

WP/24

IDENTIFICATION OF BIRD REMAINS FROM BIRD-AIRCRAFT INCIDENTS
BY THE MICROSTRUCTURE OF THE DOWNY PART OF THE FEATHER

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During the investigation of the crash of the Electra at Logan International Airport, Boston, Massachusetts, in 1960, I was asked to assist in the identification of the bird remains recovered from the aircraft engine. This was the beginning of my involvement in bird strike identification.

Since the birds ingested by the engine had been reduced to very small pieces, it was necessary to use the microscope to try to identify the remains. This study of the remains showed that the starling was the species of bird involved.

I continued to examine the microstructure of the downy barbules of various species of birds, using Asa C. Chandler's "A Study of the Structure of Feathers" (University of California Publications in Zoology Volume 13, number 11, 1916) as a starting point. Chandler primarily studied pennaceous feathers. He only examined the down of a relatively few species, so the study of the down was just beginning.

The need to identify small fragments of feathers was really the catalyst for my keen interest in the microstructure of the downy parts of feathers.

Feather identification is not only important in bird-aircraft incidents, but in the identification of feather evidence relating to criminal acts, in wildlife law enforcement, archeological feathered artifacts, and in food habit studies.

During my study I have found that it is possible to identify many families of birds by the downy barbules and that the nodal structures can furnish important diagnostic characters at the family level. Once the family of birds has been determined, it is possible by using the remaining bits of contour and flight feathers to determine the species. It is somewhat like putting together the pieces of a jigsaw puzzle.

Each feather has a midrib or rachis and the barbs branch off from the midrib to form the right and left vanes of the feather. The downy barbs or plumaceous part are at the base of the feather, and are covered up by the pennaceous or more colorful part which is toward the tip of the feather. The downy barbs branch off from the midrib or rachis; these barbs are composed of a little midrib or rachilla with barbules branching off it. The barbule is the smallest division of the feather. It is composed of a basal cell whose base is attached to the rachilla or little midrib, and numerous other cells joined end to end to form the complete barbule. The barbule without the basal cell is called a pennulum. At the distal end of the cell or at the junction of two cells are structures, which I refer to as nodal structures. These structures are important in determining the family of birds. These structures

vary according to their location on the pennulum and also according to the location of the downy barb on the midrib or rachis of the feather. The nodal structures can vary as to whether they occur on the left or right side of the barb.

The type of nodal structure, the width of the pennulum, the distance between the nodes, the pigmentation and the angle at which the basal cell is joined to the rachilla are diagnostic characters. Most groups have the nodal structures beginning after the first node and in others as in Anseriformes, the waterfowl group, the nodal structures begin more toward the distal portion of the pennula, also the structures are three pointed or triangular.

I will show you 35mm slides representing some of the species involved in bird strikes that will illustrate the characters just mentioned.

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SLIDES

Brant (<u>Branta bernicla</u>)	35x 400x	Crow (<u>Corvus brachyrhynchos</u>)	35x 125x 250x 400x
White-fronted Goose (<u>Anser albifrons</u>)	35x 400x	Catbird (<u>Dumetella carolinensis</u>)	35x 125x 250x 400x
Mottled Duck (<u>Anas platyrhynchos fulvica</u>)	35x 400x	Common Grackle (<u>Quiscalus quiscula</u>)	35x 125x 250x 400x
Wild Turkey (<u>Meleagris gallopavo</u>)	35x 125x 250x 400x	Cowbird (<u>Molothrus ater</u>)	35x 125x 250x 400x
American Coot (<u>Fulica americana</u>)	35x 125x 250x 400x	Rose-breasted Grosbeak (<u>Pheucticus ludovicianus</u>)	35x 250x 400x
Pigeon (<u>Columba livia</u>)	35x 125x 250x 400x	Fox Sparrow (<u>Passerella iliaca</u>)	35x 125x 250x
Mourning Dove (<u>Zenaidura macroura</u>)	35x 125x 250x 400x	Song Sparrow (<u>Melospiza melodia</u>)	400x
Barn Owl (<u>Tyto alba</u>)	35x 125x 250x 400x	Scarlet Tanager (<u>Piranga olivacea</u>)	400x basal nodes 400x mid nodes 400x distal nodes
Barred Owl (<u>Strix varia</u>)	35x 125x 250x 400x	Preparation of bird remains for identification	
Great Horned Owl (<u>Bubo virginianus</u>)	400x	Identification of cleaned feathers of remains from a bird strike	
Ruby-throated Hummingbird (<u>Archilochus colubris</u>)	35x 125x 400x		
Yellow-shafted Flicker (<u>Colaptes auratus</u>)	35x 125x 250x 400x		

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contour feathers prevail on the anterior half of on both lateral and medial sides. Semiplumes prevail posteriorly.

3. Downy portion of vanes becomes smaller and the pennaceous portions of vanes become relatively and more strongly knit, until shortly above the anterior portion to base.

These trends culminate in the tiny feathers on the humeral tract, the lateral anterior surface are still contour feathers, the others are semiplumes. Ankle feathers differ between the scales or through individual scales near the posterior margin.

The humeral feathers from the lower end of the tract are usually the only ones that may be identified by combination of small size, flatness of the downy relatively large pennaceous portion, and rounded tip distinguish them from other feathers.

Humeral Tract

Length: 35 to 110 mm

Downy part: 20 to

The feathers of the humeral tract proper are on the dorsal side of the shoulder (fig. 195); they are shoulder feathers in poultry terminology and as ornithological terminology. The feathers of the pectoral and subhumeral tracts are associated with them in nomenclature but are discussed in conjunction with the dorsal and ventral alar tracts, which they

The feathers of the humeral tract are all contour feathers in which the pennaceous portion has distinct zones and part of open tex are (fig. 196). The line of demarcation of the zones starts at the margin, at a variable point, the bottom of the pennaceous portion, and generally toward the rachis. The edges of the zones are slightly, and the tip is bluntly rounded. The tip is medially to one-fourth as long as the basal anterior edge, the following trends (fig. 195):

1. Feat length increases.
2. Length of rachis increases.
3. Downy portion becomes relatively (and larger).
4. Open pennaceous zone becomes larger.
5. Alar feather becomes slightly smaller in relative sizes.

Humeral feathers resemble feathers near the interscapular and dorsal tracts and certain covers on the upper side of the wing. They are separated from the interscapular and dorsal feathers by the radius, a distance of 5 to 9 mm. in the former and 3 to 5 mm. in the others. As compared with the feathers on the forearm, the humeral feather is larger. The former has larger zones of more strongly knit pennaceous texture and tends to shorter tip.

Comparisons of figures 196 and 213, 12, show

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