FEATHER DEVELOPMENT AS A MEANS OF AGING YOUNG MOCKINGBIRDS (*Mimus polyglottos*)

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INTRODUCTION

During the spring and summer of 1963 I made some continued recorded observations on the plumage appearance of young Mockingbirds (*Mimus polyglottos*) as part of a behavioral ontogeny study. These notes enabled me to create a general behavioral ontogeny based on age estimates developed from plumage aspects of laboratory and wild birds of known ages. Although the study was almost entirely on laboratory individuals, some field checks were also made to allow a comparison of field and laboratory conditions. These notes compose a general plumage ontogeny which will aid studies of the Mockingbird by indicating approximate ages of nestlings. This is not a pterylography and neither the text nor the figures should be considered to be more accurate than a description of the general aspect of the birds.

METHODS

Thirty-five individuals were taken as nestlings and put, initially, in cages one foot in width and height by two feet in length. In most cases the whole nest was taken and the siblings were kept in it. In a few cases an artificial cellulose nest was substituted when the original nest had been destroyed. At the age of 11 to 20 days the young were transferred to larger cages (see Horwich, 1965).

The young were fed on a diet of 50% wax moth larvae (*Galleria mellonella*) and 50% meal worm larvae (*Tenebrio molitor*), honey bee larvae (*Apis mellifera*), and hard-boiled eggs, with vitamins and minerals given on an experimental basis. Feeding occurred two or three times per hour from 7:00 A.M. to 7:00 P.M. The older birds were provided with a mixture of equal parts of dogfood, turkey starter mash, and dried flies, moistened with cottonseed oil (see Ficken and Dilger, 1961).

The base for aging the birds was field records on the nest histories of some of the birds captured, in which the actual day of hatching was noted. Later in the behavioral study the plumages of these birds were correlated with those of birds of unknown ages to provide some basis for aging all the birds. Four nests in the field which contained a total of 13 individuals were observed and left undisturbed. These were used to compare differences between the laboratory and the field birds. Three died on day two, four died on day four, four died on day six, and two siblings were observed until day 12 just a day before fledging.

The following ontogeny is a compilation of the life histories of all the birds including the extreme developmental characteristics of the most precocial birds.

The terms used in the description of the pterylae, feathers, and apteria are those used by Berger (1961) and Mewaldt (1958) and the names of the regions were those used by Wetherbee (1957). The descriptions of neossoptile patterns and Figures 1, 2 and 3 were made from dead specimens (one three-day-old, three four-day-olds, one seven-day-old, and three 12-13-day-old nestlings).

OBSERVATIONS

Day 1—The birds are covered with a light gray down which indicates the beginnings of some pterylae. Few descriptive notes of the down present were made. A detailed description of the down of a three-day-old specimen will be given below. The eyes are closed and the ear openings are quite visible. The gape is yellowish.

Day 2—The skin is redder than on the first day.

Day 3 (see Figure 1)—The body coloring is darker and subcutaneous pigmentation indicating pinfeathers has grown in on all pterylae. The capital tract contains a row of neossoptiles on the lower row of the eyelid, two rows, one on either side of the head, from the frontal area to the coronal area, and two large occipital tufts, one on either side of the head. Quills are visible on the capital tract including the frontal area around the bill and eyes. The spinal tract exhibits quills, and an abundance of down in the mid-dorsal and pelvic regions. Only the quills of the primaries, secondaries, and coverts and down from the greater and middle secondary coverts cover the wing.

Down also issues from the humeral tract. Minute down feathers spring from the tips of each rectrix and there is some down on a few covert quills. The femoral tracts have developed quills and also contain much down. The ventral tracts each contain small down rows.

FIGURE 1. A three-day-old nestling. (approx. 1 1/4 actual size)
a) Dorsal view. b) Ventral view.

