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A Bifurcated Rectrix on a Swainson's Thrush: Potential Insights Into Developmental Processes of Feathers

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Humple, D. 1999. House Wren with 14 rectrices. *N. Amer. Bird Bander* 24:143.

Sakai, W.H. 2006. Polydactyly in a Vaux's Swift. *Wilson J. Ornithol.* 118:424-426.

Winkler, K. 2000. Obtaining, preserving, and preparing bird specimens. *J. Field Ornithol.* 71:250-297.

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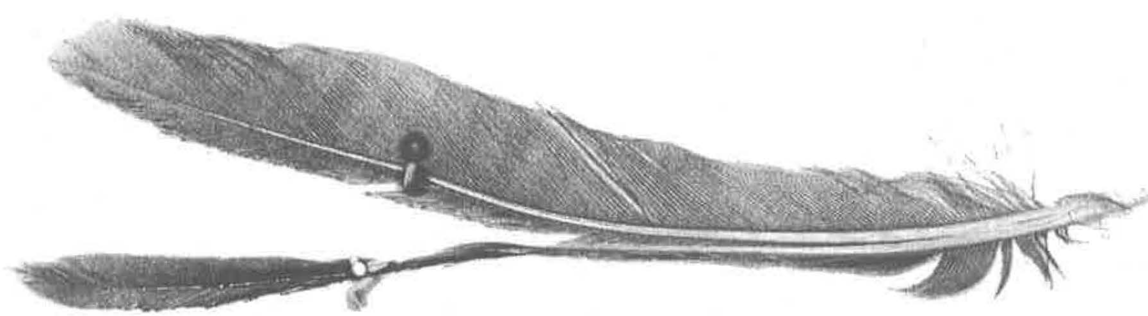
On 4 Apr 2000, during constant-effort mist-netting at the Tortuguero Field Station on the Caribbean coast of Costa Rica (10°36' N, 83°33' W), Brandt Ryder and KMB caught and banded an adult Swainson's Thrush (*Catharus ustulatus*; band number 1541-50845) with a bifurcated right outer rectrix. The feather had a single calamus but two rachides (see figure). The proximal barbs were attached to both rachides, but about halfway out the vanes became discrete, forming two "feathers." The inner "feather" was poorly developed, with minimal vane development, and twisted such that it was entirely upside-down at the tip. The outer "feather" was more normal but slightly reduced in size, particularly on the inner vane. Both rachides were relatively thin and weak.

We have handled many thousands of birds and have never seen a similar feather. A query to the BIRDBAND listserve soliciting other examples or relevant references yielded only a few replies, most describing other abnormalities. Tom Erdman, a long-time bander and museum curator, replied that bifurcated feathers are very rare and reported having seen a similar rectrix on a single Northern Saw-whet Owl (*Aegolius acadicus*) among >10,000 banded. Morgan (1918) called such feathers "not uncommon" among F_2 and back-crossed individuals of selectively bred fantail pigeons (*Columba livia*), in which the number of rectrices is variable and hereditary. (The occurrence of a trait among F_2 and back-crossed individuals indicates that it is recessive and



normally masked by dominant regulatory genes, although fantails have been back-crossed so many times that their genetics are now probably indecipherable [Erdman, pers. comm.].) He described and illustrated a continuum of bifurcation from division only at the tip to division from near the base of the calamus (he termed the latter "double feathers"). Morgan further described split feathers as having poorly developed inner vanes and barbs connecting the two shafts. Documented feather abnormalities are not limited to rectrices. Sutton and Arnold (1938) described a Blue Jay (*Cyanocitta cristata*) primary with an outer web roughly the width of the inner web, giving the feather the appearance of a rectrix. Shortt (1942) reported a Ring-billed Gull (*Larus delawarensis)* primary showing similar symmetry, as well as a rachis split near the tip.

Understanding normal feather development provides insight into how abnormal feathers may arise. This topic was treated exhaustively by Lucas and Stettenheim (1972) and much of the following discussion is based on their work. Vaned feathers grow from a follicle with a ring of actively dividing cells known as the collar. Around the collar, barb ridges differentiate among these cells. Two barb ridges fuse to form the rachis in one part of the collar. Cell division across the collar from this incipient rachis generates barb tips. From here, cell division proceeds around the collar in opposite directions, adding to the barb from the tip inwards up to the rachis. Only when the barbs are fully formed do they attach to the growing rachis. When "after-feathers" are grown, a second rachis initiates across from the first. Barb tip growth then initiates between the two rachides and proceeds in opposite directions toward them. In ratites, the four quadrants of the collar presumably develop similarly because all four vanes produced (inner and outer for both the after-feather and the main feather) are similar, distinguishable only by position in the follicle. In all feathers, once the rachis and barbs are completed, outer collar cells produce the calamus (the barbless base of the shaft), incorporating the smaller set of cells producing the rachis of the main sheath and, when present, that of the after-feather as well.

