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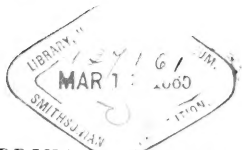
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ORNITHOLOGY

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ORNITHOLOGY

ORNITHOLOGY¹ in its proper sense is the methodical study and consequent knowledge of Birds with all that relates to them; but the difficulty of assigning a limit to the commencement of such study and knowledge gives the word a very vague meaning, and practically procures its application to much that does not enter the domain of Science. This elastic application renders it impossible in the following sketch of the history of Ornithology to draw any sharp distinction between works that are emphatically ornithological and those to which that title can only be attached by courtesy; for, since Birds have always attracted far greater attention than any other group of animals with which in number or in importance they can be compared, there has grown up concerning them a literature of corresponding magnitude and of the widest range, extending from the recondite and laborious investigations of the morphologist and anatomist to the casual observations of the sportsman or the schoolboy. The chief cause of the disproportionate amount of attention which Birds have received plainly arises from the way in which so many of them familiarly present themselves to us, or even (it may be said) force themselves upon our notice. Trusting to the freedom from danger conferred by the power of flight, most Birds have no need to lurk hidden in dens, or to sink from place to place under shelter of the inequalities of the ground or of the vegetation which clothes it, as is the case with so many other animals of similar size. Besides this, a great number of the Birds which thus display themselves freely to our gaze are conspicuous for the beauty of their plumage; and there are very few that are not remarkable for the grace of their form. Some Birds again enchant us with their voice, and others administer to our luxuries and wants, while there is scarcely a species which has not idiosyncrasies that are found to be of engaging interest the more we know of them. Moreover, it is clear that the art of the fowler is one that must have been practised from the very earliest times, and to follow that art with success no inconsiderable amount of acquaintance with the haunts and habits of Birds is a necessity. Owing to one or another of these causes, or to the combination of more than one, it is not surprising that the observation of Birds has been from a very remote period a favourite pursuit among nearly all nations, and this observation has by degrees led to a study more or less framed on methodical principles, finally reaching the dignity of a

¹ *Ornithologia*, from the Greek ὄρνιθ-, crude form of ὄρνις, a bird, and -λογία, allied to λόγος, commonly Englished a discourse. The earliest known use of the word Ornithology seems to be in the third edition of Blount's *Glossographia* (1670), where it is noted as being "the title of a late Book." See Prof. Skeat's *Etymological Dictionary of the English Language*.

science, and a study that has its votaries in almost all classes of the population of every civilized country. In the ages during which intelligence dawned on the world's total ignorance, and even now in those districts that have not yet emerged from the twilight of a knowledge still more imperfect than is our own at present,² an additional and perhaps a stronger reason for paying attention to the ways of Birds existed, or exists, in their association with the cherished beliefs handed down from generation to generation among many races of men, and not unfrequently interwoven in their mythology.³

Moreover, though Birds make a not unimportant appearance in the earliest written records of the human race, the painter's brush has preserved their counterfeit presentment for a still longer period. What is asserted—and that, so far as the writer is aware, without contradiction—by Egyptologists of the highest repute to be the oldest picture in the world is a fragmentary fresco taken from a tomb at Maydoom, and happily deposited, though in a decaying condition, in the Museum at Boolak. This picture is said to date from the time of the third or fourth dynasty, some three thousand years before the Christian era. In it are depicted with a marvellous fidelity, and thorough appreciation of form and colouring (despite a certain conventional treatment), the figures of six Geese. Four of these figures can be unhesitatingly referred to two species (*Anser albifrons* and *A. rupestris*) well known at the present day; and if the two remaining figures, belonging to a third species, were re-examined by an expert they would very possibly be capable of determination with no less certainty.⁴ In later ages the representations of Birds of one sort or another in Egyptian paintings and sculptures become countless, and the *bassi-relievi* of Assyrian monuments, though mostly belonging of course to a subsequent period, are not without them. No figures of Birds, however, seem yet to have been found on the incised stones, bones, or ivories of the prehistoric races of Europe.

It is of course necessary to name ARISTOTLE (born B.C. Aristotle. 385, died B.C. 322) as the first serious author on Ornithology with whose writings we are acquainted, but even he had,

² Of the imperfection of our present knowledge more must be said presently.

³ For instances of this among Greeks and Romans almost any dictionary or treatise of "Classical Antiquities" may be consulted, while as regards the superstitions of barbarous nations the authorities are far too numerous to be here named.

⁴ The portion of the picture containing the figures of the Geese has been figured by Mr LÖFTE (*Role in Egypt*, p. 209), and the present writer owes to that gentleman's kindness the opportunity of examining a copy made on the spot by an accomplished artist, as well as the information that it is No. 988 of Mariette's *Catalogue*. See art. MURAL DECORATION, vol. xvii. p. 39, fig. 7.

as he tells us, predecessors; and, looking to that portion of his works on animals which has come down to us, one finds that, though more than 170 sorts of Birds are mentioned,¹ yet what is said of them amounts on the whole to very little, and this consists more of desultory observations in illustration of his general remarks (which are to a considerable extent physiological or bearing on the subject of reproduction) than of an attempt at a connected account of Birds. Some of these observations are so meagre as to have given plenty of occupation to his many commentators, who with varying success have for more than three hundred years been endeavouring to determine what were the Birds of which he wrote; and the admittedly corrupt state of the text adds to their difficulties. One of the most recent of these commentators, the late Prof. Sundevall—equally proficient in classical as in ornithological knowledge—was, in 1863, compelled to leave more than a score of the Birds unrecognized. Yet it is not to be supposed that in what survives of the great philosopher's writings we have more than a fragment of the knowledge possessed by him, though the hope of recovering his *Zoικά* or his *Ἀνατομικά*, in which he seems to have given fuller descriptions of the animals he knew, can be hardly now entertained. A Latin translation by Gaza of Aristotle's existing zoological work was printed at Venice in 1503. Another version, by Scaliger, was subsequently published. Two wretched English translations have appeared.

Next in order of date, though at a long interval, comes CAIUS PLINIUS SECUNDUS, commonly known as PLINY the Elder, who died A.D. 79, author of a general and very discursive *Historia Naturalis* in thirty-seven books, of which Book X. is devoted to Birds. A considerable portion of Pliny's work may be traced to his great predecessor, of whose information he freely and avowedly availed himself, while the additions thereto made cannot be said to be, on the whole, improvements. Neither of these authors attempted to classify the Birds known to them beyond a very rough and for the most part obvious grouping. Aristotle seems to recognize eight principal groups:—(1) *Gampsonyches*, approximately equivalent to the *Accipitres* of Linnæus; (2) *Scolecophaga*, containing most of what would now be called *Oscines*, excepting indeed the (3) *Acanthophaga*, composed of the Goldfinch, Siskin, and a few others; (4) *Scnipophaga*, the Woodpeckers; (5) *Peristeroide*, or Pigeons; (6) *Schizopoda*, (7) *Steganopoda*, and (8) *Barea*, nearly the same respectively as the Linnæan *Gralia*, *Anseres*, and *Gallinæ*. Pliny, relying wholly on characters taken from the feet, limits himself to three groups—without assigning names to them—those which have "hooked talons, as Hawkes; or round long claws, as Hennes; or else they be broad, flat, and whole-footed, as Geese and all the sort in manner of water-foule"—to use the words of Philemon Holland, who, in 1601, published a quaint and, though condensed, yet fairly faithful English translation of Pliny's work.

About a century later came ÆLIAN, who died about A.D. 140, and compiled in Greek (though he was an Italian by birth) a number of miscellaneous observations on the peculiarities of animals. His work is a kind of commonplace book kept without scientific discrimination. A considerable number of Birds are mentioned, and something said of almost each of them; but that something is too often nonsense—according to modern ideas—though occasionally a fact of interest may therein be found. It contains numerous references to former or contemporary writers whose works have perished, but there is nothing to shew that they were wiser than Ælian himself.

¹ This is Sundevall's estimate; Drs Aulert and Wimmer in their excellent edition of the *Ἱστορία περὶ ζῴων* (Leipzig: 1868) limit the number to 126.

The twenty-six books *De Animalibus* of ALBERTUS ALBERTUS MAGNUS (GROOT), who died A.D. 1282, were printed in 1478; but were apparently already well known from manuscript copies. They are founded on the works of Aristotle, many of whose statements are almost literally repeated, and often without acknowledgment. Occasionally Avicenna, or some other less-known author, is quoted; but it is hardly too much to say that the additional information is almost worthless. The twenty-third of these books is *De Avibus*, and therein a great number of Birds' names make their earliest appearance, few of which are without interest from a philologist's if not an ornithologist's point of view, but there is much difficulty in recognizing the species to which many of them belong. In 1485 was printed the first dated copy of the volume known as the *Ortus Sanitatis*, to the popularity of which many editions testify. Though said by its author, JOHANN WÖNNECKE VON CAUB Cuba. (Latinized as JOHANNES DE CURA),² to have been composed from a study of the collections formed by a certain nobleman who had travelled in Eastern Europe, Western Asia, and Egypt—possibly Breidenbach, an account of whose travels in the Levant was printed at Mentz in 1486—it is really a medical treatise, and its zoological portion is mainly an abbreviation of the writings of Albertus Magnus, with a few interpolations from Isidorus of Seville (who flourished in the beginning of the seventh century, and was the author of many works highly esteemed in the Middle Ages) and a work known as *PHYSIOLOGUS* (*q.v.*). The third *tractatus* of this volume deals with Birds—including among them Bats, Bees, and other flying creatures; but as it is the first printed book in which figures of Birds are introduced it merits notice, though most of the illustrations, which are rude woodcuts, fail, even in the coloured copies, to give any precise indication of the species intended to be represented. The scientific degeneracy of this work is manifested as much by its title (*Ortus for Hortus*) as by the mode in which the several subjects are treated;³ but the revival of learning was at hand, and WILLIAM TURNER, a Turner. Northumbrian, while residing abroad to avoid persecution at home, printed at Cologne in 1544 the first commentary on the Birds mentioned by Aristotle and Pliny conceived in anything like the spirit that moves modern naturalists.⁴ In the same year and from the same press was issued a *Dialogus de Avibus* by GYBERTUS LONGOLIUS, and in 1570 Longo- CAIUS brought out in London his treatise *De rariorum animalium atque stirpium historia*. In this last work, small lius. Caius. though it be, ornithology has a good share; and all three may still be consulted with interest and advantage by its votaries.⁵ Meanwhile the study received a great impulse from the appearance, at Zurich in 1555, of the third book of the illustrious CONRAD GESNER's *Historia Animalium* Gesner. "qvi est de Auium natura," and at Paris in the same year

² On this point see G. A. Fritzel, *Botan. Zeitung*, 1846, pp. 785-790, and *Theat. Literat. Botanicae* (Lipsie: 1851), pp. 349-352.

³ Absurd as much that we find both in Albertus Magnus and the *Ortus* seems to modern eyes, if we go a step lower in the scale and consult the "Bestiaries" or treatises on animals which were common from the twelfth to the fourteenth century we shall meet with many more absurdities. See for instance that by PHILIPPE DE THAUN (PHILIPPUS TAONENSIS), dedicated to Adelaide or Alice, queen of Henry I. of England, and probably written soon after 1121, as printed by the late Mr Thomas Wright, in his *Popular Treatises on Science written during the Middle Ages* (London: 1841).

⁴ This was reprinted at Cambridge in 1823 by the late Dr George Thackeray.

⁵ The Seventh of WORTON'S *De differentiis animalium Libri Decem*, published at Paris in 1552, treats of Birds; but his work is merely a compilation from Aristotle and Pliny, with references to other classical writers who have more or less incidentally mentioned Birds and other animals. The author in his preface states—"Veterum scriptorum sententias in unum quasi cumulum coaceruavi, de meo nihil addidi." Nevertheless he makes some attempt at a systematic arrangement of Birds, which, according to his lights, is far from despicable.

Belon.

of Pierre BELON'S (BELLONIUS) *Histoire de la nature des Oyseaux*. Gesner brought an amount of erudition, hitherto unequalled, to bear upon his subject; and, making due allowance for the times in which he wrote, his judgment must in most respects be deemed excellent. In his work, however, there is little that can be called systematic treatment. Like nearly all his predecessors since Ælian, he adopted an alphabetical arrangement,¹ though this was not too pedantically preserved, and did not hinder him from placing together the kinds of Birds which he supposed (and generally supposed rightly) to have the most resemblance to that one whose name, being best known, was chosen for the headpiece (as it were) of his particular theme, thus recognizing to some extent the principle of classification.² Belon, with perhaps less book-learning than his contemporary, was evidently no mean scholar, and undoubtedly had more practical knowledge of Birds—their internal as well as external structure. Hence his work, written in French, contains a far greater amount of original matter; and his personal observations made in many countries, from England, to Egypt, enabled him to avoid most of the puerilities which disfigure other works of his own or of a preceding age. Besides this, Belon disposed the Birds known to him according to a definite system, which (rude as we now know it to be) formed a foundation on which several of his successors were content to build, and even to this day traces of its influence may still be discerned in the arrangement followed by writers who have faintly appreciated the principles on which modern taxonomers rest the outline of their schemes. Both his work and that of Gesner were illustrated with woodcuts, many of which display much spirit and regard to accuracy.

Belon, as has just been said, had a knowledge of the anatomy of Birds, and he seems to have been the first to institute a direct comparison of their skeleton with that of Man; but in this respect he only anticipated by a few years the more precise researches of VOLCHER COITER, a Frisian, who in 1573 and 1575 published at Nuremberg two treatises, in one of which the internal structure of Birds in general is very creditably described, while in the other the osteology and myology of certain forms is given in considerable detail, and illustrated by carefully-drawn figures. The first is entitled *Externarum et internarum principatium humani corporis Tabula*, &c., while the second, which is the most valuable, is merely appended to the *Lectioes Gabrielis Fallopii de partibus singularibus humani corporis*, &c., and thus, the scope of each work being regarded as medical, the author's labours were wholly overlooked by the mere natural-historians who followed, though Coiter introduced a table, "*De differentiis Avium*," furnishing a key to a rough classification of such Birds as were known to him, and this as nearly the first attempt of the kind deserves notice here.