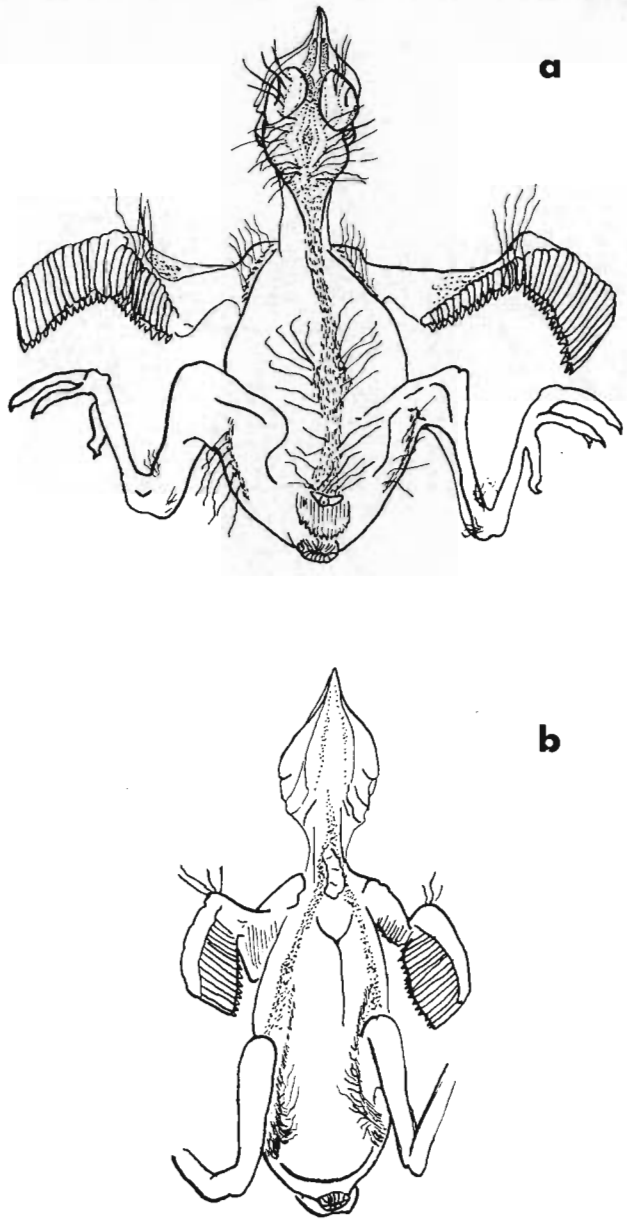


FIGURE 2. A seven-day-old nestling. (approx. actual size)
a) Dorsal view. b) Ventral view.

