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# A REVISED CLASSIFICATION FOR THE BIRDS OF THE WORLD

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Since the revision of this classification published in 1940<sup>1</sup> detailed studies by the increasing numbers of competent investigators in avian anatomy have added greatly to our knowledge of a number of groups of birds. These additional data have brought important changes in our understanding that in a number of instances require alteration in time-honored arrangements in classification, as well as the inclusion of some additional families. A few of these were covered in an edition issued in mimeographed form on November 20, 1948. The present revision includes this material and much in addition, based on the author's review of the work of others and on his own continuing studies in this field. His consideration necessarily has included fossil as well as living birds, since only through an understanding of what is known of extinct forms can we arrive at a logical grouping of the species that naturalists have seen in the living state. The changes from the author's earlier arrangement are discussed in the following paragraphs.

Addition of a separate family, Archaeornithidae, for the fossil *Archaeornis siemensi*, reflects the evident fact that our two most ancient fossil birds, *Archaeopteryx* and *Archaeornis*, are not so closely related as their earlier union in one family proposed. The characters marking the two have been under dispute in literature, mainly between Petronievics and von Nopsca. Lambrecht<sup>2</sup> has analyzed the data, finding 10 points of difference that hold. Though some of these appear trivial, enough are of sufficient weight from a taxonomic standpoint to warrant family status. Neither the suggestion that what we now recognize as *Archaeornis* is merely a young individual of *Archaeopteryx lithographica*, so that the differences seen are those of immaturity, nor the more extreme view that *Archaeopteryx* and *Archae-*

<sup>1</sup> Wetmore, A., A systematic classification for the birds of the world. Smithsonian Misc. Coll., vol. 99, No. 7, Oct. 10, 1940, pp. 1-11.

<sup>2</sup> Handbuch der Palaeornithologie, 1933, p. 86.

*ornis* have given rise respectively to our flightless and our flying birds in separate lines of descent is supported by the facts.

In the Neornithes one important result has been the arrival at a more even continuity of characters that has led to the reduction of superorders recognized in the subclass from four to three, through the combination under Neognathae of the orders formerly separated as the Palaeognathae. For years I have felt that recognition of the Palaeognathae, as a separate group apart from other birds, on the basis of a supposed peculiarity in the palate, stood on very flimsy ground. The recent studies of McDowell<sup>3</sup> demonstrate that the structure of the palaeognathous palate, in which the palatine and pterygoid bones are articulated by a squamous suture, is variable from order to order, and that in fact the details of this union vary considerably in the different groups. For example, McDowell points out that in *Dromiceius* the palatine and pterygoid are not in contact, while in a number of families placed in the Neognathae, as in the Anatidae, to name only one, the two bones are in articulation. As there is no clear-cut separation, the former Palaeognathae must be combined with the Neognathae.

The question of the weight to be given the peculiarities of uniform pterylosis, extreme specialization of the wing as a flipper for submarine progression, and incomplete fusion in the metatarsal elements, as well as such other details as erect posture in standing and walking and the anatomical adjustments involved, found in the penguins, is one that has merited careful review. It seems reasonable after this examination to retain the Impennes as a superorder, at least until we have further evidence through fossils as to their line of evolution. It is necessary, however, to remove the fossil family Cladornithidae, since Simpson<sup>4</sup> has found that the two genera *Cruschedula* and *Cladornis* placed in this family have no apparent relationship to the Sphenisciformes. These two, described by Ameghino from the Desado formation of Patagonia, now placed in the Oligocene, are based on fragmentary, considerably flattened metatarsi. The descriptions and figures that have appeared thus far are not sufficiently definite to demonstrate clearly characters of importance in classification. However, from what we now know these ancient birds cannot be considered as ancestral penguins of terrestrial habit, as has been supposed. The only suggestion that has come to me is that possibly they may belong

<sup>3</sup> The bony palate of birds. Part 1, the Palaeognathae. *Auk*, vol. 65, Oct. 1948, pp. 520-549, 6 figs.

<sup>4</sup> Simpson, George Gaylord, Fossil penguins. *Bull. Amer. Mus. Nat. Hist.*, vol. 87, art. 1, 1946, pp. 1-99, 33 figs.

in the order Pelecaniformes, in which I have placed the family tentatively in the suborder Odontopteryges, where it is located with two others of almost equally uncertain status. This allocation is wholly tentative and is no indication of belief in close relationship in the three diverse groups there assembled.

The family Eleutherornithidae is introduced for the fossil *Eleutherornis helveticus* Schaub, from the Eocene of Switzerland, described from a fairly well preserved pelvis. Apparently this is representative of an ancestral group from which the living ostriches have come. Its greatest importance is found in its indication of relationship with carinate groups though of unquestioned ratite stock. It is thus important as definite indication that the struthious birds have come from flying ancestors, and not from some distinct cursorial line that always has been flightless, as some have contended.

The family segregation in the order Procellariiformes has been oversimplified in some recent considerations, probably through misunderstanding of the group characters produced by anatomical studies, possibly also through somewhat confusing names that have been applied to familial and generic categories. The Diomedidae and Pelecanoididae have been accepted without apparent question, but the remaining species have been combined by some under a single family name. Lowe,<sup>5</sup> however, has shown that the genera included in the Hydrobatidae have a simplified condition in the quadrato-tympanic region of the skull in which the opening of the upper tympanic recess is small and is so located that it separates the squamosal and opisthotic facets. In addition, the posterior border of the sternum is truncated and entire, and basipterygoids are absent or are represented only by small spines. In the Procellariidae, on the other hand, the foramen of the upper tympanic recess is greatly enlarged and lies anterior to the two facets for the quadrate, which are joined by a bridge of bone; the posterior border of the sternum is notched; and basipterygoid processes are present. These constitute distinctive characters at the family level.