Coiter.

Contemporary with these three men was ULYSSES ALDROVANDUS, a Bolognese, who wrote an *Historia Naturalium* in sixteen folio volumes, most of which were not printed till after his death in 1605; but those on Birds appeared between 1599 and 1603. The work is almost wholly a compilation, and that not of the most discriminative kind, while a peculiar jealousy of Gesner is continuously displayed, though his statements are very constantly quoted—nearly always as those of "Ornithologus," his name appearing but few times in the text, and not at all in the list of authors

Aldro-
vandus.

¹ Even at the present day it may be shrewdly suspected that not a few ornithologists would gladly follow Gesner's plan in their despair of seeing, in their own time, a classification which would really deserve the epithet scientific.

² For instance, under the title of "Accipiter" we have to look, not only for the Sparrow-Hawk and Gos-Hawk, but for many other Birds of the Family (as we now call it) removed comparatively far from those species by modern ornithologists.

cited. With certain modifications in principle not very important, but characterized by much more elaborate detail, Aldrovandus adopted Belon's method of arrangement, but in a few respects there is a manifest retrogression. The work of Aldrovandus was illustrated by copper-plates, but none of his figures approach those of his immediate predecessors in character or accuracy. Nevertheless the book was eagerly sought, and several editions of it appeared.³

Mention must be made of a medical treatise by CASPAR SCHWENCKFELD, published at Liegnitz in 1603, under the

title of *Theriotropeum Silesiæ*, the fourth book of which consists of an "Aviarius Silesiæ," and is the earliest of the works we now know by the name of Fauna. The author was well acquainted with the labours of his predecessors, as his list of over one hundred of them testifies. Most of the Birds he describes are characterized with accuracy sufficient to enable them to be identified, and his observations upon them have still some interest; but he was innocent of any methodical system, and was not exempt from most of the professional fallacies of his time.⁴

Hitherto, from the nature of the case, the works aforesaid treated of scarcely any but the Birds belonging to the *orbis veteribus notus*; but the geographical discoveries of the sixteenth century began to bear fruit, and many animals of kinds unsuspected were, about one hundred years later, made known. Here there is only space to name BONTIUS, CÆSIUS, HERNANDEZ (or FERNANDEZ), MARCGRAVE, NIEMENBERG, and PISO,⁵ whose several works describing the natural products of both the Indies—whether the result of their own observation or compilation—together with those of OLINA and WORM, produced a marked effect, since they led up to what may be deemed the foundation of scientific Ornithology.⁶

This foundation was laid by the joint labours of FRANCIS WIL-
LUGHBY (born 1635, died 1672) and JOHN RAY (born ^{highly} 1628, died 1705), for it is impossible to separate their ^{and Ray.} share of work in Natural History more than to say that, while the former more especially devoted himself to zoology, botany was the favourite pursuit of the latter. Together they studied, together they travelled, and together they collected. Willughby, the younger of the two, and at first the other's pupil, seems to have gradually become the master; but, he dying before the promise of his life was fulfilled, his writings were given to the world by his friend Ray, who, adding to them from his own stores, published the *Ornithologia* in Latin in 1676, and in English with many emendations in 1678. In this work Birds generally were grouped in two great divisions—"Land-Fowl" and "Water-Fowl,"—the former being subdivided into those which have a crooked beak and talons and those which have a straighter bill and claws, while the latter was separated into those which frequent waters and watery places and those that swim in the water—each subdivision being further broken up into many sections, to the whole of which a key was given. Thus it became possible for almost any diligent reader without much chance of error to refer to its

³ The *Historia Naturalis* of JOHANNES JOHNSTONUS, said to be of Scottish descent but by birth a Pole, ran through several editions during the seventeenth century, but is little more than an epitome of the work of Aldrovandus.

⁴ The *Hierozoicon* of Bochart—a treatise on the animals named in Holy Writ—was published in 1619.

⁵ For Lichtenstein's determination of the Birds described by Marcgrave and Piso see the *Abhandlungen* of the Berlin Academy for 1817 (pp. 155 *sq.*).

⁶ The earliest list of British Birds seems to be that in the *Pinax Rerum Naturalium* of CHRISTOPHER MERRETT, published in 1667. In the following year appeared the *Onomasticon Zoicon* of WALTER CHARLETON, which contains some information on ornithology. An enlarged edition of the latter, under the title of *Exercitationes* &c., was published in 1677; but neither of these writers is of much authority. In 1684 SIBBALD in his *Scotia Illustrata* published the earliest Fauna of Scotland.

proper place nearly every bird he was likely to meet with. Ray's interest in ornithology continued, and in 1694 he completed a *Synopsis Methodica Avium*, which, through the fault of the booksellers to whom it was entrusted, was not published till 1713, when Derham gave it to the world.¹

Linnaeus. Two years after Ray's death, LINNÆUS, the great reformer of Natural History, was born, and in 1735 appeared the first edition of the celebrated *Systema Naturæ*. Successive editions of this work were produced under its author's supervision in 1740, 1748, 1758, and 1766. Impressed by the belief that verbosity was the bane of science, he carried terseness to an extreme which frequently created obscurity, and this in no branch of zoology more than in that which relates to Birds. Still the practice introduced by him of assigning to each species a diagnosis by which it ought in theory to be distinguishable from any other known species, and of naming it by two words—the first being the generic and the second the specific term, was so manifest an improvement upon any thing which had previously obtained that the Linnaean method of differentiation and nomenclature established itself before long in spite of all opposition, and in principle became almost universally adopted. The opposition came of course from those who were habituated to the older state of things, and saw no evil in the cumbersome, half-descriptive half-designative titles which had to be employed whenever a species was to be spoken of or written about. The supporters of the new method were the rising generation of naturalists, many of whose names have since become famous, but among them were some, whose admiration of their chief carried them to a pitch of enthusiasm which now seems absurd. Careful as Linnaeus was in drawing up his definitions of groups, it was immediately seen that they occasionally were made to comprehend creatures whose characteristics contradicted the prescribed diagnosis. His chief glory lies in his having reduced, at least for a time, a chaos into order, and in his showing both by precept and practice that a name was not a definition. In his classification of Birds he for the most part followed Ray, and where he departed from his model he seldom improved upon it.

Barrere. In 1745 BARRERE brought out at Perpignan a little book called *Ornithologie Specimen novum*, and in 1752 Möhring published at Aurich one still smaller, his *Avium Genera*. Both these works (now rare) are manifestly framed on the Linnaean method, so far as it had then reached; but in their arrangement of the various forms of Birds they differed greatly from that which they designed to supplant, and they deservedly obtained little success. Yet as systematists their authors were no worse than KLEIN, whose *Historia Avium Prodromus*, appearing at Lübeck in 1750, and *Stemmata Avium* at Leipzig in 1759, met with considerable favour in some quarters. The chief merit of the latter work lies in its forty plates, whereon the heads and feet of many Birds are indifferently figured.²

Catesby. But, while the successive editions of Linnaeus's great work were revolutionizing Natural History, and his example of precision in language producing excellent effect on scientific writers, several other authors were advancing the study of Ornithology in a very different way—a way that pleased the eye even more than his labours were pleasing the mind. Between 1731 and 1743 MARK CATESBY brought out in

London his *Natural History of Carolina*—two large folios containing highly-coloured plates of the Birds of that colony, Florida, and the Bahamas—the forerunners of those numerous costly tomes which will have to be mentioned presently at greater length.³ ELEAZAR ALBIN between 1738 and 1740 produced a *Natural History of Birds* in three volumes of more modest dimensions, seeing that it is in quarto; but he seems to have been ignorant of Ornithology, and his coloured plates are greatly inferior to Catesby's. Far better both as draughtsman and as authority was GEORGE EDWARDS, who in 1743 began, under the same title as Albin, a series of plates with letterpress, which was continued by the name of *Gleanings in Natural History*, and finished in 1760, when it had reached seven parts, forming four quarto volumes, the figures of which are nearly always quoted with approval.⁴

The year which saw the works of Edwards completed was still further distinguished by the appearance in France, where little had been done since Belon's days,⁵ in six quarto volumes, of the *Ornithologie* of MATHURIN JACQUES BRISSON—a work of very great merit so far as it goes, for as a descriptive ornithologist the author stands even now unsurpassed; but it must be said that his knowledge, according to internal evidence, was confined to books and to the external parts of Birds' skins. It was enough for him to give a scrupulously exact description of such specimens as came under his eye, distinguishing these by prefixing two asterisks to their name, using a single asterisk where he had only seen a part of the Bird, and leaving unmarked those that he described from other authors. He also added information as to the Museum (generally Réaumur's, of which he had been in charge) containing the specimen he described, acting on a principle which would have been advantageously adopted by many of his contemporaries and successors. His attempt at classification was certainly better than that of Linnaeus; and it is rather curious that the researches of the latest ornithologists point to results in some degree comparable with Brisson's systematic arrangement, for they refuse to keep the Birds-of-Prey at the head of the Class *Aves*, and they require the establishment of a much larger number of "Orders" than for a long while has been thought advisable. Of such "Orders" Brisson had twenty-six, and he gave Pigeons and Poultry precedence of the Birds which are plunderers and scavengers. But greater value lies in his generic or sub-generic divisions, which, taken as a whole, are far more natural than those of Linnaeus, and consequently capable of better diagnosis. More than this, he seems to be the earliest ornithologist, perhaps the earliest zoologist, to conceive the idea of each genus possessing what is now called a "type"—though such a term does not occur in his work; and, in like manner, without declaring it in so many words, he indicated unmistakably the existence of subgenera—all this being effected by the skillful use of names. Unfortunately he was too soon in the field to avail himself, even had he been so minded, of the convenient mode of nomenclature brought into use by Linnaeus. Immediately on the completion of his *Règne Animale* in 1756, Brisson set about his *Ornithologie*, and it is only in the last two volumes of the latter that any reference is made to the tenth edition of the *Systema Naturæ*, in which the binomial method

¹ To this was added a supplement by PETIVER on the Bird of Madras, taken from pictures and information sent him by one Edward Buckley of Fort St George, being the first attempt to catalogue the Birds of any part of the British possessions in India.

² After Klein's death his *Prodromus*, written in Latin, had the unwonted fortune of two distinct translations into German, published in the same year 1760, the one at Leipzig and Lübeck by BEHN, the other at Danzig by REYGER—each of whom added more or less to the original.

³ Several Birds from Jamaica were figured in SLOANE'S *Voyage*, &c. (1705-1725), and a good many exotic species in the *Thesaurus*, &c., of SEBA (1734-1765), but from their faulty execution these plates had little effect upon Ornithology.

⁴ The works of Catesby and Edwards were afterwards reproduced at Nuremberg and Amsterdam by SELIGMANN, with the letterpress in German, French, and Dutch.

⁵ Birds were treated of in a worthless fashion by one D. B. in a *Dictionnaire raisonné et universel des animaux*, published at Paris in 1759.

was introduced. It is certain that the first four volumes were written if not printed before that method was promulgated, and when the fame of Linnaeus as a zoologist rested on little more than the very meagre sixth edition of the *Systema Naturæ* and the first edition of his *Fauna Suecica*. Brisson has been charged with jealousy of if not hostility to the great Swede, and it is true that in the preface to his *Ornithologie* he complains of the insufficiency of the Linnaean characters, but, when one considers how much better acquainted with Birds the Frenchman was, such criticism must be allowed to be pardonable if not wholly just. BRISSON'S work was in French, with a parallel translation in Latin, which last was reprinted separately at Leyden two years afterwards.

Salerne. In 1767 there was issued at Paris a book entitled *L'histoire naturelle éclaircie dans une de ses parties principales, l'Ornithologie*. This was the work of SALERNE, published after his death, and is often spoken of as being a mere translation of Ray's *Synopsis*, but is thereby very inadequately described, for, though it is confessedly founded on that little book, a vast amount of fresh matter, and mostly of good quality, is added.

D'Aubenton. The success of Edwards's very respectable work seems to have provoked competition, and in 1765, at the instigation of Buffon, the younger D'AUBENTON began the publication known as the *Planches Enluminées d'histoire naturelle*, which appearing in forty-two parts was not completed till 1780, when the plates¹ it contained reached the number of 1008—all coloured, as its title intimates, and nearly all representing Birds. This enormous work was subsidized by the French Government; and, though the figures are utterly devoid of artistic merit, they display the species they are intended to depict with sufficient approach to fidelity to ensure recognition in most cases without fear of error, which in the absence of any text is no small praise.²

Buffon and Montbeillard. But BUFFON was not content with merely causing to be published this unparalleled set of plates. He seems to have regarded the work just named as a necessary precursor to his own labours in Ornithology. His *Histoire Naturelle, générale et particulière*, was begun in 1749, and in 1770 he brought out, with the assistance of GUÉNAU DE MONTBEILLARD,³ the first volume of that grand undertaking relating to Birds, which, for the first time since the days of Aristotle, became the theme of one who possessed real literary capacity. It is not too much to say that Buffon's florid fancy revelled in such a subject as was now that on which he exercised his brilliant pen; but it would be unjust to examine too closely what to many of his contemporaries seemed sound philosophical reasoning under the light that has since burst upon us. Strictly orthodox though he professed to be, there were those, both among his own countrymen and foreigners, who could not read his speculative indictments of the workings of Nature without a shudder; and it is easy for any one in these days to frame a reply, pointed with ridicule, to such a chapter as he wrote on the wretched fate of the Woodpecker. In the nine volumes devoted to the *Histoire Naturelle des Oiseaux* there are passages which will for ever live in the memory of those

¹ They were drawn and engraved by MARTINER, who himself began in 1787 a *Histoire des Oiseaux* with small coloured plates which have some merit, but the text is worthless. The work seems not to have been finished and is rare. For the opportunity of seeing a copy the writer is indebted to Mr Gurney.