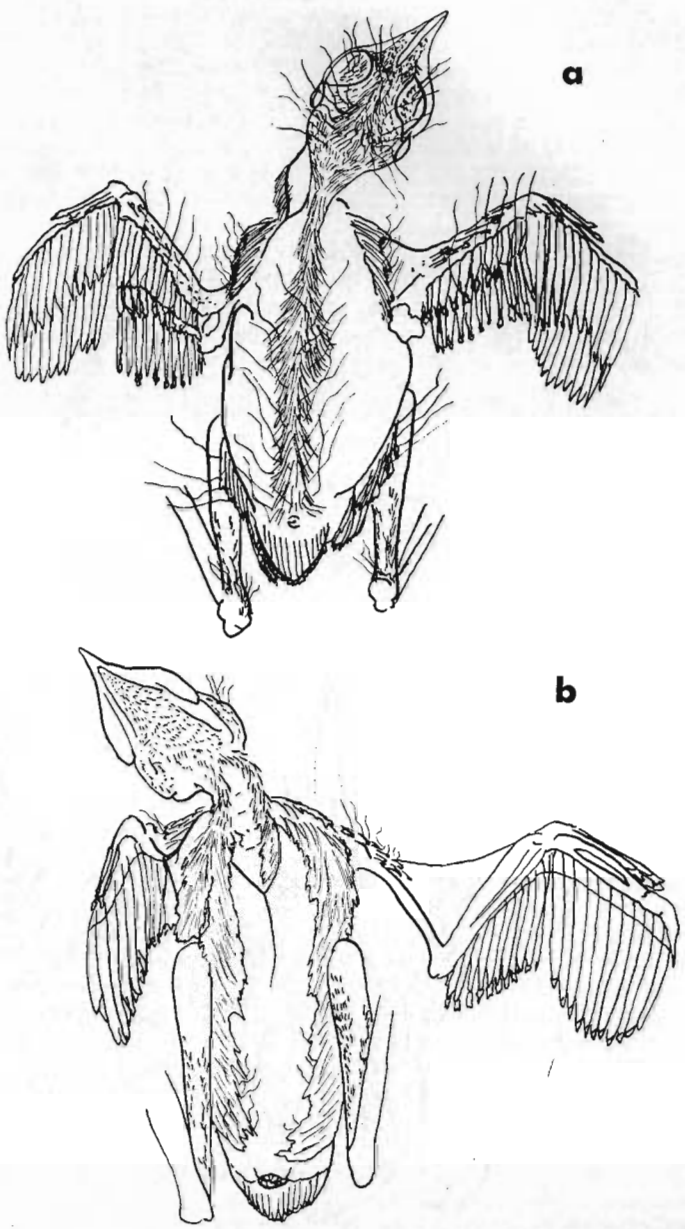
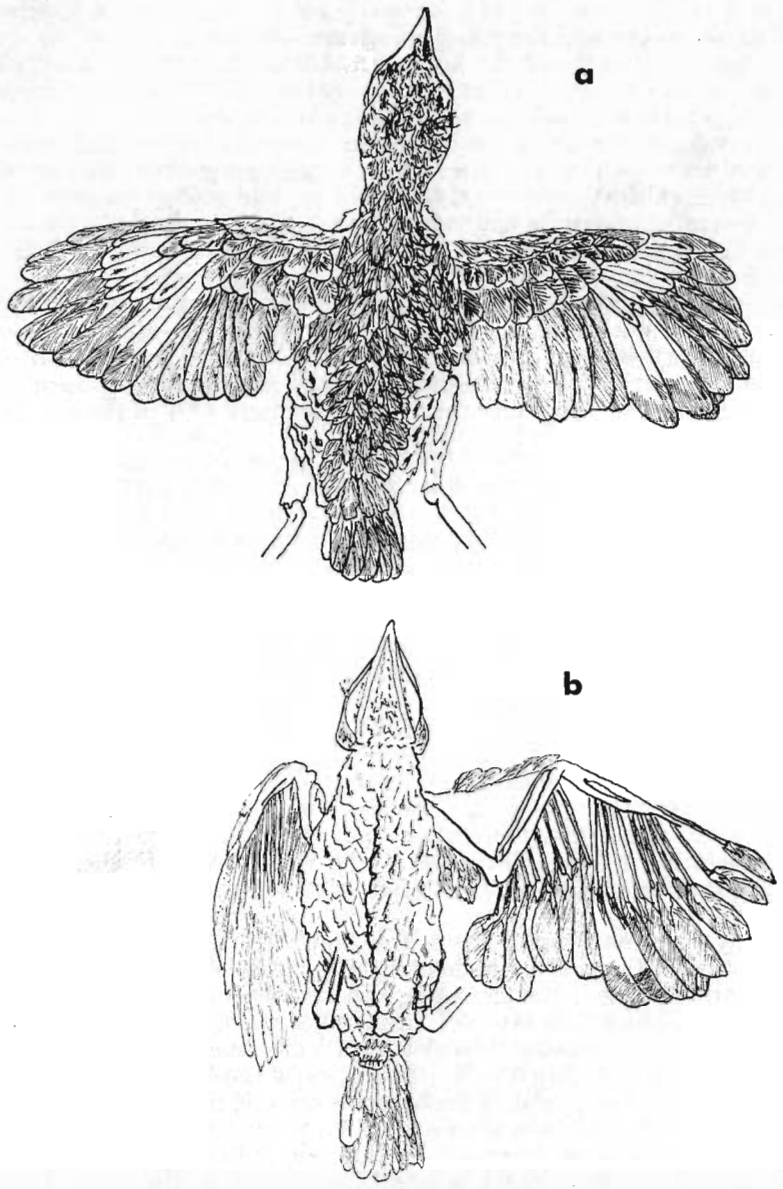


FIGURE 3. A 12-13 day-old Mockingbird. (approx. 1/2 actual size)
a) Dorsal view. b) Ventral view.



They also show some white feathers breaking out of the skin in the abdominal region. Down occurs as two tufts on the anterior and posterior faces of the crural tract only near the intertarsal joints. There is also a spotting of a few quills on it. The eyes are just beginning to open and the ear openings are still readily visible.