In the arrangement of suborders in the order Pelecaniformes we encounter in marked degree the standard difficulty of logical placement in linear alignment of groups that really stand in three-dimensional relationship. Lanham<sup>6</sup> has made a summary of the major anatomical characters of the group in which he points out the differences that set off the Phaëthontes and the Fregatae from the Pelecani. There

<sup>5</sup> Proc. Zool. Soc. London, 1925 (Jan. 14, 1926), pp. 1436-1443.

<sup>6</sup> Auk, vol. 64, 1947, pp. 65-70.

is no question that the first two carry primitive characters, which may be presumed to be similar to those found in an ancient ancestral stock, since in these resemblances they are more like other types of birds, notably the Procellariiformes. From this style the other families of the Pelecani have become widely divergent. Although the tropic-birds and the frigate-birds both have retained a part of what may be regarded as a basic pattern, they are so widely divergent in other respects that it seems more reasonable to relate them individually as branches from the common stock rather than to combine the two on one line, separate from the Pelecani. The Phaëthontes possibly may have separated earlier than the Frigatae. Among interesting differences other than those of internal anatomy, it may be noted that the tropic-birds have the young covered with down at birth and that the adults possess series of air cells under the skin on the forepart of the body like those found in pelicans and boobies. The frigate-birds have the young naked at hatching, and the emphysematous condition is mainly lacking. In view of this discussion I prefer to continue to align these groups on either side of the Pelecani.

Though there is no question that the cormorants and snake-birds are closely allied, they differ in such degree that they should be retained in separate family status. The snake-birds are marked by a peculiar conformation of the cervical vertebrae through which the beak becomes a triggered spear in feeding. The bridge of Dönitz on the ninth vertebra is an important part of this arrangement. The stomach also is unusual in possessing a curious pyloric lobe, lined with a mat of hairlike processes. And there is only one carotid artery.

The Odontopteryges, as has been noted above, are of highly doubtful status and require further study.

The family Cochleariidae, which some wish to unite with the Ardeidae, is marked externally by the strangely expanded bill, which is not only broad, but has the gonys remarkably shortened. Internally the pattern set by the broadened premaxillae is reflected in correspondingly widened palatines, which in addition have a curious flaring expansion of the lateral margin. The lachrymals are greatly reduced in size, and there are other minor peculiarities. Ridgway<sup>7</sup> lists four powder-down tracts for *Cochlearius*, a larger number than the two or three pairs that he found in the Ardeidae. This, however, needs further checking, since there is some uncertainty as to the correctness of these figures. There is no question that the boat-bills are closely related to the herons, but the greatly modified forepart of the skull

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<sup>7</sup> Studies of the American Herodiones. Bull. U. S. Geol. Geogr. Surv. Terr., vol. 4, No. 1, 1878, p. 220.

seems sufficient to warrant separation in a distinct family. Herons, with riflelike precision, habitually spear or seize their prey, while the boat-bill has the advantage of a broadened scoop. Possibly this is more efficient in shallow waters, particularly in nocturnal feeding.

In view of the fact that the structural characters of the *Balaenicipitidae* have been summarized clearly by Stresemann,<sup>8</sup> it seems strange that the status of this family has been a matter of question. The single species shows affinity both with storks and with herons, in addition to outstanding peculiarities of its own.

The flamingos, which show affinity with both *Ciconiiformes* and *Anseriformes*, have been placed by Stresemann and others in a separate order, but they seem best allocated as a suborder of the first-named group.

The superfamily *Neocathartoidea*, and family *Neocathartidae*, for the curious vulture *Neocathartes grallator* (Wetmore),<sup>9</sup> discovered recently in the Upper Eocene fossil beds of Wyoming, introduce a new element in our known avifauna in the form of a small-winged, strong-legged vulture that evidently was terrestrial with limited powers of flight. It had about the same relation to the other American vultures that the secretarybird has to the hawks and falcons. Its inclusion also requires a separate superfamily, the *Cathartoidea*, for the previously known cathartine families.

The *Numididae*, which have been placed by some as a subfamily of the *Phasianidae*, differ in completely lacking the tuberosity or plate on the inner side of the second metacarpal that is so prominent in pheasants and grouse. The *Tetraonidae*, in contrast with the *Phasianidae*, have the pelvis relatively much broader and different in proportion, and the tarsus relatively shorter in relation to the length of the tibiotarsus. With these differences in mind it seems reasonable to retain the three groups in family status, at least until more detailed knowledge of their anatomy as a whole warrants change.

In the *Turnices* the two genera of bustard-quails, *Turnix* and *Ortyxelus*, have no hind toe, the wing is eutaxic, only the left carotid is present, and the eggs are rounded oval. The plain-wanderer of Australia, *Pedionomus*, has a small hind toe, the wing is diastataxic, right and left carotids are found, and the large eggs are pyriform. It seems desirable to continue these as separate families, rather than

<sup>8</sup> Aves, in Kükenthal and Krumbach, *Handbuch der Zoologie*, vol. 7, pt. 2, sect. 8, 1934, p. 809.

<sup>9</sup> For the substitution of *Neocathartes* for *Eocathartes* Wetmore, 1944, preoccupied by *Eocathartes* Lambrecht, 1935, see *Auk*, vol. 67, 1950, p. 235.

as subfamilies of one group, an arrangement that Stresemann<sup>10</sup> has accepted.

In the suborder Phororhaci the family Psilopteridae is to be added for the South American fossils *Psilopterus* and *Smiliornis*, from the studies of Patterson.<sup>11</sup> Another group of doubtful position that may be placed tentatively in this suborder, at least until it is better known, is the family Cunampaiidae, for the fossil *Cunampaia simplex*, named by Rusconi<sup>12</sup> from the Oligocene of western Argentina.

In the Charadriiformes the main disagreements of the present day are found in the superfamily Charadriodea and the suborder Lari, in which the groups have been regarded by some as of family value and by others have been allocated the rank of subfamilies. The various structural studies that have been made have not been complete from a taxonomic point of view except for part of the species, and the conclusions derived from the data available have been in the main more philosophical than concrete. The picture therefore still remains confused.