This process suggests that split feathers could arise when two loci are activated on the collar rather than just one. Consistent with this hypothesis is the fact that the cumulative maximum width of the vanes of the documented split feathers appears to approximate the width of normal feathers' two vanes. The pinching of the wide outer vane in the Swainson's Thrush feather is readily apparent just where the smaller feather shows wider vanes. This suggests that the cumulative maximum width of the vanes grown at a given point in feather development is set by the size of the collar.

Misactivation of a second locus also can explain bilateral symmetry in feathers that are normally asymmetric, such as those reported by Sutton and Arnold (1938) and Shortt (1942). When two loci are induced accidentally, further inductive processes could initiate equivalent barb development in two regions of the collar where normal barb development proceeds under different programs on either side of the main rachis. The fusion of barbs to both rachides as seen in the Swainson's Thrush feather and described by Morgan (1918) could occur when barb tip initiation at the barb ridges is disturbed by the presence of a nearby rachis and somehow induces subsequent fusion.

Manipulations of developing feathers would be valuable to illuminate such processes and would bear on inferences concerning the evolution of feathers. We hope that the potential significance of developmental abnormalities for understanding fundamental evolutionary processes will encourage banders to note, record, and document such aberrations. One place to look for bifurcated feathers might be on natural backcrosses, such as Brewster's and Lawrence's warblers *(Vermivora pinus x chrysoptera*; Erdman, pers. comm.).

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LITERATURE CITED

Lucas, A. M. and P. R. Stettenheim. 1972. Avian anatomy. Integument. Part 2. *Agricultural Handbook 362.* U.S. Government Printing Office, Washington, DC.

Morgan, T. H. 1918. Inheritance of number of feathers of the fantail pigeon. *Am. Nat.* 51:5-27.
Shortt, T. M. 1942. Abnormal primary of Ring-billed Gull. *Auk* 59:438.
Sutton, G. M. and J. R. Arnold. 1938. An abnormal Blue Jay primary. *Auk* 55:281.

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Field Sparrow (*Spizella pusilla*) Longevity Record

Foreman's Branch Bird Observatory (formerly Chino Farms Banding Station) has been in operation on Chino Farms since 1998. FBBO is located on the eastern shore of the Chesapeake Bay in Maryland, about five miles east of Chestertown in Queen Anne's County. The observatory is surrounded by diverse habitats including second-growth woodlots, hedgerows, fallow fields, successional fields, and runs parallel to a man-made lake.

During nine years of operation, FBBO has mist-netted and banded 3468 Field Sparrows and has recaptured (including repeats and returns) approximately 760 individuals 1670 times. The fallow and successional fields around the farm are ideal for Field Sparrows that breed and winter in the area, though the breeders are not necessarily the wintering birds and vice versa.

Field Sparrow #1551-96173 was originally banded as an ASY of unknown sex on 5 Apr 1999. The last recapture date was 9 Nov 2006, making the bird at least 9 yr and 10 mo old, assuming a hatch date of 1 Jun (Kennard 1975). The previous longevity record was 8 yr and 9 mo (Klimkiewicz 2006). Sexed as a male by the presence of a cloacal protuberance on six of the recaptures, he is undoubtedly a local breeder. Field Sparrow #1551-96173 has been recaptured 22 times and was missed only in 2005.

Recap Dates of Field Sparrow 1551-96173 at FBBO	
1999	2, 3 & 31 Aug, 3 Oct
2000	31 Mar, 7 & 28 Apr, 23 May, 2 Oct
2001	8 Apr
2002	11 Apr, 6 May, 23 Sep
2003	13 & 25 Apr, 18 May
2004	24 Oct
2006	2 Apr, 15 Aug, 13 Sep, 9 Nov
2007	18 Apr

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LITERATURE CITED

Kennard, J.H. 1975. Longevity records of North American birds. *Bird-Banding* 46:56-73.
Klimkiewicz, M.K. 2006. Longevity records of North American birds. Version 2006.1 Patuxent Wildlife Research Center. Bird Banding Laboratory. Laurel, MD.

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Survival After Banding

"Does banding hurt the birds?" During a recent bird banding talk when the audience was told that we band birds year round, someone in the audience asked that question.

Most banding stations operate seasonally. However, the Wekiva Basin Banding Station operates every month of the year. During April and early May and