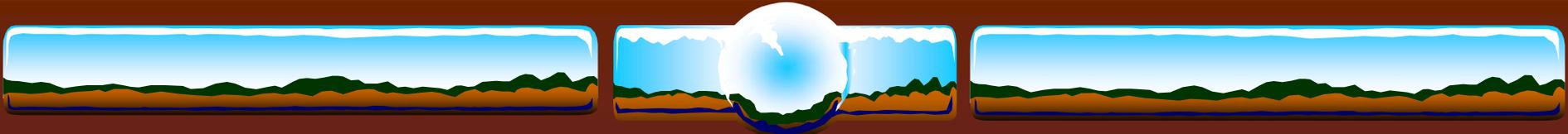


Woodpecker Tail Feathers

- ❖ When the woodpecker braces itself to chisel a hole, the tail feathers bend and spread, supporting the bird against the rough tree surface. In this way feet and tail form an effective tripod to stabilize the blows of hammering into wood.

Image removed for copyright reasons.

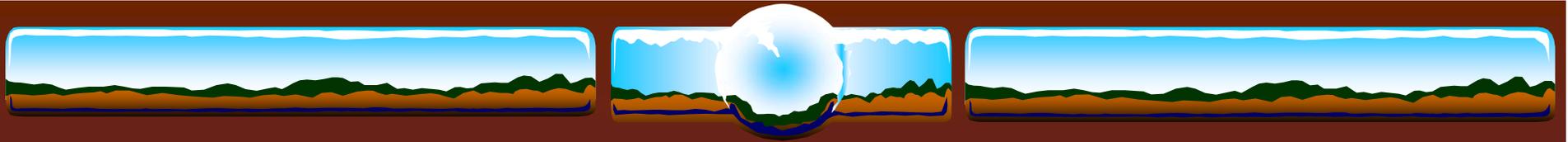
See http://www.birds.cornell.edu/programs/AllAboutBirds/BirdGuide/Hairy_Woodpecker.html



Feathers in General

- ❖ Feathers are one of the most prominent features of a bird's anatomy and they are unique to birds
- ❖ Feathers perform a number of functions for a bird:
 - ❖ Firstly, they provide **insulation**, (body temperature of most birds is maintained at around 40C).
 - ❖ Feathers allow for **flight**.

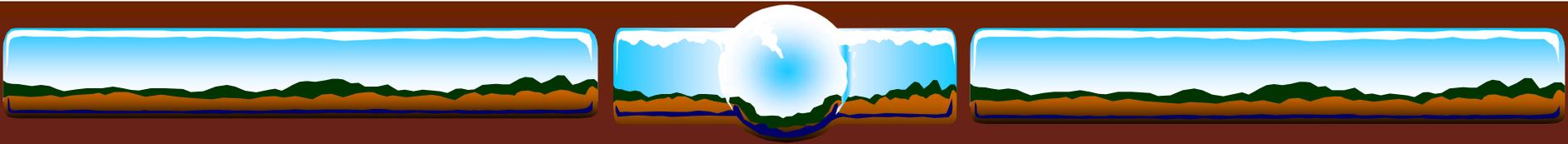
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Feather Structure

- ❖ Feathers have a basic form of a central supporting shaft called a '**rachis**' and a number of fine side branches (**barbs** and **barbules**).
- ❖ The base of the feather is called the **quill**, used by blood veins to carry nutrients to the feather

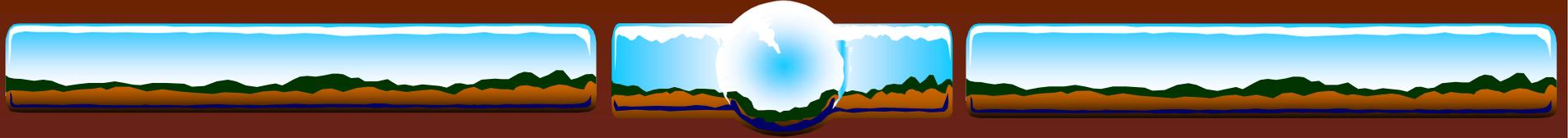
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Types of Feathers

- ❖ **Down** feathers - These are smaller and lack the barbules
 - ❖ zipped together and do not look so neat
 - ❖ soft and fluffy, providing most of the insulation

Image removed for copyright reasons.