² Between 1767 and 1776 there appeared at Florence a *Storia Naturale degli Uccelli*, in five folio volumes, containing a number of ill-drawn and ill-coloured figures from the collection of Giovanni Gerini, an ardent collector who died in 1751, and therefore must be acquitted of any share in the work, which, though sometimes attributed to him, is that of certain learned men who did not happen to be ornithologists (*cf. Savi, Ornitologia Toscana*, i. Introduzione, p. v).

³ He retired on the completion of the sixth volume, and thereupon Buffon associated LEXON with himself.

that carefully read them, however much occasional expressions, or even the general tone of the author, may grate upon their feelings. He too was the first man who formed any theory that may be called reasonable of the Geographical Distribution of Animals, though this theory was scarcely touched in the ornithological portion of his work, and has since proved to be not in accordance with facts. He proclaimed the variability of species in opposition to the views of Linnaeus as to their fixity, and moreover supposed that this variability arose in part by degradation.⁴ Taking his labours as a whole, there cannot be a doubt that he enormously enlarged the purview of naturalists, and, even if limited to Birds, that, on the completion of his work upon them in 1783, Ornithology stood in a very different position from that which it had before occupied. Because he opposed the system of Linnaeus he has been said to be opposed to systems in general; but that is scarcely correct, for he had a system of his own; and, as we now see it, it appears neither much better nor much worse than the systems which had been hitherto invented, or perhaps than any which was for many years to come propounded. It is certain that he despised any kind of scientific phraseology—a crime in the eyes of those who consider precise nomenclature to be the end of science; but those who deem it merely a means whereby knowledge can be securely stored will take a different view—and have done so.

Great as were the services of Buffon to Ornithology Latham. one direction, those of a wholly different kind rendered by our countryman JOHN LATHAM must not be overlooked. In 1781 he began a work the practical utility of which was immediately recognized. This was his *General Synopsis of Birds*, and, though formed generally on the model of Linnaeus, greatly diverged in some respects therefrom. The classification was modified, chiefly on the old lines of Willughby and Ray, and certainly for the better; but no scientific nomenclature was adopted, which, as the author subsequently found, was a change for the worse. His scope was co-extensive with that of Brisson, but Latham did not possess the inborn faculty of picking out the character wherein one species differs from another. His opportunities of becoming acquainted with Birds were hardly inferior to Brisson's, for during Latham's long lifetime there poured in upon him countless new discoveries from all parts of the world, but especially from the newly-explored shores of Australia and the islands of the Pacific Ocean. The British Museum had been formed, and he had access to everything it contained in addition to the abundant materials afforded him by the private Museum of Sir Ashton Lever.⁵ Latham entered, so far as the limits of his work would allow, into the history of the Birds he described, and this with evident zest, whereby he differed from his French predecessor; but the number of cases in which he erred as to the determination of his species must be very great, and not unfrequently the same species is described more than once. His *Synopsis* was finished in 1785; two supplements were added in 1787 and 1802,⁶ and in 1790 he produced an abstract of the work under the title of *Index Ornithologicus*, wherein he assigned names on the Linnaean method to all the species described. Not to recur again to his labours, it may be said here that between 1821 and 1828 he published at Winchester, in eleven volumes, an enlarged edition of his original work, entitling it *A General History of Birds*; but his defects as

⁴ See Prof. MIVART'S address to the Section of Biology, *Rep. Brit. Association* (Sheffield Meeting), 1879, p. 356.

⁵ In 1792 SNAW began the *Museum Leverianum* in illustration of this collection, which was finally dispersed by sale, and what is known to remain of it found its way to Vienna. Of the specimens in the British Museum described by Latham it is to be feared that scarcely any exist. They were probably very imperfectly prepared.

⁶ A German translation by Bechstein subsequently appeared.

a compiler, which had been manifest before, rather increased with age, and the consequences were not happy.¹

Mauduyt. About the time that Buffon was bringing to an end his studies of Birds, MAUDUYT undertook to write the *Ornithologie de l'Encyclopédie Méthodique*—a comparatively easy task, considering the recent works of his fellow-countrymen on that subject, and finished in 1784. Here it requires no further comment, especially as a new edition was called for in 1790, the ornithological portion of which was begun by BONNATERRE, who, however, had only finished three hundred and twenty pages of it when he lost his life in the French Revolution; and the work thus arrested was continued by VIEILLIOT under the slightly changed title of *Tableau encyclopédique et méthodique des trois règnes de la Nature*—the *Ornithologie* forming volumes four to seven, and not completed till 1823. In the former edition Mauduyt had taken the subjects alphabetically; but here they are disposed according to an arrangement, with some few modifications, furnished by D'Aubenton, which is extremely shallow and unworthy of consideration.

Pennant. Several other works bearing upon Ornithology in general, but of less importance than most of those just named, belong to this period. Among others may be mentioned the *Genera of Birds* by THOMAS PENNANT, first printed at Edinburgh in 1773, but best known by the edition which appeared in London in 1781; the *Elementa Ornithologica* and *Museum Ornithologicum* of SCHÄFER, published at Ratisbon in 1774 and 1784 respectively; PETER BROWN'S *New Illustrations of Zoology* in London in 1776; HERMANN'S *Tabulæ Affinitatum Animalium* at Strasburg in 1783, followed posthumously in 1804 by his *Observationes Zoologicae*; JACQUIN'S *Beytraege zur Geschichte der Vogel* at Vienna in 1784, and in 1790 at the same place the larger work of SPALOWSKY with nearly the same title; SPARRMAN'S *Museum Carolinæanum* at Stockholm from 1786 to 1789; and in 1794 HAYES'S *Portraits of rare and curious Birds* from the menagerie of Child the banker at Osterley near London. The same draughtsman (who had in 1775 produced a *History of British Birds*) in 1822 began another series of *Figures of rare and curious Birds*.²

P. L. S. Müller. The practice of Brisson, Buffon, Latham, and others of neglecting to name after the Linnæan fashion the species they described gave great encouragement to compilation, and led to what has proved to be of some inconvenience to modern ornithologists. In 1773 P. L. S. MÜLLER brought out at Nuremberg a German translation of the *Systema Nature*, completing it in 1776 by a *Supplement* containing a list of animals thus described, which had hitherto been technically anonymous, with diagnoses and names on the Linnaean model. In 1783 BODDAERT printed at Utrecht a *Table des Planches Enluminées*,³ in which he attempted to refer every species of Bird figured in that extensive series to its proper Linnæan genus, and to assign it a scientific name if it did not already possess one. In like manner in 1786, SCOPOLI—already the author of a little book published

at Leipzig in 1769 under the title of *Annus I. Historico-naturalis*, in which are described many Birds, mostly from his own collection or the Imperial vivarium at Vienna—was at the pains to print at Pavia in his miscellaneous *Deliciae Floræ et Faunæ Insubricæ a Specimen Zoologicum*⁴ containing diagnoses, duly named, of the Birds discovered and described by SONNERAT in his *Voyage aux Indes orientales* Sonnerat. and *Voyage à la Nouvelle Guinée*, severally published at Paris in 1772 and 1776. But the most striking example of compilation was that exhibited by J. F. GMELIN, who in 1788 commenced what he called the Thirteenth Edition of the celebrated *Systema Nature*, which obtained so wide a circulation that, in the comparative rarity of the original, the additions of this editor have been very frequently quoted, even by expert naturalists, as though they were the work of the author himself. Gmelin availed himself of every publication he could, but he perhaps found his richest booty in the labours of Latham, neatly condensing his English descriptions into Latin diagnoses, and bestowing on them binomial names. Hence it is that Gmelin appears as the authority for so much of the nomenclature now in use. He took many liberties with the details of Linnæus's work, but left the classification, at least of the Birds, as it was—a few new genera excepted.⁵

During all this time little had been done in studying the internal structure of Birds since the works of Coiter already mentioned⁶; but the foundations of the science of Embryology had been laid by the investigations into the development of the chick by the great HARVEY. Between 1666 and 1669 PERRAULT edited at Paris eight accounts of the dissection by DU VERNEY of as many species of Birds, which, translated into English, were published by the Royal Society in 1702, under the title of *The Natural History of Animals*. After the death of the two anatomists just named, another series of similar descriptions of eight other species was found among their papers, and the whole were published in the *Mémoires* of the French Academy of Sciences in 1733 and 1734. But in 1681 GERARD BLASIUS Gerard Blasius. had brought out at Amsterdam an *Anatomie Animalium*, containing the results of all the dissections of animals that he could find; and the second part of this book, treating of *Volatilia*, makes a respectable show of more than one hundred and twenty closely-printed quarto pages, though nearly two-thirds is devoted to a treatise *De Ovo et Pullo*, containing among other things a reprint of Harvey's researches, and the scientific rank of the whole book may be inferred from Bats being still classed with Birds. In 1720 VALENTINI published, at Frankfort-on-the-Main, his *Amphitheatrum Zootomicum*, in which again most of the existing accounts of the anatomy of Birds were reprinted. But these and many other contributions,⁷ made until nearly the close of the eighteenth century, though highly meritorious, were unconnected as a whole, and it is plain that no conception of what it was in the power of Comparative Anatomy to set forth had occurred to the most diligent dissectors. This privilege was reserved for GEORGES CUVIER, who in 1798 published at Paris his *Tableau Cuvier. Élémentaire de l'histoire naturelle des Animaux*, and thus laid the foundation of a thoroughly and hitherto unknown

¹ He also prepared for publication a second edition of his *Index Ornithologicus*, but this was never printed, and the manuscript is now in the present writer's possession.

² The *Naturalist's Miscellany* or *Vivarium Naturale*, in English and Latin, of SHAW and NODDER, the former being the author, the latter the draughtsman and engraver, was begun in 1789 and carried on till Shaw's death, forming twenty-four volumes. It contains figures of more than 280 Birds, but very poorly executed. In 1814 a sequel, *The Zoological Miscellany*, was begun by LEACH, Nodder continuing to do the plates. This was completed in 1817, and forms three volumes with 149 plates, 27 of which represent Birds.

³ Of this work only fifty copies were printed, and it is one of the rarest known to the ornithologist. Only two copies are believed to exist in England, one in the British Museum, the other in private hands. It was reprinted in 1874 by Mr Tegetmeier.

⁴ This was reprinted in 1882 by the Willughby Society.

⁵ DAUDIN'S unfinished *Traité élémentaire et complet d'Ornithologie* appeared at Paris in 1800, and therefore is the last of these general works published in the eighteenth century.

⁶ A succinct notice of the older works on Ornithology is given by Prof. SELENKA in the introduction to that portion of Dr Bronn's *Klassen und Ordnungen des Thierreichs* relating to Birds (pp. 1-9) published in 1869; and Prof. CARUS'S *Geschichte der Zoologie*, published in 1872, may also be usefully consulted for further information on this and other heads.

⁷ The treatises of the two BARTHOLINIS and BORRICHUS published at Copenhagen deserve mention if only to record the activity of Danish anatomists in those days.

mode of appreciating the value of the various groups of the Animal Kingdom. Yet his first attempt was a mere sketch.¹ Though he made a perceptible advance on the classification of Linnæus, at that time predominant, it is now easy to see in how many ways—want of sufficient material being no doubt one of the chief—Cuvier failed to produce a really natural arrangement. His principles, however, are those which must still guide taxonomers, notwithstanding that they have in so great a degree overthrown the entire scheme which he propounded. Confining our attention here, as of course it ought to be confined, to Ornithology, Cuvier's arrangement of the Class *Aves* is now seen to be not very much better than any which it superseded. But this view is gained by following the methods which Cuvier taught. In the work just mentioned few details are given; but even the more elaborate classification of Birds contained in his *Leçons d'Anatomie Comparée* of 1805 is based wholly on external characters, such as had been used by nearly all his predecessors; and the *Règne Animal* of 1817, when he was in his fullest vigour, afforded not the least evidence that he had ever dissected a couple even of Birds² with the object of determining their relative position in his system, which then, as before, depended wholly on the configuration of bills, wings, and feet. But, though apparently without such a knowledge of the anatomy of Birds as would enable him to apply it to the formation of that natural system which he was fully aware had yet to be sought, he seems to have been an excellent judge of the characters afforded by the bill and limbs, and the use he made of them, coupled with the extraordinary reputation he acquired on other grounds, procured for his system the adhesion for many years of the majority of ornithologists, and its influence though waning is still strong. Regret must always be felt by them that his great genius was never applied in earnest to their branch of study, especially when we consider that had it been so the perversion of energy in regard to the classification of Birds witnessed in England for nearly twenty years, and presently to be mentioned, would most likely have been prevented.³

Hitherto mention has chiefly been made of works on General Ornithology, but it will be understood that these were largely aided by the enterprise of travellers, and as there were many of them who published their narratives in separate forms their contributions have to be considered. Of those travellers then the first to be here especially named is MARSIGLI, the fifth volume of whose *Danubius Pannonico-Mysicus* is devoted to the Birds he met with in the valley of the Danube, and appeared at the Hague in 1725, followed by a French translation in 1744.⁴ Most of the many pupils whom Linnæus sent to foreign countries submitted their discoveries to him, but KALM, HASSELQVIST, and OSBECK published separately their respective travels

in North America, the Levant, and China.⁵ The incessant journeys of PALLAS and his colleagues—FALK, GEORGI, Pallas, S. G. GMELIN, GÜLDENSTÄDT, LEPECHIN, and others—in the exploration of the recently extended Russian empire supplied not only much material to the *Commentarii* and *Acta* of the Academy of St Petersburg, but more that is to be found in their narratives,—all of it being of the highest interest to students of Palaearctic or Nearctic Ornithology. Nearly the whole of their results, it may here be said, were summed up in the important *Zoographia Rosso-Asiatica* of the first-named naturalist, which saw the light in 1811,—the year of its author's death,—but, owing to circumstances over which he had no control, was not generally accessible till twenty years later. Of still wider interest are the accounts of Cook's three famous voyages, though unhappily much of the information gained by the naturalists who accompanied him on one or more of them seems to be irretrievably lost: the original observations of the elder FORSTER were not printed till 1844, and the valuable collection of zoological drawings made by the younger FORSTER still remains unpublished in the British Museum. The several accounts by JOHN WHITE, COLLINS, PHILLIPS, HUNTER, and others of the colonization of New South Wales at the end of the last century ought not to be overlooked by any Australian ornithologist. The only information at this period on the Ornithology of South America is contained in the two works on Chili by MOLINA, published at Bologna in 1776 and 1782. The travels of LE VAILLANT in South Africa having been completed in 1785, his great *Oiseaux d'Afrique* began to appear in Paris in 1790; but it is hard to speak properly of this work, for several of the species described in it are certainly not, and never were in his time, inhabitants of that country, though he sometimes gives a long account of the circumstances under which he observed them.⁶