Day 4—Feathers of the spinal tract and the femoral tract are starting to break open from their sheaths. Down on the ventral tract appears to have grown but this is not definite.

Day 5—Much down still remains about the head and lower spinal tract. The tail is now seen as very short quills. The ventral and femoral feathers are very prominent, and mostly unsheathed. The ventral tracts are the most advanced but much of the skin of the ventral apterium is still visible. The eyes are now completely open.

Day 6—Pinfeathers of the head and neck are now easily seen and are partly unsheathed. There is also some unsheathing of the marginal coverts, the secondary coverts, and the humeral tract. The secondaries have scarcely opened and the primaries remain in closed sheaths. Most unsheathing has occurred first in the ventral tracts and then in the femoral tracts.

Day 7 (see Figure 2)—All of the flight feathers are predominantly sheathed. The secondary coverts have continued to unsheath and the tips of the rectrices have started to fray. Much down remains on all areas described on day 3 but they are attached to much larger pinfeathers now.

The breast feather sheaths are mostly broken open and the two ventral tracts leave little visible skin of the ventral apterium. The eyes appear enlarged and the ears are still visible.

Day 8—The remiges are starting to unsheath at the ends (predominantly the secondaries). Down is concentrated in two tufts on the head and is also visible on the back. The rest is gone due to abrasion or is hidden by the juvenal feathers.

Day 9—The spinal tract still has some sheathing, but the frayed quills are longer. Both the primaries and secondaries on the wing are now unsheathed more than one-half inch at the tips. The rectrices have unsheathed more. The white breast feathers fully cover the ventral apterium. The femoral tracts are fully unsheathed, yet down remains on them.

Day 10—The femoral tracts are complete. When sitting in the nest the nestlings show little sheathing but when their wings and feet are extended, the sheathing can be seen on the remiges and rectrices. More than one-half inch is uncovered.

Day 11—The head retains down tufts on either side.

Day 12 (see Figure 3)—Except for a few secondary coverts and the flight feathers, most of the feathers are completely unsheathed. Down remains on the capital and spinal tracts. Some sheathing on the remiges and rectrices occurs but this is only in the proximal parts of the feathers and is best seen from a ventral view of the spread wings (Figure 3b).

Day 13—The bird retains down on the capital and spinal tracts. Sheathing remains on the remiges and rectrices.

Day 20—Down is no longer visible on the head or elsewhere.

Day 80—The beginning of the post-juvenal molt occurs in late summer when the pure white breast feathers grow beneath the older spotted ones of the juvenal plumage.

Day 89—The first winter plumage is now complete and a full white breast has resulted. At this time I noticed no molting of the juvenal flight feathers so the molt is incomplete. However, a partial molt of the remiges and rectrices was observed by Michener (1953). A complete molt occurred during the following summer when the bird was over one year of age.

After about five months of age the eyes change from a dark gray to a light grayish-green. At about ten months of age there is a gradual color change to pale yellow. By 16 months it appears light orange or dull yellow. By 18 months it still had not reached the bright yellow-orange or yellow mentioned by Michener (1953) and which I have seen in adults.

The above data has been simplified in Table I to stress main points in the feather development.

DISCUSSION

Feather development becomes an important tool in the approximation of the ages of young birds. It allows one to assign approximate ages to nestlings under observation. The actual body development (weight) of some young in the laboratory seemed less than the weight of their age equivalents in the field; this was probably due to the incomplete diet of the laboratory feeding. In one particular case a bird, captured at 10 days of age, was heavier and much more active than some of the older laboratory individuals which had been obtained at an early age. This discrepancy occurred only when nestlings were taken at less than seven days of age. In these cases the young birds, probably due to some diet deficiency, did not develop in good health and usually died. Before death most maintenance behavior decreased. Thus the feather growth appeared rather constant in all groups but the behavioral preening movements which cause the unsheathing of the feathers decreased in unhealthy birds. These birds then showed less unsheathing and an atypical appearance.