Types of Feathers

❖ **Contour** feathers- These give the bird its shape and color

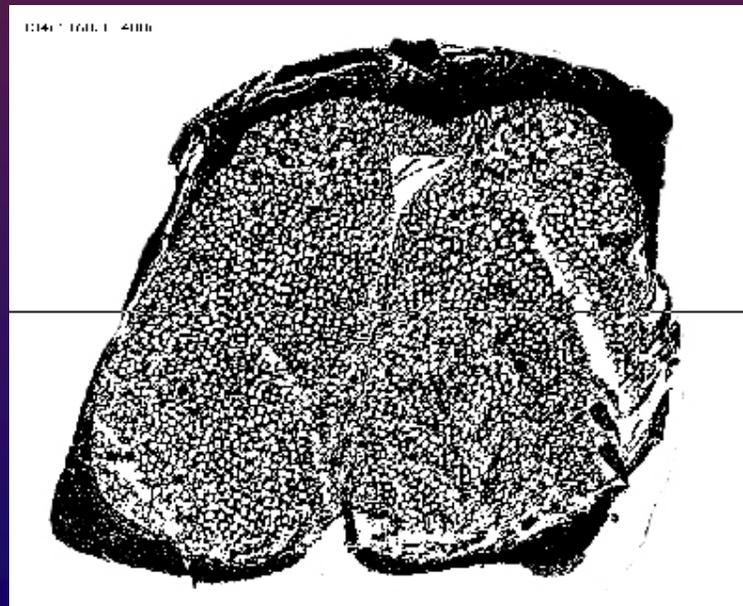
- ❖ tail feathers called retrices
- ❖ flight feathers, called remiges

Image removed for copyright reasons.

Feathers are made of **keratin**, a protein which also makes up horn and hair in animals and beaks in birds.

Rachis Cross-Section

- ❖ The cross-section of the rachis has a thin, solid shell surrounding a foam-like core

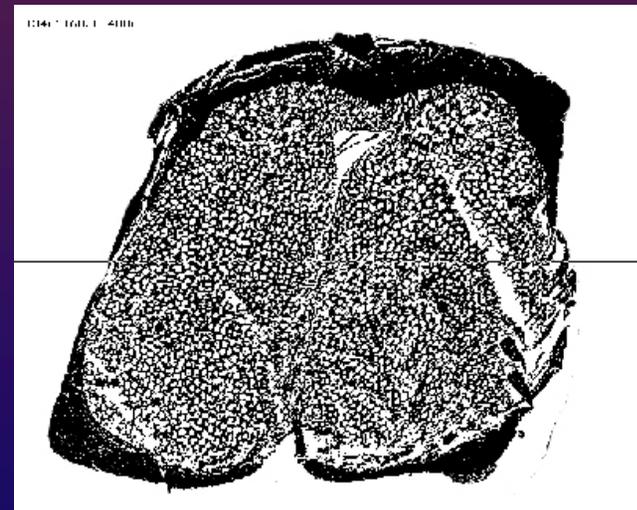


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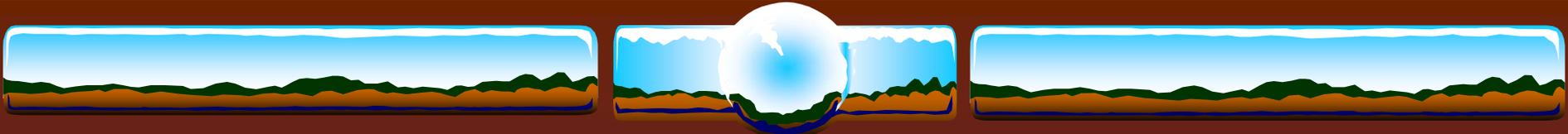
Rachis Cross-Section

- ❖ The bending stiffness of the rachis depends on:
 - ❖ The stiffness of the material it is made from (keratin)
 - ❖ The cross-sectional geometry

The bending stiffness of woodpecker tail feathers is especially high, as a result of their cross-sectional geometry. It is this feature that makes them good for bracing the woodpecker against the forces of pecking.