From travellers who employ themselves in collecting the animals of any distant country the zoologists who stay at home and study those of their own district, be it great or small, are really not so much divided as at first might appear. Both may well be named "Faunists," and of the latter there were not a few who having turned their attention more or less to Ornithology should here be mentioned, and first among them RZACZYNSKI, who in 1721 brought out at Sandomirsk the *Historia naturalis curiosa regni Polonia*, to which an *Auctuarium* was posthumously published at Danzig in 1742. This also may be perhaps the most proper place to notice the *Historia Avium Hungariae* of GROSSINGER, published at Posen in 1793. In 1734 J. L. FRISCH began the long series of works on the Birds of Germany with which the literature of Ornithology is enriched, by his *Vorstellung der Vögel Teutschlands*, which was only completed in 1763, and, its coloured plates proving very attractive, was again issued at Berlin in 1817. The little fly-sheet of ZORN⁷—for it is scarcely more—on the Birds of the Hercynian Forest made its appearance at Pappenheim in 1745. In 1756 KRAMER published at Vienna a modest *Elenchus* of the plants and animals of Lower Austria, and J. D. PETERSEN produced at Altona in 1766 a *Verzeichniss baltischer Vögel*; while in 1791 J. B. FISCHER'S *Versuch einer Naturgeschichte von Livland* appeared at Königsberg, next year BESEKE brought out at Mitau his *Beitrag zur Naturgeschichte der Vögel Kurlands*,

¹ It had no effect on LACÉPÈDE, who in the following year added a *Tableau Méthodique* containing a classification of Birds to his *Discours d'Overture* (*Mém. de l'Institut*, iii. pp. 454-468, 503-519).

² So little regard did he pay to the Osteology of Birds that, according to De Blainville (*Jour. de Physique*, xcii. p. 187, note), the skeleton of a Fowl to which was attached the head of a Hornbill was for a long time exhibited in the Museum of Comparative Anatomy at Paris! Yet, in order to determine the difference of structure in their organs of voice, Cuvier, as he says in his *Leçons* (iv. p. 464), dissected more than one hundred and fifty species of Birds. Unfortunately for him, as will appear in the sequel, it seems not to have occurred to him to use any of the results he obtained as the basis of a classification.

³ It is unnecessary to enumerate the various editions of the *Règne Animal*. Of the English translations, that edited by Griffiths and Pidgeon is the most complete. The ornithological portion of it contained in these volumes received many additions from JOHN EDWARD GRAY, and appeared in 1829.

⁴ Though much later in date, the *Iter per Posenam Sclawoniam* of PILLER and MITTERFACHER, published at Buda in 1783, may perhaps be here most conveniently mentioned.

⁵ The results of FORSKÅL'S travels in the Levant, published after his death by Niebuhr, require mention, but the ornithology they contain is but scant.

⁶ It has been charitably suggested that, his collection and notes having suffered shipwreck, he was induced to supply the latter from his memory and the former by the nearest approach to his lost specimens that he could obtain. This explanation, poor as it is, fails, however, in regard to some species.

⁷ His earlier work under the title of *Petinothologie* can hardly be deemed scientific.

and in 1794 SIEMSEN'S *Handbuch* of the Birds of Mecklenburg was published at Rostock. But these works, locally useful as they may have been, did not occupy the whole attention of German ornithologists, for in 1791 BECHSTEIN reached the second volume of his *Gemeinnützige Naturgeschichte Deutschlands*, treating of the Birds of that country, which ended with the fourth in 1795. Of this an abridged edition by the name of *Ornithologisches Taschenbuch* appeared in 1802 and 1803, with a supplement in 1812; while between 1805 and 1809 a fuller edition of the original was issued. Moreover in 1795 J. A. NAUMANN humbly began at Cöthen a treatise on the Birds of the principality of Anhalt, which on its completion in 1804 was found to have swollen into an Ornithology of Northern Germany and the neighbouring countries. Eight supplements were successively published between 1805 and 1817, and in 1822 a new edition was required. This *Naturgeschichte der Vögel Deutschlands*, being almost wholly rewritten by his son J. F. NAUMANN, is by far the best thing of the kind as yet produced in any country. The fulness and accuracy of the text, combined with the neat beauty of its coloured plates, have gone far to promote the study of Ornithology in Germany, and while essentially a popular work, since it is suited to the comprehension of all readers, it is throughout written with a simple dignity that commends it to the serious and scientific. Its twelfth and last volume was published in 1844—by no means too long a period for so arduous and honest a performance, and a supplement was begun in 1847; but, the editor—or author as he may be fairly called—dying in 1857, this continuation was finished in 1860 by the joint efforts of J. H. BLASIUS and Dr BALDAMUS. In 1800 BORKHAUSEN with others commenced at Darmstadt a *Teutsche Ornithologie* in folio which appeared at intervals till 1812, and remains unfinished, though a reissue of the portion published took place between 1837 and 1841.

Other countries on the Continent, though not quite so prolific as Germany, bore some ornithological fruit at this period; but in all Southern Europe only four faunistic products can be named—the *Saggio di Storia Naturale Bresciana* of PILATI, published at Brescia in 1769; the *Ornithologia dell' Europa Meridionale* of BERNINI, published at Parma between 1772 and 1776; the *Uccelli di Sardegna* of CETTI, published at Sassari in 1776; and the *Romanæ Ornithologia* of GILIUS, published at Rome in 1781—the last being in great part devoted to Pigeons and Poultry. More appeared in the North, for in 1770 Amsterdam sent forth the beginning of NOZEMAN'S *Nederlandsche Vogelen*, a fairly illustrated work in folio, but only completed by HOUTTUYN in 1829, and in Scandinavia most of all was done. In 1746 the great LINNÆUS had produced a *Fauna Suecica*, of which a second edition appeared in 1761, and a third revised by RETZIUS in 1800. In 1764 BRÜNNICH published at Copenhagen his *Ornithologia Borealis*, a compendious sketch of the Birds of all the countries then subject to the Danish crown. At the same place appeared in 1767 LEE'M'S work *De Laponibus Finmarckia*, to which GUNNERUS contributed some good notes on the Ornithology of Northern Norway, and at Copenhagen and Leipzig was published in 1780 the *Fauna Groenlandica* of ORTHO FABRICIUS, FABRICIUS.

Of strictly American origin can here be cited only BARTRAM'S *Travels through North and South Carolina* and BARTON'S *Fragments of the Natural History of Pennsylvania*,² both printed at Philadelphia, one in 1791, the other in 1799; but J. R. FORSTER published a *Catalogue of the Animals of North America* in London in 1771, and the

following year described in the *Philosophical Transactions* a few Birds from Hudson's Bay.³ A greater undertaking was PENNANT'S *Arctic Zoology*, published in 1785, with a Pennant supplement in 1787. The scope of this work was originally intended to be limited to North America, but circumstances induced him to include all the species of Northern Europe and Northern Asia, and though not free from errors it is a praiseworthy performance. A second edition appeared in 1792. The Ornithology of Britain naturally demands greater attention. The earliest list of British Birds we possess is that given by MERRETT in his *Pinxit Rerum Merrett. Naturalium Britannicarum*, printed in London in 1667.³ In 1677 PLOT published his *Natural History of Oxfordshire*, Plot, which reached a second edition in 1705, and in 1686 that of *Staffordshire*. A similar work on *Lancashire, Cheshire, and the Peak* was sent out in 1700 by LEIGH, and one on Leigh. *Cornwall* by BORLASE in 1758—all these four being printed Berlase, at Oxford. In 1766 appeared PENNANT'S *British Zoology*, Pennant, a well-illustrated folio, of which a second edition in octavo was published in 1768, and considerable additions (forming the nominally third edition) in 1770, while in 1777 there were two issues, one in octavo the other in quarto, each called the fourth edition. In 1812, long after the author's death, another edition was printed, of which his son-in-law Hamner was the reputed editor, but he received much assistance from Latham, and through carelessness many of the additions herein made have often been ascribed to Pennant. In 1769 BERKENHOUT gave to the world his *Berken- Outlines of the Natural History of Great Britain and Ireland*, which reappeared under the title of *Synopsis* of the same in 1795. TUNSTALL'S *Ornithologia Britannica*, which Tunstall, appeared in 1771, is little more than a list of names.⁴ In 1781 NASH'S *Worcestershire* included a few ornithological notices; and WALCOTT in 1789 published an illustrated Walcot. *Synopsis of British Birds*, coloured copies of which are rare. In 1791 J. HEYSHAM added to Hutchins's *Cumberland* a list of Birds of that county, and in 1794 DONOVAN began Donovan, a *History of British Birds* which was only finished in 1819—the earlier portion being reissued about the same time. In 1800 LEWIN brought out a very worthless work with Lewin, the same title.

All the foregoing publications yield in importance to two that remain to be mentioned, a notice of which will fitly conclude this part of our subject. In 1767 Pennant, several of whose works have already been named, entered into correspondence with GILBERT WHITE, receiving from him much information, almost wholly drawn from his own observation, for the succeeding editions of the *British Zoology*. In 1769 White began exchanging letters of a similar character with Barrington. The epistolary intercourse with the former continued until 1780 and with the latter until 1787. In 1789 White's share of the correspondence, together with some miscellaneous matter, was published as *The Natural History of Selborne*—from the name of the village in which he lived. Observations on Birds form the principal though by no means the whole theme of this book, which may be safely said to have done more to promote a love of Ornithology in this country than any other work that has been written, nay more than all the other works (except one next to be mentioned) put together. It has passed through a far greater number of

² Both of these treatises have also been reprinted by the Willughby Society.

³ In this year there were two issues of this book; one, nominally a second edition, only differs from the first in having a new title-page. No real second edition ever appeared, but in anticipation of it Sir THOMAS BROWNE prepared in or about 1671 (?) his "Account of Birds found in Norfolk," of which the draught, now in the British Museum, was printed in his collected works by Wilkin in 1835. If a fair copy was ever made its resting-place is unknown.

⁴ It has been republished by the Willughby Society.

¹ This extremely rare book has been reprinted by the Willughby Society.

Bechstein.

The Naumanns.

Borkhausen.

Cetti.

Nozeman.

Brünnich.

Fabricius, FABRICIUS.

Bartram, Barton.

J. R. Forster.

Donovan.

Gilbert White.

editions than any other work in Natural History in the whole world, and has become emphatically an English classic—the graceful simplicity of its style, the elevating tone of its spirit, and the sympathetic chords it strikes recommending it to every lover of Nature, while the severely scientific reader can scarcely find an error in any statement it contains, whether of matter of fact or opinion. It is almost certain that more than half the zoologists of the British Islands for the past seventy years or more have been infected with their love of the study by Gilbert White; and it can hardly be supposed that his influence will cease.¹

Bewick.

The other work to the importance of which on Ornithology in this country allusion has been made is BEWICK'S *History of British Birds*. The first volume of this, containing the Land-Birds, appeared in 1797²—the text being, it is understood, by Beilby—the second, containing the Water-Birds, in 1804. The woodcuts illustrating this work are generally of surpassing excellence, and it takes rank in the category of artistic publications. Fully admitting the extraordinary execution of the engravings, every ornithologist may perceive that as portraits of the Birds they are of very unequal merit. Some of the figures were drawn from stuffed specimens, and accordingly perpetuate all the imperfections of the original; others represent species with the appearance of which the artist was not familiar, and these are either wanting in expression or are caricatures;³ but those that were drawn from live Birds, or represent species which he knew in life, are worthy of all praise. It is well known that the earlier editions of this work, especially if they be upon large paper, command extravagant prices; but in reality the copies on smaller paper are now the rarer, for the stock of them has been consumed in nurseries and schoolrooms, where they have been torn up or worn out with incessant use. Moreover, whatever the lovers of the fine arts may say, it is nearly certain that the "Bewick Collector" is mistaken in attaching so high a value to these old editions, for owing to the want of skill in printing—indifferent ink being especially assigned as one cause—many of the earlier issues fail to show the most delicate touches of the engraver, which the increased care bestowed upon the edition of 1847 (published under the supervision of Mr John Hancock) has revealed,—though it must be admitted that certain blocks have suffered from wear of the press so as to be incapable of any more producing the effect intended. Of the text it may be said that it is respectable, but no more. It has given satisfaction to thousands of readers in time past, and will, it may be hoped, give satisfaction to thousands in time to come.

The existence of these two works explains the widely-spread taste for Ornithology in this country, which is to foreigners so puzzling, and the zeal—not always according to knowledge, but occasionally reaching to serious study—with which that taste is pursued.

Having thus noticed, and it is to be hoped pretty thoroughly, the chief ornithological works begun if not completed prior to the commencement of the present cen-

¹ Next to the original edition, that known as Bennett's, published in 1837, which was reissued in 1875 by Mr Harting, was long deemed the best; but it must give place to that of Bell, which appeared in 1877, and contains much additional information of great interest. But the editions of Markwick, Herbert, Blyth, and Jardine all possess features of merit. An elaborately prepared edition, issued of late years under the management of one who gained great reputation as a naturalist, only shews his ignorance and his vulgarity.