Preening aids in the removal of the feather sheathing and perhaps in initially freeing the feather from the skin. In addition, according to Ingram (1920) the down subjected to the most friction will disappear first (ventral and femoral tracts) while down on the head will remain longest due to its inaccessability to preening. A preening-like movement of the breast first occurred on day 1. Actual preening of the ventral tract occurred on day 3 and on this day a portion of white abdominal feathers was freed (Figure 1). At this time preening of the femoral tract also occurs. These two areas seem most easily reached and in addition a fluffy ventral tract would be an advantage to a young bird which rests most of the time on its breast and abdomen. By the seventh day preening on top of the wing begins and it is not until the tenth day that preening under the

Table I. A condensation of the main points in the physical development of Mockingbirds.

abbreviations: D, down present; Q, quills first appear; US, unsheathing or unsheathed; S, sheathing or sheathed; subcut., subcutaneous; vent. apt., ventral apterium; 1°, primaries; 2°, secondaries or secondary.

Day	General	Ventral Tracts	Femoral Tracts	Capital Tracts	Spinal Tracts	Crural Tracts	Alar Tracts	Tail	Eyes	Ear Openings
1	D-gape yellow	D-subcut. Q	D	D	D	D	D-Q	D-Q	closed	visible
3	skin dark subcut. Q	abdomen begins US	D-Q	D-Q	D-Q	D	D-Q	D	begin to open	”
4			begin US		begin US					
5		D-mostly US-vent. apt. seen	D-mostly US	D	D	D	D	D	open	”
6				begin US			coverts, humerals US-1°, 2° S		”	”
7		vent. apt. hardly visible	D-mostly US	D	D	D	D	D-begins US	”	”
8			D	D	D		2° begin US		”	”
9		vent. apt. not visible-US complete					1°, 2° US over 1/2″		”	”

Day	General	Ventral Tracts	Femoral Tracts	Capital Tracts	Spinal Tracts	Crural Tracts	Alar Tracts	Tail	Eyes	Ear Openings
10							S on 1°, 2°		”	”
11				D tufts	D				”	”
12				D ”	D		S on remiges and	little S	”	not visible
13				D ”	D		2° coverts			
20	no D visible									
80		begin post-juvenal molt					partial molt of flight feathers		dark grey	”
89		molt ends								

5 months—eyes are light grey-green
10 months—eyes are pale yellow
12+ months—first complete molt takes place
16 months—eyes are light orange or dull yellow

wing is observed. Figure 3 indicates the large amount of sheathing remaining on the underwing by day 12.

The Mockingbird development parallels that of another mimid. A similar ontogenetical description was made by Rand (1941) of the Curve-billed Thrasher. These two species are very similar but the thrasher lags in development by a few days. On the second day the thrasher shows a darkening of the skin and by the fourth day the feather tracts become visible. The eyes begin to open at 5 days of age, two days later than in the Mockingbirds and are wide open the following day. The rectrices break out of the sheath at the tip one day earlier. The ventral tract (abdominal region) breaks four days later than in Mockingbirds but it is still one of the first tracts to unsheath. Day 16 for the thrasher is the approximate date of fledging and at this time it still shows some sheathing on the wing and tail and all down is gone except for traces on the head. This is similar to the Mockingbird on day 13 when fledging occurs (see Figure 3).

The mimids in general conform to a basic neossoptile body pattern except for the Catbird which was found to differ slightly (Wetherbee, 1957). All specimens which I have examined have conformed to this pattern. The Mockingbird is thus a well covered nestling, retaining the tracts most often lost in evolution (ventral, crural, ocular, alar). Wetherbee also considered the possibility of the growth of down. I have seen some indications of growth in the ventral pterylae in the Mockingbird, but my data shows some gaps, and further investigations are necessary.

SUMMARY

1. The plumage development of 35 hand-raised nestling Mockingbirds was observed as part of a behavioral ontogeny.

2. The descriptions of birds of known ages in the laboratory and in the field were used as a measure to approximate the ages of any young Mockingbirds.

3. A description of the plumage ontogeny is given with reference to figures drawn from preserved specimens.

4. Some of the shortcomings of the laboratory observations are discussed.

5. A discussion of the relevance of behavior to the general aspect of the bird follows.

6. The similarity of feather development and neossoptiles in mimids is mentioned.

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