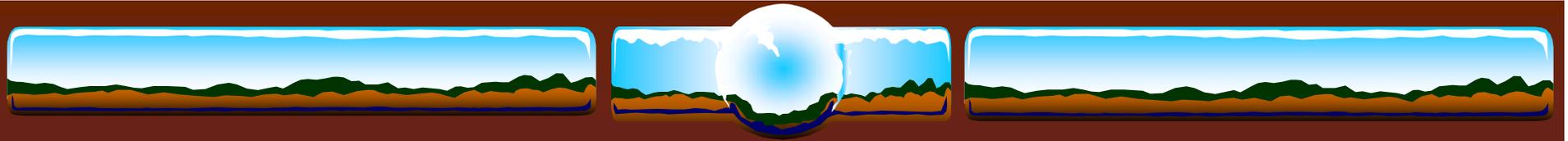


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Moment of Inertia

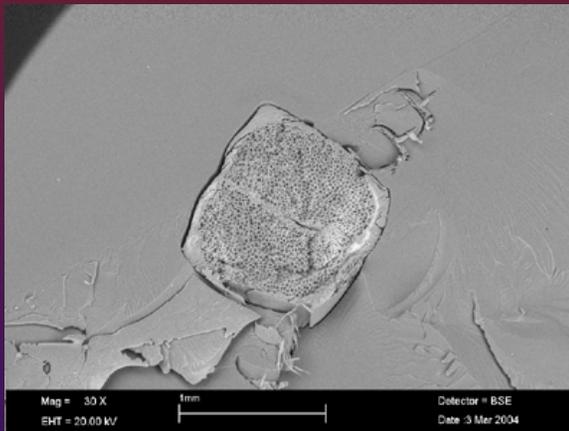
- ❖ Bending stiffness depends on the moment of inertia of the cross section
- ❖ The moment of inertia is increased by placing material far away from the center of the rachis
- ❖ A hollow tube with a large radius and thin wall has a high moment of inertia but can buckle (think of how a drinking straw kinks when bent)
- ❖ The foam-like core in the rachis allows it to have a thin outer wall without buckling or kinking.



Moment of Inertia Data

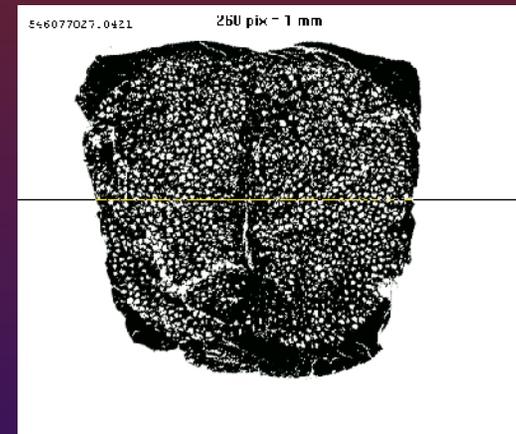
- ❖ We have taken microscope images of the cross sections of tail feathers and body feathers from different species of woodpeckers
- ❖ From the images we have measured the moment of inertia of each cross section