In view of the diverse specializations that are apparent, and the obvious long evolutionary history, it appears better to me to continue to acknowledge the main segregations as families, at least until the subjects involved have been more thoroughly investigated. A family, Rhegminornithidae, is added for the fossil *Rhegminornis calobates* Wetmore, described from the Lower Miocene of Florida. This was as large as a medium-sized curlew, of peculiar form as regards the foot, the only part of the skeleton known, which shows certain characters that seems to point toward the jaçanas, though the bird is to be placed in the Charadriodea.

In the Lari the terns and the gulls are regarded as one family, though there are some reasons that make further examination of this treatment desirable. The Rynchopidae differ decidedly in absence of the ambiens and the biceps slip, and in the completely different form of the bill. The iris opens and closes vertically in slitlike form, a condition that I have not seen in any other bird.<sup>13</sup>

The Stercorariidae possess a 2-notched sternum, large caeca, a cere, and a complex rhamphotheca. In the Laridae ambiens and biceps slip are present, the sternum is 4-notched, there is no cere, and the rhamphotheca is simple in form.

<sup>10</sup> Loc. cit., p. 760.

<sup>11</sup> Field Mus. Nat. Hist., geol. ser., vol. 8, No. 8, Oct. 31, 1941, pp. 52-53.

<sup>12</sup> Bol. Pal. Buenos Aires, No. 21, May 2, 1946 (p. 1).

<sup>13</sup> Wetmore, A., A note on the eye of the black skimmer (*Rynchops nigra*). Proc. Biol. Soc. Washington, vol. 32, Dec. 31, 1919, p. 195.



Old World ornithologists in the main have regarded the owls as belonging to a single family, but while all are deceivingly similar in general aspect, the decided differences found in the barn-owl group merit family recognition. Ridgway<sup>14</sup> years ago summarized the considerable structural characters separating the Tytonidae and the Strigidae. It is necessary here only to point out the more outstanding structural differences of the Tytonidae in the lack of the manubrium, and the different form of the posterior margin of the sternum, which is entire or has two shallow notches, the union of the furculum with the carina sterni, the straight outline of the palatines, and the ventral pteryla where the outer branch joins posteriorly to the main tract. The Strigidae possess a manubrium, the sternum is 4-notched, the furculum is separate, the palatines are greatly expanded posteriorly, and the posterior end of the ventral pteryla does not join the main tract at the posterior end.

Lucas<sup>15</sup> long ago demonstrated the differences between the true swifts and the crested swifts, though his work seems latterly to have been largely overlooked in view of the recent inclusion of the two in one group, as by Stresemann and by Mayr and Amadon. The skull in the Hemiprocniidae is quite distinct in the general form of the cranium and in the development of the nasals, vomer, and palatines, while the hypotarsus has a tendinal foramen (like that found in hummingbirds), and the plantar tendons have the flexor longus hallucis connected with the branch of the flexor perforans digitorum, which extends to the fourth digit. Coupled with this there may be noted the curious nest, which, fastened to the side of a branch, is barely large enough to contain one egg, and the further fact that these birds perch regularly on branches and twigs in trees.

As *Apus* Scopoli, published in 1777, is recognized now in place of *Micropus* Meyer and Wolf, 1810, for the type genus of the swifts, the terms in the classification change to order Apodiformes, suborder Apodi, and family Apodidae, which replace the former terms Micropodiformes, Micropodi, and Micropodidae, respectively.

The proposal of Mayr and Amadon<sup>16</sup> to include the rollers in one family, the Coraciidae, with three subfamilies, goes back to the arrangement of Dresser in his monograph of the group.<sup>17</sup> Sclater,<sup>18</sup>

<sup>14</sup> U. S. Nat. Mus. Bull. 50, pt. 6, 1914, p. 598.

<sup>15</sup> Auk, vol. 6, 1889, pp. 8-13; vol. 12, 1895, pp. 155-157.

<sup>16</sup> A classification of recent birds. Amer. Mus. Nov., No. 1496, Apr. 2, 1951, pp. 9, 35.

<sup>17</sup> A monograph of the Coraciidae, or family of the rollers. London, 1893, pp. i-xx, 1-111, 27 plates.

<sup>18</sup> Proc. Zool. Soc. London, 1865, pp. 682-688, 8 figs.

however, many years ago, pointed out the pelvic powder-down tracts, the small manubrium and other peculiarities of *Leptosoma*, and set it apart in a distinct family. The anatomy of the syrinx and feet was further elaborated by Forbes.<sup>19</sup> The family Leptosomatidae therefore should be recognized.

The ground rollers, *Brachypteracias*, *Atelornis*, and *Uratelornis*, usually have been included as a subfamily of the Leptosomatidae, but Stresemann<sup>20</sup> places them in a separate family, the Brachypteraciidae. There seems to be reason for this in their general appearance, though their anatomy is not well known. *Brachypteracias*, in its skeleton, differs from *Coracias* and *Eurystomus* in the much greater depth of the outer notch on the posterior border of the sternum, in the much broader and stronger pelvis, the heavier femur, and the greater curvature of the shaft and reduction of the crista superior of the humerus. I have not seen the skull. The habit of life is markedly different. Although anatomical material of the other genera is not presently available, it seems reasonable to accept Stresemann's proposal. These peculiar birds certainly are not closely allied to *Leptosoma*.

Lack of information on the anatomy of the wood-hoopoes must be the reason for the recent nonrecognition of the Phoeniculidae as a family separate from the Upupidae, since the two are quite distinct and have been so recognized for many years. The external differences are readily apparent. In the skeleton in *Phoeniculus* (of which I have seen several examples) the posterior part of the nasal area is ossified, there being only a small, narrow, elongated nasal opening; the ectethmoid is much reduced; the anterior end of the pterygoids is broadly expanded; the sphenoidal rostrum is swollen at the anterior end, where the expanded ends of the pterygoids join it; the quadrates are decidedly larger; the keel of the sternum is greatly reduced, being only half as high as in *Upupa*; the furculum is broader; the pelvis is narrowed, and considerably elongated posterior to the acetabulum, with the ischio-pubic fenestra greatly enlarged; and the tarsus is heavier and broader, with two definite fenestra below the head. There are other minor details. In all of the above the characters of *Upupa* are directly opposite. The two groups appear to me to be sharply set off as distinct families.