² There were two issues—virtually two editions—of this with the same date on the title-page, though one of them is said not to have been published till the following year. Among several other *indices* this may be recognized by the woodcut of the "Sea Eagle" at page 11 bearing at its base the inscription "Weyliffe, 1791," and by the additional misprint on page 145 of *Salmacilus* for *Scheniclus*.

³ This is especially observable in the figures of the Birds-of-Prey.

tury, together with their immediate sequels, those which follow will require a very different mode of treatment, for their number is so great that it would be impossible for want of space to deal with them in the same extended fashion, though the attempt will finally be made to enter into details in the case of works constituting the foundation upon which apparently the superstructure of the future science has to be built. It ought not to need stating that much of what was, comparatively speaking, only a few years ago regarded as scientific labour is now no longer to be so considered. The mere fact that the principle of Evolution, and all its admission carries with it, has been accepted in some form or other by almost all naturalists, has rendered obsolete nearly every theory that had hitherto been broached, and in scarcely any branch of zoological research was theory more rife than in Ornithology. One of these theories must presently be noticed at some length on account of the historical importance which attaches to its malefic effects in impeding the progress of true Ornithology in Britain; but charity enjoins us to consign all the rest as much as possible to oblivion.

On reviewing the progress of Ornithology since the end of the last century, the first thing that will strike us is the fact that general works, though still undertaken, have become proportionally fewer, and such as exist are apt to consist of mere explanations of systematic methods that had already been more or less fully propounded, while special works, whether relating to the ornithic portion of the Fauna of any particular country, or limited to certain groups of Birds—works to which of late years the name of "Monograph" has become wholly restricted—have become far more numerous. But this seems to be the natural law in all sciences, and its cause is not far to seek. As the knowledge of any branch of study extends, it outgrows the opportunities and capabilities of most men to follow it as a whole; and, since the true naturalist, by reason of the irresistible impulse which drives him to work, cannot be idle, he is compelled to confine his energies to narrower fields of investigation. That in a general way this is for some reason to be regretted is true; but, like all natural operations, it carries with it some recompense, and the excellent work done by so-called "specialists" has over and over again proved of the greatest use to advancement in different departments of science, and in none more than in Ornithology.⁴

Another change has come over the condition of Ornithology, as of kindred sciences, induced by the multiplication of learned societies which issue publications as well as of periodicals of greater or less scientific pretension—the latter often enjoying a circulation far wider than the former. Both kinds increase yearly, and the desponding mind may fear the possibility of its favourite study expiring through being smothered by its own literature. Without anticipating such a future disaster, and looking merely to what has gone before, it is necessary here to premise that, in the observations which immediately follow, treatises which have appeared in the publications of learned bodies or in other scientific periodicals must, except they be of prime importance, be hereinafter passed unnoticed; but their omission will be the less felt because the more recent of those of a "faunal" character have generally been mentioned in a former dissertation (*BIRDS*, vol. iii. pp. 737-764) under the different Regions or

⁴ The truth of the preceding remarks may be so obvious to most men who have acquaintance with the subject that their introduction here may seem unnecessary; but it is certain that the facts they state have been very little appreciated by many writers who profess to give an account of the progress of Natural History during the present century.

countries with which they deal, while reference to the older of these treatises is usually given by the writers of the newer. Still it seems advisable here to furnish some connected account of the progress made in the ornithological knowledge of those countries in which the readers of the present volume may be supposed to take the most lively interest—for example, the British Islands and those parts of the European continent which lie nearest to them or are most commonly sought by travellers, the Dominion of Canada and the United States of America, South Africa, India, together with Australia and New Zealand. The more important Monographs, again, will usually be found cited in the series of special articles on Birds contained in this work, though, as will be immediately perceived, there are some so-styled Monographs, which by reason of the changed views of classification that at present obtain have lost their restricted character, and for all practical purposes have now to be regarded as general works.

It will perhaps be most convenient to begin by mentioning some of these last, and in particular a number of them which appeared at Paris very early in this century. First in order of them is the *Histoire Naturelle d'une partie d'Oiseaux nouveaux et rares de l'Amérique et des Indes*, a folio volume¹ published in 1801 by LE VAILLANT. This is devoted to the very distinct and not nearly-allied groups of Hornbills and of birds which for want of a better name we must call "Chatterers," and is illustrated, like those works of which a notice immediately follows, by coloured plates, done in what was then considered to be the highest style of art and by the best draughtsmen procurable. The first volume of a *Histoire Naturelle des Perroquets*, a companion work by the same author, appeared in the same year, and is truly a Monograph, since the Parrots constitute a Family of birds so naturally severed from all others that there has rarely been anything else confounded with them. The second volume came out in 1805, and a third was issued in 1837—38 long after the death of its predecessor's author, by BOURJOT ST-HILAIRE. Between 1803 and 1806 Le Vaillant also published in just the same style two volumes with the title of *Histoire Naturelle des Oiseaux de Paradis et des Rolliers, suivie de celle des Toucans et des Barbous*, an assemblage of forms, which, miscellaneous as it is, was surpassed in incongruity by a fourth work on the same scale, the *Histoire Naturelle des Promerops et des Guépriers, des Couroucous et des Touracos*, for herein are found Jays, Waxwings, the Cock-of-the-Rock (*Rupicola*), and what not besides. The plates in this last are by Barraband, for many years regarded as the perfection of ornithological artists, and indeed the figures, when they happen to have been drawn from the life, are not bad; but his skill was quite unable to vivify the preserved specimens contained in Museums, and when he had only these as subjects he simply copied the distortions of the "bird-stuffer." The following year, 1808, being aided by Temminck of Amsterdam, of whose son we shall presently hear more, Le Vaillant brought out the sixth volume of his *Oiseaux d'Afrique*, already mentioned. Four more volumes of this work were promised; but the means of executing them were denied to him, and, though he lived until 1824, his publications ceased.

A similar series of works was projected and begun about the same time as that of Le Vaillant by AUDEBERT and VIEILLOT, though the former, who was by profession a painter and illustrated the work, was already dead more than a year before the appearance of the two volumes, bearing date 1802, and entitled *Oiseaux dorés ou a reflets métalliques*, the effect of the plates in which he sought to heighten by the lavish use of gilding. The first volume

¹ There is also an issue of this, as of the same author's other works, on large quarto paper.

contains the "Colibris, Oiseaux-mouches, Jacamars et Promerops," the second the "Grimperaux" and "Oiseaux de Paradis"—associations which set all the laws of systematic method at defiance. His colleague, Vieillot, brought out in 1805 a *Histoire Naturelle des plus beaux Chanteurs de la Zone Torride* with figures by Langlois of tropical Finches, Grosbeaks, Buntings, and other hard-billed birds; and in 1807 two volumes of a *Histoire Naturelle des Oiseaux de l'Amérique Septentrionale*, without, however, paying much attention to the limits commonly assigned by geographers to that part of the world. In 1805 ANSELME DESMAREST published a *Histoire naturelle des Tangaras*,² Desmarest of *des Manakins et des Todiers*, which, though belonging to the same category as all the former, differs from them in its more scientific treatment of the subjects to which it refers; and, in 1808, TEMMINCK, whose father's aid to Le Vaillant has already been noticed, brought out at Paris a *Histoire Naturelle des Pigeons* illustrated by Madame Knip, who had drawn the plates for Desmarest's volume.² Temminck.

Since we have begun by considering these large illustrated works in which the text is made subservient to the coloured plates, it may be convenient to continue our notice of such others of similar character as it may be expedient to mention here, though thereby we shall be led somewhat far afield. Most of them are but luxuries, and there is some degree of truth in the remark of Andreas Wagner in his *Report on the Progress of Zoology for 1843*, drawn up for the Ray Society (p. 60), that they "are not adapted for the extension and promotion of science, but must inevitably, on account of their unnecessary costliness, constantly tend to reduce the number of naturalists who are able to avail themselves of them, and they thus enrich ornithology only to its ultimate injury." Earliest in date as it is greatest in bulk stands AUDUBON'S egregious *Birds of America* Audubon. in four volumes, containing four hundred and thirty-five plates, of which the first part appeared in London in 1827 and the last in 1838. It does not seem to have been the author's original intention to publish any letter-press to this enormous work, but to let the plates tell their own story, though finally, with the assistance, as is now known, of WILLIAM MACGILLIVRAY, a text, on the whole Macgillivray. more than respectable, was produced in five large octavos under the title of *Ornithological Biography*, of which more will be said in the sequel. Audubon has been greatly extolled as an ornithological artist; but he was far too much addicted to representing his subjects in violent action and in postures that outrage nature, while his drawing is very frequently defective.³ In 1866 Mr D. G. ELLIOT began, and Elliot. in 1869 finished, a sequel to Audubon's great work in two volumes, on the same scale—*The New and Hitherto unfigured Species of the Birds of North America*, containing life-size figures of all those which had been added to its fauna since the completion of the former.

In 1830 JOHN EDWARD GRAY commenced the *Illustrations of Indian Zoology*, a series of plates of vertebrated animals, but mostly of birds, from drawings it is believed by native artists in the collection of General HARDWICKE, whose name is therefore associated with the work. Scientific

² Temminck subsequently reproduced, with many additions, the text of this volume in his *Histoire naturelle des Pigeons et des Gallinacés*, published at Amsterdam in 1813-15, in 3 vols. 8vo. Between 1838 and 1848 M. FLORENT-PROVOST brought out at Paris a further set of illustrations of Pigeons by M^{me}. Knip.

³ On the completion of these two works, for they must be regarded as distinct, an octavo edition in seven volumes under the title of *The Birds of America* was published in 1840-44. In this the large plates were reduced by means of the "camera lucida," the text was revised, and the whole systematically arranged. Other reprints have since been issued, but they are vastly inferior both in execution and value. A sequel to the octavo *Birds of America*, corresponding with it in form, was brought out in 1853-55 by CASSIN as *Illustrations of the Birds of California, Texas, Oregon, British and Russian America*.

Lear.

names are assigned to the species figured; but no text was ever supplied. In 1832 Mr LEAR, afterwards well known as a painter, brought out his *Illustrations of the Family of Psittacidae*, a volume which deserves especial notice from the extreme fidelity to nature and the great artistic skill with which the figures were executed.

Gould.

This same year (1832) saw the beginning of the marvellous series of illustrated ornithological works by which the name of JOHN GOULD is likely to be always remembered. *A Century of Birds from the Himalaya Mountains* was followed by *The Birds of Europe* in five volumes, published between 1832 and 1837, while in the interim (1834) appeared *A Monograph of the Ramphastidae*, of which a second edition was some years later called for, then the *Icones Avium*, of which only two parts were published (1837-38), and *A Monograph of the Trogonidae* (1838), which also reached a second edition. Sailing in 1838 for New South Wales, on his return in 1840 he at once commenced the greatest of all his works, *The Birds of Australia*, which was finished in 1848 in seven volumes, to which several supplementary parts, forming another volume, were subsequently added. In 1849 he began *A Monograph of the Trochilidae or Humming-birds* extending to five volumes, the last of which appeared in 1861, and has since been followed by a supplement now in course of completion by Mr SALVIN. *A Monograph of the Odontophorinæ or Partridges of America* (1850); *The Birds of Asia*, in seven volumes, the last completed by Mr SHARPE (1850-83); *The Birds of Great Britain*, in five volumes (1862-73); and *The Birds of New Guinea*, begun in 1875, and, after the author's death in 1881, undertaken by Mr Sharpe, make up the wonderful tale consisting of more than forty folio volumes, and containing more than three thousand coloured plates. The earlier of these works were illustrated by Mrs Gould, and the figures in them are fairly good; but those in the later, except when (as he occasionally did) he secured the services of Mr WOLF, are not so much to be commended. There is, it is true, a smoothness and finish about them not often seen elsewhere; but, as though to avoid the exaggerations of Audubon, Gould usually adopted the tamest of attitudes in which to represent his subjects, whereby expression as well as vivacity is wanting. Moreover, both in drawing and in colouring there is frequently much that is untrue to nature, so that it has not uncommonly happened for them to fail in the chief object of all zoological plates, that of affording sure means of recognizing specimens on comparison. In estimating the letterpress, which was avowedly held to be of secondary importance to the plates, we must bear in mind that, to ensure the success of his works, it had to be written to suit a very peculiarly composed body of subscribers. Nevertheless a scientific character was so adroitly assumed that scientific men—some of them even ornithologists—have thence been led to believe the text had a scientific value, and that of a high class. However it must also be remembered that, throughout the whole of his career, Gould consulted the convenience of working ornithologists by almost invariably refraining from including in his folio works the technical description of any new species without first publishing it in some journal of comparatively easy access.

Fraser.

An ambitious attempt to produce in England a general series of coloured plates on a large scale was Mr FRASER'S *Zoologia Typica*, the first part of which bears date 1841-42. Others appeared at irregular intervals until 1849, when the work, which seems never to have received the support it deserved, was discontinued. The seventy plates (forty-six of which represent birds) composing, with some explanatory letterpress, the volume are by C. Couzens and H. N. Turner,—the latter (as his publications prove) a zoologist of much promise, who in 1851 died, a victim to

his own zeal for investigation, of a wound received in dissecting. The chief object of the author, who had been naturalist to the Niger Expedition, and curator to the Museum of the Zoological Society of London, was to figure the animals contained in its gardens or described in its *Proceedings*, which until the year 1848 were not illustrated.

Wolf.

The publication of the *Zoological Sketches* of Mr WOLF, from animals in the gardens of the Zoological Society, was begun about 1855, with a brief text by MITCHELL, at that time the Society's secretary, in illustration of them. After his death in 1859, the explanatory letterpress was rewritten by Mr SCLATER, his successor in that office, and a volume was completed in 1861. Upon this a second series was commenced, and brought to an end in 1868. Though a comparatively small number of species of Birds are figured in this magnificent work (seventeen only in the first series, and twenty-two in the second), it must be mentioned here, for their likenesses are so admirably executed as to place it in regard to ornithological portraiture at the head of all others. There is not a single plate that is unworthy of the greatest of all animal painters.