Moment of Inertia Data Hairy Woodpecker

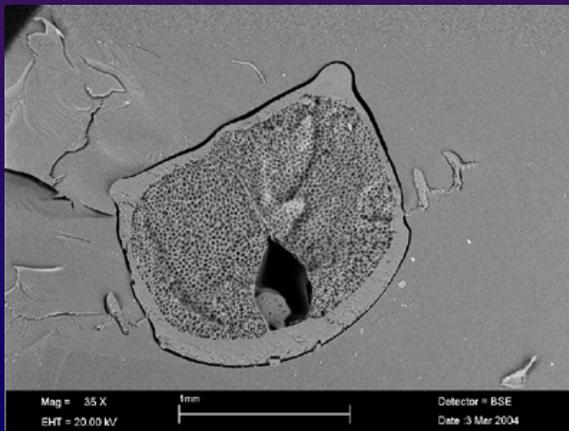


Body Feather

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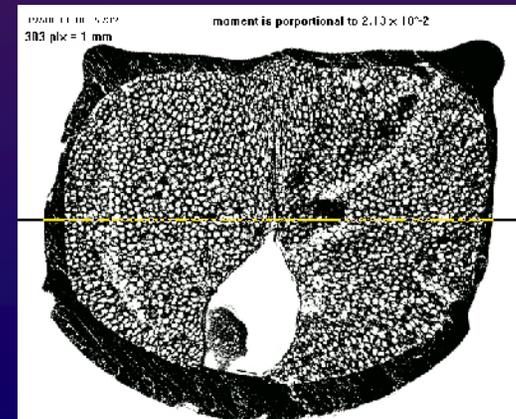


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Tail Feather

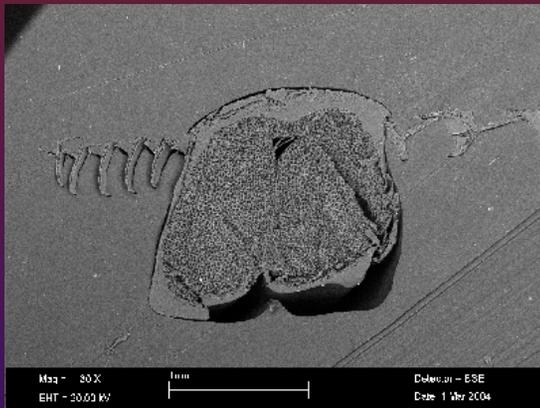
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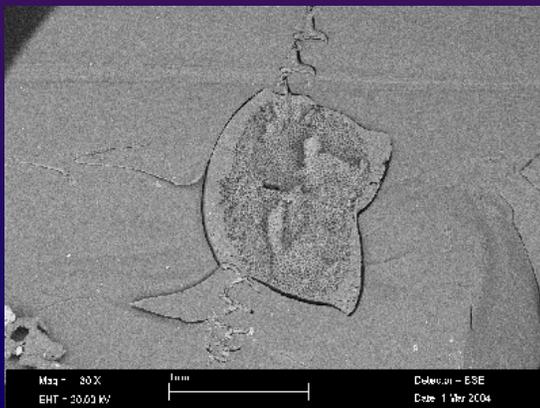
Moment of Inertia Data

Lewis Woodpecker



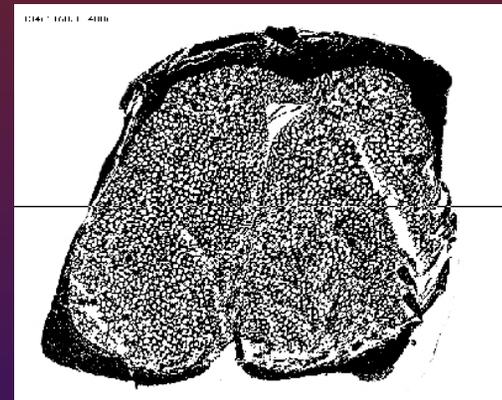
Body Feather

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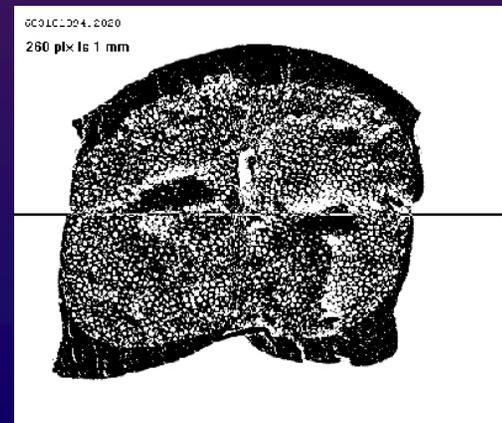


Tail Feather

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