The Passeriformes, with more living species than all the other

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<sup>19</sup> Proc. Zool. Soc. London, 1880, pp. 465-475, 5 figs.

<sup>20</sup> Loc. cit., p. 829.

orders combined, and far fewer fossil forms discovered to date, present many difficult problems in their logical arrangement. The major groups are clear, whether we rank them as suborders or superfamilies being a matter of opinion. But the limits of numerous families contained in these larger categories are uncertain. The internal anatomy is known fully for so few kinds that details of difference are poorly understood. The superficial resemblances, on the other hand, are so obvious in many cases that there is much confusion. Under the circumstances it continues to seem appropriate to me to accept the family grouping that has been current for many years, except in those cases where detailed studies clearly indicate change. There is much supposition in these matters, that has led to various proposals for combination, some part of which undoubtedly will prove correct. It is equally probable that a part, possibly a considerably larger part, may prove to be unfounded when details are more clearly known. If change is accepted under these circumstances it may prove unwarranted, necessitating further change, perhaps a return to the original supposition. Since this can only prove confusing I prefer the conservative course. In the remarks that follow I will discuss only a few matters on which I have more or less concrete ideas.

In the superfamily Furnarioidea, Von Ihering<sup>21</sup> unites the Furnariidae and the Dendrocolaptidae, since he is unable to separate two groups on the basis of the form of the posterior border of the nasal opening. The variation that he shows seems quite true, but there are numbers of other points of supposed difference concerned in the osteology and other structural details, and therefore his suggestion is far from established. Pycraft,<sup>22</sup> though seemingly uncertain in the beginning, finally retained the two families. It may prove that some genera are wrongfully allocated at present between the two groups, and that their shifting, when we have sufficient information, will clear our understanding.

In the Tyrannoidea, the family Oxyruncidae is known through external characters that seem to warrant separation. If the sharpbills have other affinities it is doubtful that these are within the Tyrannidae, where some have placed them.

In the family Cracticidae, recognized by Australian ornithologists, the skull according to Pycraft<sup>23</sup> (mainly from examination of *Gymnorhina*) has the zygomatic process of the squamosal bifurcate, the postorbital process large, the orbitosphenoid ossified, the interorbital

<sup>21</sup> Auk, vol. 32, 1915, pp. 145-153, pls. 11-12.

<sup>22</sup> Proc. Zool. Soc. London, 1906, pp. 133-159, figs. 49-52.

<sup>23</sup> Proc. Zool. Soc. London, 1907, pp. 355-365.

septum with a single opening, the prefrontals unusually large, and the form of the palate peculiar. In his phylogenetic tree Pycraft places the group on a common stem with the Artamidae, and not far from the Paradiseidae. His account is mainly descriptive and difficult to summarize in concrete form.

The family Grallinidae is likewise recognized officially by Australian ornithologists for *Grallina cyanoleuca*, the magpie-lark. The principal study of the osteology is that of Shufeldt,<sup>24</sup> but the account is mainly descriptive and without definite conclusion. Amadon<sup>25</sup> recently has placed *Corcorax* and *Struthidea* here tentatively, though this seems subject to further proof.

Stonor<sup>26</sup> has outlined excellent reasons for recognition of the Ptilonorhynchidae, finding that they differ from Paradiseidae, with which they have been united, in having an apterium in the center of the dorsal feather tract, the tip of the vomer convex, larger, more developed maxillo-palatines, the margin of the palatines angular, smaller ectethmoid, much larger lachrymal, and slender, greatly elongated orbital ramus of the quadrate. The genera *Loria* and *Loboparadisca*, usually included here, he transfers to the Paradiseidae. His conclusion is that "the Ptilonorhynchidae constitute a singularly complete and isolated family of the acromyodian passerine birds and show no special relationship to any other, being sharply marked off by the structure of the skull, the colour-pattern, and the bower-building habit."

Oberholser<sup>27</sup> has set up a distinct family Irenidae for the fairy bluebirds (*Irena*), and Delacour<sup>28</sup> a family Aegithinidae for the leafbirds, which would cover *Irena*, *Aegithina*, and *Chloropsis*. Inasmuch as the internal anatomy of these seems as yet unknown, I have not included such a family, pending further information.

The proper allocation of the genus *Chamaea* for the wren-tits, at present accepted by the A. O. U. Committee on Classification and Nomenclature as a separate family, the Chamaeidae, is one of considerable uncertainty. Delacour<sup>29</sup> has suggested that they be located in the

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<sup>24</sup> Emu, vol. 23, July 1923, pp. 16-19, pl. 6.

<sup>25</sup> Emu, vol. 50, Oct. 1950, pp. 123-127.

<sup>26</sup> Proc. Zool. Soc. London, vol. 107, ser. B, pt. 3, Sept. 1937, pp. 475-490, figs. 1-9. It should be noted that the names on figures 6 and 8 have been transposed, figure 6 being *Semioptera wallacci*, and figure 8 *Amblyornis subalaris*, and not the reverse as printed on pp. 481 and 483.

<sup>27</sup> Journ. Washington Acad. Sci., vol. 7, Oct. 19, 1917, pp. 537-541.

<sup>28</sup> Zoologica, vol. 31, 1946, p. 3.

<sup>29</sup> L'Oiseaux, vol. 16, 1946, pp. 18, 25, 35.

family Timaliidae in a special subfamily in which he includes also such diverse genera as *Chrysomma* (*Moupinia*), *Panurus*, *Conostoma*, and *Paradoxornis* (combining under this name *Suthora*, *Psittiparus*, *Neosuthora*, and *Cholornis*). This is an obviously heterogeneous assemblage, in which *Chamaea* has slight resemblances to the first only. From *Moupinia poecilotis* (placed in *Chrysomma* by Delacour) the wren-tit differs definitely in weaker, less arched bill and in differently proportioned feet. It has no close resemblance to any of the others that are mentioned. Although the relationships of *Chamaea* are obviously uncertain, it is retained as a family pending other information.

