As an answer to the second question, concerning the seeming randomness of occurrence of the abbreviated condition, the following is suggested. Since the fledgling requires an efficient airfoil for flight, selection would be against young which were fledged with a gap in the wing. The number of feathers involved and the extent of the reduction of the juvenal inner primaries is, therefore, probably correlated with the relationship between the time of fledging and the speed of the post-juvenal primary molt. The abbreviated condition of the inner primaries is an advantage to the nestling which becomes a disadvantage to the fledgling. The balance between these factors results in the apparently random variations found among different species in the extent of the abbreviated condition. In the sapsuckers (*Sphyrapicus*), the Lewis Woodpecker (*Asyndesmus lewis*), and the White-bellied Woodpecker (*Leuconerpes candidus*), Chapin found that there is no reduction in the size of the juvenal inner primaries. In these species it is likely that the post-juvenal molt does not begin soon enough to permit the juvenal inner primaries to be abbreviated during the nestling period but dropped and regrown before fledging. Chapin (*op. cit.*, p. 545) notes that a young Lewis Woodpecker, with a full-grown wing, showed, "no sign either of reduction of the inner primaries or of a beginning of post-juvenal molt." This seems to be admissible evidence in favor of the hypothesis offered above. Some statements by Bent, although not supported by incontestable evidence, suggest that the post-juvenal molt in the Lewis Woodpecker and the sapsuckers may not begin until after fledging. He states (Bull. U. S. Natl. Mus. 174: 229, 1939) that the post-juvenal molt of the Lewis Woodpecker begins in September, some two or three months after fledging and (p. 132) that the post-juvenal molt in the Yellow-bellied Sapsucker (*S. varius*) is accomplished by a series of partial molts which may begin in July, after fledging, and last until early spring.

Similarly, the species with one abbreviated inner primary are apparently those in which the post-juvenal molt begins early enough to allow time for one primary to be dropped and regrown while the species with two abbreviated juvenal inner primaries have a relatively still earlier post-juvenal molt. As previously noted, this hypothesis also explains why the inner primaries are the ones involved—simply because the primary molt begins with the inner primary and proceeds outward.

If this hypothesis is correct why should not other species having a complete post-juvenal molt have evolved a similar arrangement? A quick survey of available references containing information on molts does not reveal any other species in which the post-juvenal molt begins before fledging (Witherby, *et al.*, Handbook Brit. Birds, 1944; Dwight, Ann. N. Y. Acad. Sci., 13: 73–360, 1900). The reason why woodpeckers should be unique in this respect (if indeed they are) is probably related to their long period of nestling life. It is well known that the woodpeckers, and their relatives the toucans, honey-guides, and barbets, have relatively short incubation periods but exceptionally long periods of nestling development before fledging.

It seems possible then, that the abbreviated inner primaries of nestling woodpeckers are an adaptation to nest life, which also provides a metabolic saving, and that the evolution of this condition has been possible because of the unique combination of a complete post-juvenal molt, beginning with the inner primaries, and an unusually long period of nestling life.—CHARLES G. SIBLEY, *Department of Conservation, Cornell University, Ithaca, New York.*

The Loss of Teeth in Birds.—The fact that birds have lost their teeth during the course of evolution is well known but the adaptive advantages which prompted this loss are not known. Nearly every avian feature is concerned in some way with adaptation for flight and this would suggest that the reduction and eventual loss of teeth also somehow favored this adaptation. Little has been ventured in the past by way of a possible explanation for this loss of teeth. The most prevalent idea at present seems to be that it was in response to the detrimental effects of the weight involved in possessing teeth and their attendant rather heavy supporting jaws, especially so far from the center of gravity.

Many present day forms have bills as heavy as, or heavier than, tooth-bearing jaws would necessarily be. This is probably a secondary condition that can exist because of the relative perfectness of other flight-adapted features. It may be that the ancestral types, not so perfectly adapted for flight as present forms, lost their teeth because any advantage making for better flight would be at a greater premium than at present. Once lost, it would be impossible for teeth to reoccur since they have been derived by a long process of evolution from placoid scales. Some modern forms have secondarily evolved "teeth" which are hooks or serrations of the horny coverings of the maxillae and mandibles. This demonstrates that teeth or tooth-like structures are still an advantage, particularly to some groups. The tooth-like structures present in modern forms are useful as meat-tearing structures or for holding active and or slippery prey. They are not, however, used for chewing.

I believe that another possible explanation for this loss of true teeth (admitting that weight reduction may be a partial explanation) involves the necessarily very high rate of metabolism of birds which is in turn a response to the flying habit. Such a high rate of metabolism necessitates the rapid ingestion of great quantities of food, usually of high caloric value. This in turn calls for rapid digestion and assimilation of this food. The more finely divided the food is the quicker it can be utilized. Teeth, of course, can process food into fine enough particles for rapid digestion if chewing is long enough, but rapid ingestion would then be impossible. Birds have evolved, instead, a muscular gizzard within which food is ground rapidly and finely with the aid of ingested grit. This permits the rapid and frequent ingestion of food which can be temporarily stored in the esophagus or crop while a relatively constant process of ingestion and digestion takes place.

Forms which are adapted to take foods which are easily digested such as flesh and nectar do not require this rather elaborate digestive system although many flesh eaters need "teeth" to aid in tearing their prey into small enough pieces to be swallowed. I think that it is likely that modern birds which do not need a muscular, grinding type of stomach have evolved from ancestral types which did because of increased demands for more rapid ingestion and digestion.

I suggest that the greater feeding efficiency of a grinding, muscular gizzard (developing along with the increasing necessity for a progressively higher rate of metabolism coincidental to greater flight efficiency) made teeth less necessary and led, consequently, to their reduction and final loss.—WILLIAM C. DILGER, *Laboratory of Ornithology, Cornell University, Ithaca, New York.*

Absence of Syrinx in the Turkey Vulture (*Cathartes aura*).—Dissection of the trachea of the Turkey Vulture shows no syrinx. The trachea branches into two bronchi much as in mammals, with no syringeal drum, no pessulus, and no wide expanses of membrane between cartilages or at the apex of the bronchi. The cartilages are very narrow, considering the size of the bird, none over 1 mm. in width. The bronchi consist not of half-rings of cartilage but of complete rings, the inner portion of each ring extremely fine, almost hair-like. Although very thin, these cartilages appear to give enough support to the internal bronchial membranes to