Proceeding to illustrated works generally of less pretentious size but of greater ornithological utility than the books last mentioned, which are fitter for the drawing-room than the study, we next have to consider some in which the text is not wholly subordinated to the plates, though the latter still form a conspicuous feature of the publication. First of these in point of time as well as in importance is the *Nouveau Recueil des Planches Coloriées d'Oiseaux* of TEMMINCK and LAUGIER, intended as a sequel to the *Planches Enluminées* of D'Aubenton before noticed (page 6), and like that work issued both in folio and quarto size. The first portion of this was published at Paris in 1820, and of its one hundred and two *livraisons*, which appeared with great irregularity (*Ibis*, 1868, p. 500), the last was issued in 1839, containing the titles of the five volumes that the whole forms, together with a "Tableau Méthodique" which but indifferently serves the purpose of an index. There are six hundred plates, but the exact number of species figured (which has been computed at six hundred and sixty-one) is not so easily ascertained. Generally the subject of each plate has letterpress to correspond, but in some cases this is wanting, while on the other hand descriptions of species not figured are occasionally introduced, and usually observations on the distribution and construction of each genus or group are added. The plates, which shew no improvement in execution on those of Martinet, are after drawings by Huet and Prêtre, the former being perhaps the less bad draughtsman of the two, for he seems to have had an idea of what a bird when alive looks like, though he was not able to give his figures any vitality, while the latter simply delineated the stiff and dishevelled specimens from museum shelves. Still the colouring is pretty well done, and experience has proved that generally speaking there is not much difficulty in recognizing the species represented. The letterpress is commonly limited to technical details, and is not always accurate; but it is of its kind useful, for in general knowledge of the outside of Birds Temminck probably surpassed any of his contemporaries. The "Tableau Méthodique" offers a convenient concordance of the old *Planches Enluminées* and its successor, and is arranged after the system set forth by Temminck in the first volume of the second edition of his *Manuel d'Ornithologie*, of which something must presently be said.

Temminck
and
Laugier.

The *Galerie des Oiseaux*, a rival work, with plates by OUDART, seems to have been begun immediately after the former. The original project was apparently to give a figure and description of every species of Bird; but that was soon found to be impossible; and, when six parts had

Oudart.

been issued, with text by some unnamed author, the scheme was brought within practicable limits, and the writing of the letterpress was entrusted to VIEILLOT, who, proceeding on a systematic plan, performed his task very creditably, completing the work, which forms two quarto volumes, in 1825, the original text and fifty-seven plates being relegated to the end of the second volume as a supplement. His portion is illustrated by two hundred and ninety-nine coloured plates that, wretched as they are, have been continually reproduced in various text-books—a fact possibly due to their subjects having been judiciously selected. It is a tradition that, this work not being favourably regarded by the authorities of the Paris Museum, its draughtsman and author were refused closer access to the specimens required, and had to draw and describe them through the glass as they stood on the shelves of the cases.

In 1825 JARDINE and SELBY began a series of *Illustrations of Ornithology*, the several parts of which appeared at long and irregular intervals, so that it was not until 1839 that three volumes containing one hundred and fifty plates were completed. Then they set about a Second Series, which, forming a single volume with fifty-three plates, was finished in 1843. These authors, being zealous amateur artists, were their own draughtsmen to the extent even of lithographing the figures. In 1828 JAMES WILSON (author of the article ORNITHOLOGY in the 7th and 8th editions of the present work) began, under the title of *Illustrations of Zoology*, the publication of a series of his own drawings (which he did not, however, himself engrave) with corresponding letterpress. Of the thirty-six plates illustrating this volume, a small folio, twenty are devoted to Ornithology, and contain figures, which, it must be allowed, are not very successful, of several species rare at the time.

Though the three works last mentioned fairly come under the same category as the *Planches Enluminees* and the *Planches Coloriees*, no one of them can be properly deemed their rightful heirs. The claim to that succession was made in 1845 by DES MURS for his *Iconographie Ornithologique*, which, containing seventy-two plates by Prévot and Oudart¹ (the latter of whom had marvellously improved in his drawings since he worked with Vieillot), was completed in 1849. Simultaneously with this DES MURS began a work on a plan precisely similar, the *Esquisses Ornithologiques*, illustrated by Severeys, which, however, stopped short in 1849 with its thirty-seventh plate, while the letterpress unfortunately does not go beyond that belonging to the twentieth. In 1866 the succession was again taken up by the *Exotic Ornithology* of MESSRS SCLATER and SALVIN, containing one hundred plates, representing one hundred and four species, all from Central or South America, which are neatly executed by Mr Smit. The accompanying letterpress is in some places copious, and useful lists of the species of various genera are occasionally subjoined, adding to the definite value of the work, which, forming one volume, was completed in 1869.

Lastly here must be mentioned ROWLEY'S *Ornithological Miscellany* in three quarto volumes, profusely illustrated, which appeared between 1875 and 1878. The contents are as varied as the authorship, and, most of the leading English ornithologists having contributed to the work, some of the papers are extremely good, while in the plates, which are in Mr Keulemans's best manner, many rare species of Birds are figured, some of them for the first time.

All the works lately named have been purposely treated at some length, since being very costly they are not easily accessible. The few next to be mentioned, being of smaller size (octavo), may be within reach of more persons, and

therefore can be passed over in a briefer fashion without detriment. In many ways, however, they are nearly as important. SWAINSON'S *Zoological Illustrations* in three volumes, containing one hundred and eighty-two plates, whereof seventy represent Birds, appeared between 1820 and 1821, and in 1829 a Second Series of the same was begun by him, which, extending to another three volumes, contained forty-eight more plates of Birds out of one hundred and thirty-six, and was completed in 1833. All the figures were drawn by the author, who as an ornithological artist had no rival in his time. Every plate is not beyond criticism, but his worst drawings shew more knowledge of bird-life than do the best of his English or French contemporaries. A work of somewhat similar character, but one in which the letterpress is of greater value, is the *Centurie Zoologique* of LESSON, a single volume that, though bearing the date 1830 on its title page, is believed to have been begun in 1829,² and was certainly not finished until 1831. It received the benefit of Isidore Geoffroy St-Hilaire's assistance. Notwithstanding its name it only contains eighty plates, but of them forty-two, all by Frère and in his usual stiff style, represent Birds. Concurrently with this volume appeared Lesson's *Traité d'Ornithologie*, which is dated 1831, and may perhaps be here most conveniently mentioned. Its professedly systematic form strictly relegates it to another group of works, but the presence of an "Atlas" (also in octavo) of one hundred and nineteen plates to some extent justifies its notice in this place. Between 1831 and 1834 the same author brought out, in continuation of his *Centurie*, his *Illustrations de Zoologie* with sixty plates, twenty of which represent Birds.

In 1832 KITTLITZ began to publish some *Kupfertafeln zur Naturgeschichte der Vögel*, in which many new species are figured; but the work came to an end with its thirty-sixth plate in the following year. In 1845 REICHENBACH commenced with his *Praktische Naturgeschichte der Vögel* the extraordinary series of illustrated publications which, under titles far too numerous here to repeat, ended in or about 1855, and are commonly known collectively as his *Vollständigste Naturgeschichte der Vögel*.³ Herein are contained more than nine hundred coloured and more than one hundred uncoloured plates, which are crowded with the figures of Birds, a large proportion of them reduced copies from other works, and especially those of Gould.

It now behoves us to turn to general and particularly systematic works in which plates, if they exist at all, form but an accessory to the text. These need not detain us for long, since, however well some of them may have been executed, regard being had to their epoch, and whatever repute some of them may have achieved, they are, so far as general information and especially classification is concerned, wholly obsolete, and most of them almost useless except as matters of antiquarian interest. It will be enough merely to name DUMÉRIL'S *Zoologie Analytique* (1806) and GRAVENHORST'S *Vergleichende Uebersicht des thierischen und einiger neuern zoologischen Systeme* (1807); nor need we linger over SHAW'S *General Zoology*, a pretentious compilation continued by STEPHENS. The last seven of its fourteen volumes include the *Class Aves*, and the first part of them appeared in 1809, but, the original author dying in 1815, when only two volumes of Birds were published, the remainder was brought to an end in 1820 by his successor, who afterwards became well known as an entomologist. The engravings which these volumes contain are mostly bad copies, often of bad figures,

¹ In 1828 he had brought out, under the title of *Manuel d'Ornithologie*, two handy duodecims which are very good of their kind.

² Technically speaking they are in quarto, but their size is so small that they may be well spoken of here. In 1870 Dr A. B. Meyer brought out an *Index* to them.

³ Technically speaking they are in quarto, but their size is so small that they may be well spoken of here. In 1870 Dr A. B. Meyer brought out an *Index* to them.

Vieillot.

Jardine
and Selby.

Wilson.

Des Murs.

Du Bus.

Sclater
and
Salvin.

Rowley.

Swainson.

Lesson.

Kittlitz.

Reichen-
bach.Shaw and
Stephens.

though many are piracies from Bewick, and the whole is a most unsatisfactory performance. Of a very different kind is the next we have to notice, the *Prodromus Systematis Mannalium et Avium* of ILLIGER, published at Berlin in 1811, which must in its day have been a valuable little manual, and on many points it may now be consulted to advantage—the characters of the Genera being admirably given, and good explanatory lists of the technical terms of Ornithology furnished. The classification was quite new, and made a step distinctly in advance of anything that had before appeared.¹ In 1816 VIEILLOT published at Paris an *Analyse d'une nouvelle Ornithologie Élémentaire*, containing a method of classification which he had tried in vain to get printed before, both in Turin and in London.² Some of the ideas in this are said to have been taken from Illiger; but the two systems seem to be wholly distinct. Vieillot's was afterwards more fully expounded in the series of articles which he contributed between 1816 and 1819 to the Second Edition of the *Nouveau Dictionnaire d'Histoire Naturelle* containing much valuable information. The views of neither of these systematizers pleased TEMMINCK, who in 1817 replied rather sharply to Vieillot in some *Observations sur la Classification méthodique des Oiseaux*, a pamphlet published at Amsterdam, and prefixed to the second edition of his *Manuel d'Ornithologie*, which appeared in 1820, an *Analyse du Système Général d'Ornithologie*. This proved a great success, and his arrangement, though by no means simple,³ was not only adopted by many ornithologists of almost every country, but still has some adherents. The following year RANZANI of Bologna, in his *Elementi di Zoologia*—a very respectable compilation—came to treat of Birds, and then followed to some extent the plan of De Blainville and Merrem (concerning which much more has to be said by and by) placing the Struthious Birds in an Order by themselves. In 1827 WAGLER brought out the first part of a *Systema Avium*, in this form never completed, consisting of forty-nine detached monographs of as many genera, the species of which are most elaborately described. The arrangement he subsequently adopted for them and for other groups is to be found in his *Natürliches System der Amphibien* (pp. 77–128), published in 1830, and is too fanciful to require any further attention. The several attempts at system-making by KAUP, from his *Allgemeine Zoologie* in 1829 to his *Ueber Classification der Vögel* in 1849, were equally arbitrary and abortive; but his *Skizze der Entwickelungs-Geschichte* in 1829 must be here named, as it is so often quoted on account of the number of new genera which the peculiar views he had embraced compelled him to invent. These views he shared more or less with Vigors and Swainson, and to them attention will be immediately especially invited, while consideration of the scheme gradually developed

from 1831 onward by CHARLES LUCIEN BONAPARTE, and Bonastill not without its influence, is deferred until we come to treat of the rise and progress of what we may term the reformed school of Ornithology. Yet injustice would be done to one of the ablest of those now to be called the old masters of the science if mention were not here made of the *Conspectus Generum Avium*, begun in 1850 by the naturalist last named, with the help of SCHLEGEL, and unfortunately interrupted by its author's death six years later.⁴ The systematic publications of GEORGE ROBERT G. R. GRAY, so long in charge of the ornithological collection of the British Museum, began with a *List of the Genera of Birds* published in 1840. This, having been closely, though by no means in a hostile spirit, criticized by STRICKLAND (*Ann. Nat. History*, vi. p. 410; vii. pp. 26 and 159), was followed by a Second Edition in 1841, in which nearly all the corrections of the reviewer were adopted, and in 1844 began the publication of *The Genera of Birds*, beautifully illustrated—first by MITCHELL and afterwards by Mr WOLF—which will always keep Gray's name in remembrance. The enormous labour required for this work seems scarcely to have been appreciated, though it remains to this day one of the most useful books in an ornithologist's library. Yet it must be confessed that its author was hardly an ornithologist but for the accident of his calling. He was a thoroughly conscientious clerk, devoted to his duty and unsparing of trouble. However, to have conceived the idea of executing a work on so grand a scale as this—it forms three folio volumes, and contains one hundred and eighty-five coloured and one hundred and forty-eight uncoloured plates, with references to upwards of two thousand four hundred generic names—was in itself a mark of genius, and it was brought to a successful conclusion in 1849. Costly as it necessarily was, it has been of great service to working ornithologists. In 1855 Gray brought out, as one of the Museum publications, *A Catalogue of the Genera and Subgenera of Birds*, a handy little volume, naturally founded on the larger works. Its chief drawback is that it does not give any more reference to the authority for a generic term than the name of its inventor and the year of its application, though of course more precise information would have at least doubled the size of the book. The same deficiency became still more apparent when, between 1869 and 1871, he published his *Hand-List of Genera and Species of Birds* in three octavo volumes (or parts, as they are called). Never was a book better named, for the working ornithologist must almost live with it in his hand, and though he has constantly to deplore its shortcomings, one of which especially is the wrong principle on which its index is constructed, he should be thankful that such a work exists. Many of its defects are, or perhaps it were better said ought to be, supplied by GIEBEL'S *Theaurus Ornithologia*, also in three volumes, published between 1872 and 1877, a work admirably planned, but the execution of which, whether through the author's carelessness or the printer's fault, or a combination of both, is lamentably disappointing. Again and again it will afford the enquirer who consults it valuable hints, but he must be mindful never to trust a single reference in it until it has been verified. It remains to warn the reader also that, useful as are both this work and those of Gray, their utility is almost solely confined to experts.