The recent suggestions for the union of the Bombycillidae, Ptilonotidae, and the Dulidae in one family are not substantiated by examination of the skeleton. *Dulus*, the palm-chat, is widely different from the other two, a structural distinction that is further emphasized by its curious communal nesting habits. The first two seem more closely related but are separated clearly by characters found in the ectethmoid region of the skull, and in the manubrium, to mention only two points that are easily apparent. Delacour and Amadon<sup>30</sup> consider *Hypocolius* closely allied to *Ptilogonyx*.

While Zimmer<sup>31</sup> believes that the family Vireonidae should be included in the Vireonidae, separate family rank in my opinion is definitely justified. In addition to characters assigned by Pycraft<sup>32</sup> for the shrike-vireos I have found recently that in the pterylosis the dorsal tract on the lower back is forked, the arms being broad at the ends, and separated from the narrowed line that continues onto the caudal area. This is completely different from the usual rhomboid found in the vireos, and may indicate that the family eventually should be removed from the vicinity of the Vireonidae.

The family characters of the pepper-shrikes, likewise outlined by Pycraft in the reference given above, are easily apparent on examination of the skeleton.

The family Callaeidae has been separated by Stonor<sup>33</sup> on the weakened keel of the sternum, the great development of the lower limb, coupled with reduced powers of flight, and the presence of a mouth wattle, for three peculiar genera, *Callaeus*, *Heterolocha*, and *Philesturnus* of New Zealand.

<sup>30</sup> Ibis, 1949, pp. 427-429, pl. 19.

<sup>31</sup> Amer. Mus. Nov., No. 1160, Jan. 30, 1942, p. 10.

<sup>32</sup> Proc. Zool. Soc. London, 1907, pp. 352-379.

<sup>33</sup> Ibis, 1942, pp. 1-18, figs. 1-10, tables 1-3.

The former family Melithreptidae becomes the family Meliphagidae, since the name of the type genus is now accepted as *Meliphaga* Lewin, 1808.

In a similar way the family Compsothlypidae for the wood warblers becomes the family Parulidae, since the former *Compsothlypis* Cabanis, 1851, is replaced by the older *Parula* Bonaparte, described in 1838.

The order of arrangement in the Passeriformes is in part necessarily arbitrary, through the easily perceptible and often remarked fact that we are under necessity of listing groups in linear order in a two-dimensional alignment when actually they stand in three-dimensional relationship to one another. (There is, further, another element that may be regarded almost as a fourth dimension, in some of the extinct groups known only as fossils that have no close relatives alive today.) The sequence that I have adopted is the one that best represents my present understanding, based on personal studies that now have extended over a period of nearly 50 years. I will repeat what I have said elsewhere, that I have placed the Fringillidae at the end of the list, because of my feeling that this group is the modern expression of a main core or stem that through the earlier Tertiary periods has given rise to more specialized assemblages that we now recognize as distinct families. Further specialization is apparent in some parts of the existing fringilline assemblage that, if undisturbed, may lead to further differentiation, should these variants be able to persist for the necessary millenniums in our rapidly changing world. Adjacent to the Fringillidae I place the other groups that obviously are closely allied to them. Attempts to arrange the avian families with the Corvidae and their allies in the terminal position, as accepted in various earlier classifications, and as followed now by Mayr and Amadon, because of supposed more advanced development of the brain appear to me quite uncertain, particularly in view of our decidedly limited information in this field. Should this idea be coupled with belief in superior mental reactions in the corvine assemblage, I would consider this more an anthropomorphic interpretation than one supported by scientific fact.

The formation of the group names has been one of recent interesting discussion. The suffixes -idae and -inae for families and subfamilies are accepted rather universally so that they do not require examination. In view of the limited number of species covered in ornithology I see no point in the introduction of tribes as another category between the subfamily and the genus. This may be useful to entomologists with their tens of thousands of species, but seems unnecessary and

cumbersome with birds. In some of the more comprehensive avian genera there are groups of species more closely allied to one another than to their fellows, but the taxonomist may discuss these at need as groups without imposing another burden on a classification that now is highly divided. For the group names above the family level, I believe it preferable to use suffixes that allow immediate identification of the rank, coupled with a stem that, like the family name, is based on a current generic term. Where ordinal and subordinal names are both formed as Latin plurals there is possibility of confusion.

The detailed classification that follows shows as its main improvements our better understanding of some of the peculiar birds found in Australia and New Zealand, and some additional historical data of importance in our slowly growing knowledge of extinct forms in the fossil record. Stresemann, and more recently Amadon and Mayr, have made many valuable suggestions as to the relationships of numerous peculiar genera that in part are still of uncertain position. It remains intriguing to observe the vast amount of information still to be secured before our basis for final classification may be considered complete.

October 1, 1951.

#### Class Aves, Birds.

##### Subclass Archaeornithes, Ancestral Birds.

Order Archaeopterygiformes, *Archaeopteryx*, *Archaeornis*.

Family Archaeopterygidae, *Archaeopteryx* (fossil),  
Archaeornithidae, *Archaeornis* (fossil).

##### Subclass Neornithes, True Birds.

##### Superorder Odontognathae, New World Toothed Birds.

Order Hesperornithiformes, Hesperornithes.

Family Hesperornithidae, *Hesperornis*, *Hargeria* (fossil).

Enaliornithidae,<sup>34</sup> *Enaliornis* (fossil).

Baptornithidae, *Baptornis* (fossil).

Order Ichthyornithiformes, Ichthyornithes.

Family Ichthyornithidae, *Ichthyornis* (fossil).

Apatornithidae, *Apatornis* (fossil).

<sup>34</sup> Position provisional. Lambrecht, *Handbuch der Palaeornithologie*, 1933, pp. 255-261, unites the Baptornithidae with this group, which he considers closely related to the loons and grebes.

- Superorder Impennes, Penguins.  
 Order Sphenisciformes, Penguins.  
 Family Spheniscidae, Penguins.
- Superorder Neognathae, Typical Birds.  
 Order Caenagnathiformes, Caenagnathus.  
 Family Caenagnathidae, *Caenagnathus*<sup>35</sup> (fossil).
- Order Struthioniformes, Ostriches.  
 Family Eleutherornithidae, *Eleutherornis* (fossil).  
 Struthionidae, Ostriches.
- Order Rheiformes, Rheas.  
 Family Rheidae, Rheas.
- Order Casuariiformes, Cassowaries, Emus.  
 Family Casuariidae, Cassowaries.  
 Dromiceidae, Emus.  
 Dromornithidae, *Dromornis* (fossil).
- Order Aepyornithiformes, Elephantbirds.  
 Family Aepyornithidae, *Aepyornis* (fossil and extinct).
- Order Dinornithiformes, Moas.  
 Family Dinornithidae, Moas (fossil and extinct).  
 Anomalopterygidae, *Anomalopteryx*, *Emeus*,  
 and Allies (fossil and extinct).
- Order Apterygiformes, Kiwis.  
 Family Apterygidae, Kiwis.
- Order Tinamiformes, Tinamous.  
 Family Tinamidae, Tinamous.
- Order Gaviiformes, Loons.  
 Family Gaviidae, Loons.
- Order Colymbiformes, Grebes.  
 Family Colymbidae, Grebes.
- Order Procellariiformes, Albatrosses, Shearwaters, Petrels,  
 and Allies.  
 Family Diomedidae, Albatrosses.  
 Procellariidae, Shearwaters, Fulmars.  
 Hydrobatidae, Storm Petrels.  
 Pelecanoididae, Diving Petrels.
- Order Pelecaniformes, Tropic-birds, Pelicans, Frigate-birds,  
 and Allies.  
 Suborder Phaëthontes, Tropic-birds.  
 Family Phaëthontidae, Tropic-birds.

<sup>35</sup> This interesting genus, listed tentatively in the above superorder, possibly is not avian.



Suborder Pelecani, Pelicans, Boobies, Cormorants, Snake-birds.

Superfamily Pelecanoidea, Pelicans and Allies.

Family Pelecanidae, Pelicans.

Cyphornithidae, *Cyphornis*, *Palaeochenoides* (fossil).

Superfamily Suloidea, Boobies, Cormorants, and Allies.

Family Pelagornithidae, *Pelagornis* (fossil).

Sulidae, Boobies, Gannets.

Elopterygidae, *Elopteryx*, *Eostega*, *Actiornis* (fossil).

Phalacrocoracidae, Cormorants.

Anhingidae, Snake-birds

Suborder Fregatae, Frigate-birds.

Family Fregatidae, Frigate-birds.

Suborder Odontopteryges, Odontopteryx, Pseudodontornis, Cladornithes (fossil).

Family Odontopterygidae, *Odontopteryx* (fossil).

Pseudodontornithidae,<sup>36</sup> *Pseudodontornis* (fossil).

Cladornithidae, *Cladornis*, *Cruschedula* (fossil).

Order Ciconiiformes, Herons, Storks, and Allies.

Suborder Ardeae, Herons, Bitterns.

Family Ardeidae, Herons, Bitterns.

Cochleariidae, Boat-billed Herons.

Suborder Balaenicipites, Whale-headed Storks.

Family Balaenicipitidae, Whale-headed Storks.

Suborder Ciconiae, Storks, Ibises, Spoonbills.

Superfamily Scopoidea, Hammerheads.

Family Scopidae, Hammerheads.

Superfamily Ciconioidea, Storks.

Family Ciconiidae, Storks, Jabirus.

Superfamily Threskiornithoidea, Ibises.

Family Threskiornithidae, Ibises, Spoonbills.

Suborder Phoenicopteriformes, Flamingos.

Family Agnopterygidae, *Agnopteryx* (fossil).

Scaniornithidae, *Scaniornis*, *Parascaniornis* (fossil).

Phoenicopteridae, Flamingos.

<sup>36</sup> Position not certain; see Lambrecht, *Handbuch der Palaeornithologie*, 1933, pp. 305-308.

- Order Anseriformes, Screamers, Ducks, Geese, Swans.
  - Suborder Anhimae, Screamers.
    - Family Anhimidae, Screamers.
  - Suborder Anseres, Ducks, Geese, Swans.
    - Family Paranyrociidae, *Paranyroca* (fossil).
    - Anatidae, Ducks, Geese, Swans.
- Order Falconiformes, Vultures, Hawks, Falcons.
  - Suborder Cathartae, New World Vultures.
    - Superfamily Neocathartoidea, Neocathartes.
      - Family Neocathartidae, *Neocathartes* (fossil).
    - Superfamily Cathartoidea, New World Vultures.
      - Family Cathartidae, New World Vultures.
      - Teratornithidae, *Teratornis*, *Cathartornis* (fossil).
  - Suborder Falcones, Secretarybirds, Hawks, Falcons.
    - Superfamily Sagittarioidea, Secretarybirds.
      - Family Sagittariidae, Secretarybirds.
    - Superfamily Falconoidea, Hawks, Falcons, and Allies.
      - Family Accipitridae, Hawks, Old World Vultures, Harriers.
      - Pandionidae, Ospreys.
      - Falconidae, Falcons, Caracaras.
- Order Galliformes, Megapodes, Curassows, Pheasants, Hoatzins.
  - Suborder Galli, Megapodes, Curassows, Grouse, Pheasants.
    - Superfamily Cracoidea, Megapodes, Curassows.
      - Family Megapodiidae, Megapodes.
      - Gallinuloididae, *Gallinuloides* (fossil).
      - Cracidae, Curassows, Guans, Chachalacas.
    - Superfamily Phasianoidea, Grouse, Pheasants, Turkeys.
      - Family Tetraonidae, Grouse.
      - Phasianidae, Quails, Pheasants, Peacocks.
      - Numididae, Guineafowl.
      - Meleagrididae, Turkeys.
  - Suborder Opisthocomi, Hoatzins.
    - Family Opisthocomidae, Hoatzins.
- Order Gruiformes, Cranes, Rails, and Allies.
  - Suborder Mesoenatides, Roatelos, Monias.
    - Family Mesoenatidae, Roatelos, Monias.
  - Suborder Turnices, Bustard-quails, Hemipodes.
    - Family Turnicidae, Bustard-quails.
    - Pedionomidae, Plain-wanderers.