With the exception to which reference has just been made, scarcely any of the ornithologists hitherto named indulged their imagination in theories or speculations. Nearly all were content to prosecute their labours in a plain fashion consistent with common sense, plodding

¹ Illiger may be considered the founder of the school of nomenclatorial purists. He would not tolerate any of the "barbarous" generic terms adopted by other writers, though some had been in use for many years.

² The method was communicated to the Turin Academy, 10th January 1814, and was ordered to be printed (*Mém. Ac. Sc. Turin*, 1813–14, p. xxviii); but, through the derangements of that stormy period, the order was never carried out (*Mém. Acad. Sc. Turin*, xxiii. p. xcvi). The minute-book of the Linnean Society of London shows that his *Prozusio* was read at meetings of that Society between 15th November 1814 and 21st February 1815. Why it was not at once accepted is not told, but the entry respecting it, which must be of much later date, in the "Register of Papers" is "Published already." It is due to Vieillot to mention these facts, as he has been accused of publishing his method in haste to anticipate some of Cuvier's views, but he might well complain of the delay in London. Some reparation has been made to his memory by the reprinting of his *Analyse* by the Willughby Society.

³ He recognized sixteen Orders of Birds, while Vieillot had been content with five, and Illiger with seven.

⁴ To this very indispensable work a good index was supplied in 1865 by Dr Finsch.

steadily onwards in their efforts to describe and group the various species of Birds, as one after another they were made known. But this was not always to be, and now a few words must be said respecting a theory which was promulgated with great zeal by its upholders during the end of the first and early part of the second quarter of the present century, and for some years seemed likely to carry all before it. The success it gained was doubtless due in some degree to the difficulty which most men had in comprehending it, for it was enwrapped in alluring mystery, but more to the confidence with which it was announced as being the long looked-for key to the wonders of creation, since its promoters did not hesitate to term it the discovery of "the Natural System," though they condescended, by way of explanation to less exalted intellects than their own, to allow it the more moderate appellation of the Circular or Quinary System.

A comparison of the relation of created beings to a number of intersecting circles is as old as the days of NIEREMBERG, who in 1635 wrote (*Historia Naturæ*, lib. iii. cap. 3)—"Nullus hiatus est, nulla fractio, nulla dispersio formarum, invicem connexa sunt velut annulus annulo"; but it is almost clear that he was thinking only of a chain. In 1806 FISCHER DE WALDHEIM, in his *Tableaux Synoptiques de zoognosie* (p. 181), quoting Nierenberg, extended his figure of speech, and, while justly deprecating the notion that the series of forms belonging to any particular group of creatures—the *Mammalia* was that whence he took his instance—could be placed in a straight line, imagined the various genera to be arrayed in a series of contiguous circles around Man as a centre. Though there is nothing to shew that Fischer intended, by what is here said, to do anything else than illustrate more fully the marvellous interconnection of different animals, or that he attached any realistic meaning to his metaphor, his words were eagerly caught up by the prophet of the new faith. This was WILLIAM SHARPE MACLEAY, a man of education and real genius, who in 1819 and 1821 brought out a work under the title of *Horæ Entomologicae*, which was soon after hailed by VIGORS as containing a new revelation, and applied by him to Ornithology in some "Observations on the Natural Affinities that connect the Orders and Families of Birds," read before the Linnean Society of London in 1823, and afterwards published in its *Transactions* (xiv. pp. 395-617). In the following year VIGORS returned to the subject in some papers published in the recently established *Zoological Journal*, and found an energetic condisciple and coadjutor in SWAINSON, who, for more than a

Quinary system.

Macleay.

Vigors.

Swainson.

dozen years—to the end, in fact, of his career as an ornithological writer—was instant in season and out of season in pressing on all his readers the views he had, through VIGORS, adopted from Macleay, though not without some modification of detail if not of principle. What these views were it would be manifestly improper for a septic to state except in the terms of a believer. Their enunciation must therefore be given in Swainson's own words, though it must be admitted that space cannot be found here for the diagrams, which it was alleged were necessary for the right understanding of the theory. This theory, as originally propounded by Macleay, was said by Swainson in 1835 (*Geogr. and Classific. of Animals*, p. 202) to have consisted of the following propositions:—

- "1. That the series of natural animals is continuous, forming, as it were, a circle; so that, upon commencing at any one given point, and thence tracing all the modifications of structure, we shall be imperceptibly led, after passing through numerous forms, again to the point from which we started.
- "2. That no groups are natural which do not exhibit, or show an evident tendency to exhibit, such a circular series.
- "3. That the primary divisions of every large group are ten, five of which are composed of comparatively large circles, and five of smaller; these latter being termed *osculant*, and being intermediate between the former, which they serve to connect.
- "4. That there is a tendency in such groups as are placed at the opposite points of a circle of affinity "to meet each other."
- "5. That one of the five larger groups into which every natural circle is divided "bears a resemblance to all the rest, or, more strictly speaking, consists of types which represent those of each of the four other groups, together with a type peculiar to itself."

As subsequently modified by Swainson (*loc. cit.* p. 224, 225), the foregoing propositions take the following form:—

- "I. That every natural series of beings, in its progress from

a given point, either actually returns, or evinces a tendency to return, again to that point, thereby forming a circle.

"II. The primary circular divisions of every group are three actually, or five apparently.

"III. The contents of such a circular group are symbolically (or analogically) represented by the contents of all other circles in the animal kingdom.

"IV. That these primary divisions of every group are characterized by definite peculiarities of form, structure, and economy, which, under diversified modifications, are uniform throughout the animal kingdom, and are therefore to be regarded as the PRIMARY TYPES OF NATURE.

"V. That the different ranks or degrees of circular groups exhibited in the animal kingdom are NINE in number, each being involved within the other."

Though, as above stated, the theory here promulgated owed its temporary success chiefly to the extraordinary assurance and pertinacity with which it was urged upon a public generally incapable of understanding what it meant, that it received some support from men of science must be admitted. A "circular system" was advocated by the eminent botanist FRIES, and the views of Macleay met with the partial approbation of the celebrated entomologist KIRBY, while at least as much may be said of the imaginative OKEN, whose mysticism far surpassed that of the Quinarians. But it is obvious to every one who nowadays indulges in the profitless pastime of studying their writings that, as a whole, they failed in grasping the essential difference between *homology* (or "affinity," as they generally termed it) and *analogy* (which is only a learned name for an uncertain kind of resemblance)—though this difference had been fully understood and set forth by Aristotle himself—and, moreover, that in seeking for analogies on which to base their foregone conclusions they were often put to hard shifts. Another singular fact is that they often seemed to be totally unaware of the tendency if not the meaning of some of their own expressions: thus Macleay could write, and doubtless in perfect good faith (*Trans. Linn. Society*, xvi. p. 9, note), "Naturalists have nothing to do with mysticism, and but little with *a priori* reasoning." Yet his followers, if not he himself, were ever making use of language in the highest degree metaphorical, and were always explaining facts in accordance with preconceived opinions. FLEMING, already the

Fleming.

author of a harmless and extremely orthodox *Philosophy of Zoology*, pointed out in 1829 in the *Quarterly Review* (xli. pp. 302-327) some of the fallacies of Macleay's method, and in return provoked from him a reply, in the form of a letter addressed to VIGORS *On the Dying Struggle of the Dichotomous System*, couched in language the force of which no one even at the present day can deny, though to the modern naturalist its invective power contrasts ludicrously with the strength of its ratiocination. But, confining ourselves to what is here our special business, it is to be remarked that perhaps the heaviest blow dealt at these strange doctrines was that delivered by REXNIE, who, in an edition of Montagu's *Ornithological Dictionary* (pp. xxxiii-lv), published in 1831 and again issued in 1833, attacked the Quinary System, and especially its application to Ornithology by VIGORS and SWAINSON, in a way that might perhaps have demolished it, had not the author mingled with his undoubtedly sound reasoning such that is foreign to any question with which a naturalist, as such, ought to deal—though that herein he was only following the example of one of his opponents, who had constantly treated the subject in like manner, is to be allowed. This did not hinder Swainson, who had succeeded in getting the ornithological portion of the first zoological work ever published at the expense of the British Government (namely, the *Fauna Boréal-Americana*) executed in accordance with his own opinions, from maintaining them more strongly than ever in several of the volumes treating of Natural History which he contributed to the *Cabinet Cyclopædia*—among others that from which we have just given some extracts—and in what may be deemed the culmination in England of the Quinary System, the volume of the "Naturalist's Library" on *The Natural Arrangement and History of Flycatchers*, published in 1838, of which unhappy performance mention has already been made in this present work (vol. ix. p. 350, note). This seems to have been his last attempt; for, two years later, his *Bibliography of Zoology* shows little trace of his favourite theory, though nothing he had uttered in its support was retracted. Appearing almost simultaneously with this work, an article by STRICKLAND (*Mag. Nat. History*, ser. 2, iv. pp. 219-226) entitled *Observations upon the Affinities and Analogies of Organized Beings* administered to the theory a shock from which it never recovered, though attempts were now and then made by its adherents to revive it; and, even ten years or more later, KAUP, one of the few foreign ornithologists who had embraced Quinary principles, was by mistaken kindness allowed to publish *Monographs of the Birds-of-Prey* (Jardine's *Contributions to Ornithology*, 1849, pp. 63-75, 96-121; 1850, pp. 51-80; 1851, pp. 119-130; 1852, pp. 103-122; and *Trans. Zool. Society*, iv. pp. 201-260), in which its absurdity reached the climax.

The mischief caused by this theory of a Quinary System was

¹ We prefer giving them here in Swainson's version, because he seems to have set them forth more clearly and concisely than Macleay ever did, and, moreover, Swainson's application of them to Ornithology—a branch of science that lay outside of Macleay's proper studies—appears to be more suitable to the present occasion.

very great, but was chiefly confined to Britain, for (as has been already stated) the extraordinary views of its adherents found little favour on the continent of Europe. The purely artificial character of the System of Linnaeus and his successors had been perceived, and men were at a loss to find a substitute for it. The new doctrine, loudly proclaiming the discovery of a "Natural" System, led away many from the steady practice which should have followed the teaching of Cuvier (though he in Ornithology had not been able to act up to the principles he had laid down) and from the extended study of Comparative Anatomy. Moreover, it veiled the honest attempts that were making both in France and Germany to find real grounds for establishing an improved state of things, and consequently the labours of DE BLAINVILLE, ERISSMAN, GÉOFFROY ST-HILAIRE, and L'HERMINIER, of MERREM, JOHANNES MÜLLER, and NITZSCH—to say nothing of others—were almost wholly unknown on this side of the Channel, and even the value of the investigations of British ornithologists of high merit, such as MACARTNEY and MACGILLIVRAY, was almost completely overlooked. True it is that there were not wanting other men in these islands whose common sense refused to accept the metaphorical doctrine and the mystical jargon of the Quinarians, but so strenuously and persistently had the latter asserted their infallibility, and so vigorously had they assailed any who ventured to doubt it, that most peaceable ornithologists found it best to bend to the furious blast, and in some sort to acquiesce at least in the phraseology of the self-styled interpreters of Creative Will. But, while thus lamenting this unfortunate perversion into a mistaken channel of ornithological energy, we must not over-blame those who caused it. Macleay indeed never pretended to a high position in this branch of science, his tastes lying in the direction of Entomology; but few of their countrymen knew more of Birds than did Swainson and Vigors; and, while the latter, as editor for many years of the *Zoological Journal*, and the first Secretary of the Zoological Society, has special claims to the regard of all zoologists, so the former's indefatigable pursuit of Natural History, and conscientious labour in its behalf—among other ways by means of his graceful pencil—deserve to be remembered as a set-off against the injury he unwittingly caused.

Fauna. It is now incumbent upon us to take a rapid survey of the ornithological works which come more or less under the designation of "Fauna";¹ but these are so numerous that it will be necessary to limit this survey, as before indicated, to those countries alone which form the homes of English people, or are commonly visited by them in ordinary travel.

New Zealand. Beginning with our Antipodes, it is hardly needful to go further back than Mr Buller's beautiful *Birds of New Zealand* (4to, 1827-73), with coloured plates by Mr Kenlemans, since the publication of which the same author has issued a *Manual of the Birds of New Zealand* (8vo, 1852), founded on the former; but justice requires that mention be made of the labours of G. R. Gray, first in the Appendix to Dieffenbach's *Travels in New Zealand* (1843) and then in the ornithological portion of the *Zoology of the Voyage of H.M.S. "Erebus" and "Terror,"* begun in 1864, but left unfinished from the following year until completed by Mr Sharpe in 1876. A considerable number of valuable papers on the Ornithology of the country by Drs Hector and Von Haast, Prof. Hutton, Mr Potts, and others are to be found in the *Transactions and Proceedings of the New Zealand Institute*.

Australia. Passing to Australia, we have the first good description of some of its Birds in the several old voyages and in Latham's works before mentioned (pages 6 and 8). Shaw's *Zoology of New Holland* (4to, 1794) added those of a few more, as did J. W. Lewin's *Natural History of the Birds of New South Wales* (4to, 1822), which reached a third edition in 1833. Gould's great *Birds of Australia* has been already named, and he subsequently reproduced with some additions the text of that work under the title of *Handbook to the Birds of Australia* (2 vols. 8vo, 1865). In 1866 Mr Diggles commenced a similar publication, *The Ornithology of Australia*, but the coloured plates, though fairly drawn, are not comparable to those of his predecessor. This is still incomplete, though the parts that have appeared have been collected to form two volumes and issued with title-pages. Some notices of Australian Birds by Mr Ramsay and others are to be found in the *Proceedings of the Linnaean Society of New South Wales* and of the *Royal Society of Tasmania*.