Suborder Grues, Cranes, Limpkins, Trumpeters, Rails.

Superfamily Gruoidea, Cranes, Limpkins, Trumpeters.

Family Geranoididae, *Geranoides* (fossil).

Eogruidae, *Eogrus* (fossil).

Gruidae, Cranes.

Aramidae, Limpkins.

Psophiidae, Trumpeters.

Superfamily Ralloidea, Rails.

Family Orthocnemidae,<sup>87</sup> *Orthocnemus*, *Elaphrocne-*  
*mus* (fossil).

Rallidae, Rails, Coots, Gallinules.

Suborder Heliornithes, Sun-grebes.

Family Heliornithidae, Sun-grebes.

Suborder Rhynocheti, Kagus.

Family Rhynochetidae, Kagus.

Suborder Eurypygae, Sun-bitterns.

Family Eurypygidae, Sun-bitterns.

Suborder Phororhaci, *Phororhacos* and Allies.

Family Phororhacidae, *Phororhacos* and Allies (fos-  
sil).

Psilopteridae, *Psilopterus* and Allies (fossil).

Brontornithidae, *Brontornis*, *Liornis*, and Allies  
(fossil).

Opisthodactylidae, *Opisthodactylus* (fossil).

Cunampaiidae, *Cunampaia* (fossil).

Suborder Cariamae, Cariamas and Allies.

Family Bathornithidae, *Bathornis* (fossil).

Hermosiornithidae, *Hermosiornis*, *Procariama*  
(fossil).

Cariamidae, Cariamas.

Suborder Otides, Bustards.

Family Otidae, Bustards.

Order Diatrymiformes, *Diatryma*, *Omorhamphus*, and Allies.

Family Diatrymidae, *Diatryma* (fossil).

Gastornithidae, *Gastornis*, *Remiornis* (fossil).

Order Charadriiformes, Shorebirds, Gulls, Auks.

Suborder Charadrii, Shorebirds.

Superfamily Jacanoidea, Jaçanas.

Family Jacanidae, Jaçanas.

<sup>87</sup> Position provisional. See Lambrecht, *Handbuch der Palaeornithologie*, 1933, pp. 490-493.

Superfamily Charadrioidea, Plovers, Sandpipers, and Allies.

- Family Rhegminornithidae, *Rhegminornis* (fossil).
- Rostratulidae, Painted Snipe.
- Haematopodidae, Oystercatchers.
- Charadriidae, Plovers, Turnstones, Surf-birds.
- Scolopacidae, Snipe, Woodcock, Sandpipers.
- Recurvirostridae, Avocets, Stilts.
- Presbyornithidae, *Presbyornis* (fossil).
- Phalaropodidae, Phalaropes.

Superfamily Dromadoidea, Crab-plovers.

- Family Dromadidae, Crab-plovers.

Superfamily Burhinoidea, Thick-knees.

- Family Burhinidae, Thick-knees.

Superfamily Glareoloidea, Pratincoles, Coursers.

- Family Glareolidae, Pratincoles, Coursers.

Superfamily Thinocoroidea, Seed-snipe.

- Family Thinocoridae, Seed-snipe.

Superfamily Chionidoidea, Sheath-bills.

- Family Chionididae, Sheath-bills.

Suborder Lari, Gulls, Terns, Skimmers.

- Family Stercorariidae, Skuas, Jaegers.
- Laridae, Gulls, Terns.
- Rynchopidae, Skimmers.

Suborder Alcae, Auks.

- Family Alcidae, Auks, Auklets, Murres.

Order Columbiformes, Sand-grouse, Pigeons, Doves.

Suborder Pterocletes, Sand-grouse.

- Family Pteroclididae, Sand-grouse.

Suborder Columbae, Pigeons and Doves.

- Family Raphidae, Dodos, Solitaires.
- Columbidae, Pigeons, Doves.

Order Psittaciformes, Lories, Parrots, Macaws.

- Family Psittacidae, Lories, Parrots, Macaws.

Order Cuculiformes, Plantain-eaters, Cuckoos.

Suborder Musophagi, Plantain-eaters.

- Family Musophagidae, Plantain-eaters.

Suborder Cuculi, Cuckoos, Roadrunners, Anis.

- Family Cuculidae, Cuckoos, Roadrunners, Anis.

- Order Strigiformes, Owls.
  - Family Protostrigidae, *Protostrix* (fossil).
  - Tytonidae, Barn Owls.
  - Strigidae, Owls.
- Order Caprimulgiformes, Oilbirds, Goatsuckers.
  - Suborder Steatornithes, Oilbirds.
    - Family Steatornithidae, Oilbirds.
  - Suborder Caprimulgi, Frogmouths, Goatsuckers.
    - Family Podargidae, Frogmouths.
    - Nyctibiidae, Potoos.
    - Aegothelidae, Owlet-frogmouths.
    - Caprimulgidae, Goatsuckers.
- Order Apodiformes, Swifts, Hummingbirds.
  - Suborder Apodi, Swifts.
    - Family Aegialornithidae,<sup>38</sup> *Aegialornis* (fossil).
    - Apodidae, Swifts.
    - Hemiprocnidae, Crested Swifts.
  - Suborder Trochili, Hummingbirds.
    - Family Trochilidae, Hummingbirds.
- Order Coliiformes, Colies.
  - Family Coliidae, Colies.
- Order Trogoniformes, Trogons.
  - Family Trogonidae, Trogons.
- Order Coraciiformes, Kingfishers, Bee-eaters, Rollers, Horn-bills.
  - Suborder Alcedines, Kingfishers, Todies, Motmots.
    - Superfamily Alcedinoidea, Kingfishers.
      - Family Alcedinidae, Kingfishers.
    - Superfamily Todoidea, Todies.
      - Family Todidae, Todies.
    - Superfamily Momotoidea, Motmots.
      - Family Momotidae, Motmots.
  - Suborder Meropes, Bee-eaters.
    - Family Meropidae, Bee-eaters.
  - Suborder Coracii, Rollers, Hoopoes.
    - Family Coraciidae, Rollers.
      - Brachypteraciidae, Ground-rollers.
      - Leptosomatidae, Cuckoo-rollers.
      - Upupidae, Hoopoes.
      - Phoeniculidae, Wood-hoopoes.

<sup>38</sup> Placed here provisionally. See Lambrecht, *Handbuch der Palaeornithologie*, 1933, pp. 623-624.

- Suborder Bucerotes, Hornbills.
  - Family Bucerotidae, Hornbills.
- Order Piciformes, Jacamars, Barbets, Toucans, Woodpeckers.
  - Suborder Galbulae, Jacamars, Barbets, Toucans.
    - Superfamily Galbuloidea, Jacamars, Puffbirds.
      - Family Galbulidae, Jacamars.
      - Bucconidae, Puffbirds.
    - Superfamily Capitonoidea, Barbets, Honey-guides.
      - Family Capitonidae, Barbets.
      - Indicatoridae, Honey-guides.
    - Superfamily Ramphastoidea, Toucans.
      - Family Ramphastidae, Toucans.
  - Suborder Pici, Woodpeckers.
    - Family Picidae, Woodpeckers, Piculets.
- Order Passeriformes, Perching Birds.
  - Suborder Eurylaimi, Broadbills.
    - Family Eurylaimidae, Broadbills.
  - Suborder Tyranni, Ovenbirds, Tyrant Flycatchers, and Allies.
    - Superfamily Furnarioidea, Ovenbirds, Woodhewers, and Allies.
      - Family Dendrocolaptidae, Woodhewers.
      - Furnariidae, Ovenbirds.
      - Formicariidae, Ant-thrushes.
      - Conopophagidae, Ant-pipits.
      - Rhinocryptidae, Tapaculos.
    - Superfamily Tyrannoidea, Tyrant Flycatchers, Pittas, and Allies.
      - Family Cotingidae, Cotingas.
      - Pipridae, Manakins.
      - Tyrannidae, Tyrant Flycatchers.
      - Oxyruncidae, Sharpbills.
      - Phytotomidae, Plant-cutters.
      - Pittidae, Pittas.
      - Acanthisittidae, New Zealand Wrens.
      - Philepittidae, Asities, False Sunbirds.
  - Suborder Menurae, Lyrebirds.
    - Family Menuridae, Lyrebirds.
    - Atrichornithidae, Scrub-birds.
  - Suborder Passeres, Songbirds.
    - Family Alaudidae, Larks.
    - Palaeospizidae, *Palaeospiza* (fossil).

Hirundinidae, Swallows.  
 Campephagidae, Cuckoo-shrikes.  
 Dicruridae, Drongos.  
 Oriolidae, Old World Orioles.  
 Corvidae, Crows, Magpies, Jays.  
 Cracticidae, Bell Magpies, Australian Butcher-  
 birds.  
 Grallinidae, Magpie-larks.  
 Ptilonorhynchidae, Bowerbirds.  
 Paradiseidae, Birds of Paradise.  
 Paradoxornithidae, Parrotbills, Suthoras.  
 Paridae, Titmice.  
 Sittidae, Nuthatches.  
 Hyposittidae, Coral-billed Nuthatches.  
 Certhiidae, Creepers.  
 Chamaeidae, Wren-tits.  
 Timaliidae, Babbling Thrushes.  
 Pycnonotidae, Bulbuls.  
 Cinclidae, Dippers.  
 Troglodytidae, Wrens.  
 Mimidae, Thrashers, Mockingbirds.  
 Turdidae, Thrushes.  
 Zeledoniidae,<sup>39</sup> Wren-thrushes.  
 Sylviidae, Old World Warblers.  
 Regulidae, Kinglets.  
 Muscicapidae, Old World Flycatchers.  
 Prunellidae, Accentors, Hedge-sparrows.  
 Motacillidae, Wagtails, Pipits.  
 Bombycillidae, Waxwings.  
 Ptilogonatidae, Silky Flycatchers.  
 Dulidae, Palm-chats.  
 Artamidae, Wood-swallows.  
 Vangidae, Vanga Shrikes.  
 Laniidae, Shrikes.  
 Prionopidae, Wood-shrikes.  
 Cyclarhidae, Pepper-shrikes.  
 Vireolaniidae, Shrike-vireos.  
 Callaeidae, Wattled Crows, Huias, Saddlebacks.  
 Sturnidae, Starlings.

<sup>39</sup> For notes on *Zeledonia* see Ridgway, U. S. Nat. Mus. Bull. 50, pt. 4, 1907, p. 885.

Meliphagidae, Honey-eaters.  
Nectariniidae, Sunbirds.  
Dicaeidae, Flower-peckers.  
Zosteropidae, White-eyes.  
Vireonidae, Vireos.  
Coerebidae, Honey-creepers.  
Drepanididae, Hawaiian Honey-creepers.  
Parulidae, Wood Warblers.  
Ploceidae, Weaver-finches.  
Icteridae, Blackbirds, Troupials.  
Tersinidae, Swallow-tanagers.  
Thraupidae, Tanagers.  
Catamblyrhynchidae, Plush-capped Finches.  
Fringillidae, Grosbeaks, Finches, Buntings.