Ceylon. Coming to our Indian possessions, and beginning with Ceylon, we have Kelaart's *Prodromus Faunæ Zeylanicæ* (8vo, 1852), and the admirable *Birds of Ceylon* by Capt. Legge (4to, 1878-80), with coloured plates by Mr Kenlemans of all the peculiar species. It is hardly possible to name any book that has been more conscientiously executed than this. In regard to continental India many

of the more important publications have been named in a former article (*BIRDS*, iii, pp. 762, 763), and since that was written the chief work that has appeared is Blyth's *Mammals and Birds of Burma* (8vo, 1875). Jerdon's *Birds of India* (8vo, 1862-64; reprinted 1877) still reigns supreme as the sole comprehensive work on the Ornithology of the Peninsula. A very fairly executed compilation on the subject by an anonymous writer is to be found in a late edition of the *Cyclopædia of India* published at Madras. It is needless to observe that *Stray Feathers*, an ornithological journal for India and its dependencies, and maintained with much spirit by Mr A. O. Hume, contains many interesting and some valuable papers.

In regard to South Africa, besides the well-known work of South Le Vaillant already mentioned, there is the second volume of Sir Africa. Andrew Smith's *Illustrations of the Zoology of South Africa* (4to, 1838-42), which is devoted to birds. This is an important but cannot be called a satisfactory work. Its one hundred and fourteen plates by Ford truthfully represent one hundred and twenty-two of the mounted specimens obtained by the author in his explorations into the interior. Mr Layard's handy *Birds of South Africa* (8vo, 1867), though by no means free from faults, has much to recommend it. A so-called new edition of it by Mr Sharpe has since appeared (1875-84), but is executed on a plan so wholly different that it must be regarded as a distinct work. Andersson's *Notes on the Birds of Damara Land* (8vo, 1872) has been carefully edited by Mr Gurney, whose knowledge of South-African ornithology is perhaps greater than that of any one else. It is much to be regretted that of the numerous sporting books that treat of this part of the world so few give any important information respecting the Birds.

Of special works relating to the latter West Indies, Waterton's West well-known *Wanderings* has passed through several editions since Indies. its first appearance in 1825, and must be mentioned here, though, strictly speaking, much of the country he traversed was not British territory. To Dr Cabanis we are indebted for the ornithological results of Richard Schomburgk's researches given in the third volume (pp. 662-765) of the latter's *Reisen im Britisch-Guiana* (8vo, 1848), and then in Létouart's *Oiseaux de l'île de la Trinidad* (8vo, 1866). Of the Antilles there is only to be named Mr Gosse's excellent *Birds of Jamaica* (12mo, 1847), together with its *Illustrations* (sm. fol., 1849) beautifully executed by him. A nominal list, with references, of the Birds of the island is contained in the *Handbook of Jamaica* for 1881 (pp. 103-117).

So admirable a "List of Faunal Publications relating to North North American Ornithology" up to the year 1878 has been given by Dr America. Coues as an appendix to his *Birds of the Colorado Valley* (pp. 567-784) that nothing more of the kind is wanted except to notice the chief separate works which have since appeared. These may be said to be Mr Stearns's *New England Bird Life* (2 vols. 8vo, 1881-83), revised by Dr Coues, and the several editions of his own *Check List of North American Birds* (8vo, 1882), and *Key to North American Birds* (1884); while it may be added that the concluding volumes of the *North American Birds* of Prof. Baird, the late Dr Brewer, and Mr Ridgway (the first three of which were published in 1874) are expected to be issued about the time that these lines will meet the reader's eye. Yet some of the older works are still of sufficient importance to be especially mentioned here, and especially that of Alexander Wilson, whose *American Ornithology*, originally published between 1808 and 1814, has gone through many editions than there is room to specify, though mention should be made of those issued in Great Britain, by Jameson (4 vols. 16mo, 1831), and Jardine (3 vols. 8vo, 1832). The former of these has the entire text, but 20 plates; the latter reproduces the plates, but the text is in places much condensed, and excellent notes are added. A continuation of Wilson's work, under the same title and on the same plan, was issued by Bonaparte between 1825 and 1833, and most of the later editions include the work of both authors. The works of Audubon, with their continuations by Cassin and Mr Elliot, and the *Fauna Boreali-Americana* of Richardson and Swainson have already been noticed (pages 11 and 15); but they need naming here, as also does Nuttall's *Manual of the Ornithology of the United States and of Canada* (2 vols., 1832-34; 2d ed., 1840); the *Birds of Long Island* (8vo, 1844) by Giraud, remarkable for its excellent account of the habits of shore-birds; and of course the *Birds of North America* (4to, 1855) by Prof. Baird, with the co-operation of Cassin and Mr Lawrence, which originally formed a volume (ix.) of what are known as the "Pacific Railroad Reports." Apart from these special works the scientific journals of Boston, New York, Philadelphia, and Washington contain innumerable papers on the Ornithology of the country, while in 1876 the *Bulletin of the Nuttall Ornithological Club* began to appear and continued until 1884, when it was superseded by *The Auk*, established solely for the promotion of Ornithology in America, and

¹ A very useful list of more general scope is given as the Appendix to an address by Mr Sclater to the British Association in 1875 (*Report*, pt. ii, pp. 114-133).

² This is a posthumous publication, nominally forming an extra number of the *Journal of the Asiatic Society*; but, since it was separately issued, it is entitled to notice here.

numbering among its supporters almost every American ornithologist of repute, its editors being Messrs Allen, Coues, Ridgway, Brewer, and Chamberlain.

Scandi-
navia.

Returning to the Old World, among the countries whose Ornithology will most interest British readers we have first Iceland, the fullest—indeed the only full—account of the Birds of which is Faber's *Prodromus der isländischen Ornithologie* (8vo, 1822), though the island has since been visited by several good ornithologists, — Procter, Krüper, and Wolley among them. A list of its Birds, with some notes, bibliographical and biological, has been given as an Appendix to Mr Baring-Gould's *Iceland, its Scenes and Sagas* (8vo, 1862); and Mr Shepherd's *North-west Peninsula of Iceland* (8vo, 1867) recounts a somewhat profitless expedition made thither expressly for ornithological objects. For the Birds of the Feroes there is Herr H. C. Müller's *Færøernes Fauna* (8vo, 1862), of which a German translation has appeared.¹ The Ornithology of Norway has been treated in a great many papers by Herr Collett, some of which may be said to have been separately published as *Norges Fugle* (8vo, 1868; with a supplement, 1871), and *The Ornithology of Northern Norway* (8vo, 1872)—this last in English. For Scandinavia generally the latest work is Herr Collin's *Skandinaviens Fugle* (8vo, 1873), being a greatly better edition of the very moderate *Dannmarks Fugle* of Kjørboiling; but the ornithological portion of Nilsson's *Skandinaviske Fauna, Faglarna* (3d ed., 2 vols. 8vo, 1858) is of great merit; while the text of Sundevall's *Svenska Faglarna* (obl. fol., 1856-73), unfortunately unfinished at his death, and Herr Holmgren's *Skandinaviens Fuglar* (2 vols. 8vo, 1866-75) deserve naming.

Germany.

Works on the Birds of Germany are far too numerous to be recounted. That of the two Naumanns, already mentioned, and yet again to be spoken of, stands at the head of all, and perhaps at the head of the "Faunal" works of all countries. For want of space it must here suffice simply to name some of the ornithologists who in this century have elaborated, to an extent elsewhere unknown, the science as regards their own country:—Altum, Baldamus, Bechstein, Blasius (father and two sons), Bolle, Borggreve, whose *Vogel-Fauna von Norddeutschland* (8vo, 1869) contains what is practically a bibliographical index to the subject, Brehm (father and sons), Von Droste, Gütke, Gloger, Hintz, Alexander and Eugen von Homeyer, Jackel, Koch, König-Warthausen, Krüper, Kutter, Landbeck, Landois, Leisler, Von Maltzan, Bernard Meyer, Von der Mühle, Neumann, Tobias, Johann Wolf, and Zander.² Were we to extend the list beyond the boundaries of the German empire, and include the ornithologists of Austria, Bohemia, and the other states subject to the same monarch, the number would be nearly doubled; but that would overpass our proposed limits, though Herr von Pelzeln must be named.³ Passing onward to Switzerland, we must content ourselves by referring to the list of works, forming a *Bibliographia Ornithologica Helvetica*, drawn up by Dr Stölker for Dr Fatio's *Bulletin de la Société Ornithologique Suisse* (ii. pp. 90-119). As to Italy, we can but name here the *Fauna d'Italia*, of which the second part, *Uccelli* (8vo, 1872), by Count Salvadori, contains an excellent bibliography of Italian works on the subject, and the posthumously published *Ornithologia Italiana* of Savi (3 vols. 8vo, 1873-77).⁴ Coming to the Iberian peninsula, we must in default of separate works depart from our rule of not mentioning contributions to journals, for of the former there are only Col. Irby's *Ornithology of the Straits of Gibraltar* (8vo, 1875) and Mr A. C. Smith's *Spring Tour in Portugal*⁵ to be named, and these only partially cover the ground. However, Dr A. E. Brehm has published a list of Spanish Birds (*Allgemeine deutsche Naturgeschichte*, Zehnter, iii. p. 431), and *The Ibis* contains several excellent papers by Lord Lilford and by Mr Saunders, the latter of whom there records (1871, p. 65) the few works on Ornithology by Spanish authors, and in the *Bulletin de la Société Zoologique de France* (i. p. 315; ii. pp. 11, 89, 185) has given a list of the Spanish Birds known to him.

Italy.

Spain
and
Portugal.

France.

Returning northwards, we have of the Birds of the whole of France nothing of real importance more recent than the volume

Oiseau in Vieillot's *Faune Française* (8vo, 1822-29); but there is a great number of local publications of which Mr Saunders has furnished (*Zoologist*, 1878, pp. 93-99) a catalogue. Some of these seem only to have appeared in journals, but many have certainly been issued separately. Those of most interest to English ornithologists naturally refer to Brittany, Normandy, and Picardy, and are by Bailon, Benoist, Blandin, Bureau, Canivet, Chesnon, Degland, Demarie, De Norgnet, Gentil, Harly, Lemetzel, Lemontnier, Lesauvage, Maigron, Marcotte, Nourry, and Tassé, while perhaps the *Ornithologie Parisienne* of M. René Parquet, under the pseudonym of Nérée Quéput, should also be named. Of the rest the most important are the *Ornithologie Provençale* of Roux (2 vols. 4to, 1825-29); Risso's *Histoire naturelle... des environs de Nice* (5 vols. 8vo, 1826-27); the *Ornithologie du Dauphiné* of Bouteille and Labatie (2 vols. 8vo, 1843-44); the *Faune Méridionale* of Crespon (2 vols. 8vo, 1844); the *Ornithologie de la Savoie* of Bailly (4 vols. 8vo, 1853-54), and *Les Richesses ornithologiques du midi de la France* (4to, 1859-61) of M.M. Jaubert and Barthélemy-Lapommeraye. For Belgium the *Faune Belge* of Baron Belgium. De Selys-Longchamps (8vo, 1842), old as it is, remains the classical work, though the *Planches colorées des Oiseaux de la Belgique* of M. Dubois (8vo, 1851-60) is so much later in date. In regard to Holland we have Schlegel's *De Vogels van Nederland* (3 vols. 8vo, Holland, 1854-58; 2d ed., 2 vols., 1878), besides his *De Dieren van Nederland: Vogels* (8vo, 1861).

Before considering the ornithological works relating solely to the Europe of British Islands, it may be well to cast a glance on a few of those general, that refer to Europe in general, the more so since most of them are of Continental origin. First we have the already-mentioned *Manuel d'Ornithologie* of Temminck, which originally appeared as a single volume in 1815,⁶ but that was speedily superseded by the second edition of 1820, in two volumes. Two supplementary parts were issued in 1835 and 1840 respectively, and the work for many years deservedly maintained the highest position as the authority on European Ornithology—indeed in England it may almost without exaggeration be said to have been nearly the only foreign ornithological work known; but, as could only be expected, grave defects are now to be discovered in it. Some of them were already manifest when one of its author's colleagues, Schlegel (who had been employed to write the text for Susemill's plates, originally intended to illustrate Temminck's work), brought out his bilingual *Revue critique des Oiseaux d'Europe* (8vo, 1844), a very remarkable volume, since it correlated and consolidated the labours of French and German, to say nothing of Russian, ornithologists. Of Gould's *Birds of Europe* (5 vols. fol., 1832-37) nothing need be added to what has been already said. The year 1849 saw the publication of Degland's *Ornithologie Européenne* (2 vols. 8vo), a work fully intended to take the place of Temminck's; but of which Bonaparte, in a caustic but by no means ill-deserved *Revue Critique* (12mo, 1850), said that the author had performed a miracle since he had worked without a collection of specimens and without a library. A second edition, revised by M. Gerbe (2 vols. 8vo, 1867), strove to remedy, and to some extent did remedy, the grosser errors of the first, but enough still remain to make few statements in the work trustworthy unless corroborated by other evidence. Meanwhile in England Dr Bree had in 1858 begun the publication of *The Birds of Europe not observed in the British Isles* (4 vols. 8vo), which was completed in 1863, and in 1875 reached a second and improved edition (5 vols.). In 1862 M. Dubois brought out a similar work on the "Espèces non observées en Belgique," being supplementary to that of his above named. In 1870 Dr Fritsch completed his *Naturgeschichte der Vogel Europas* (8vo, with atlas in folio); and in 1871 Messrs Sharpe and Dresser began the publication of their *Birds of Europe*, which was completed by the latter in 1879 (8 vols. 4to), and is unquestionably the most complete work of its kind, both for fulness of information and beauty of illustration—the coloured plates being nearly all by Mr Kenlemans, or when not by him from the hardly inferior hand of Mr Neale. In so long an undertaking mistakes and omissions are of course to be found if any one likes the invidious task of seeking for them; but many of the errors imputed to this work prove on investigation to refer to matters of opinion and not to matters of fact, while many more are explicable if we remember that while the work was in progress Ornithology was being prosecuted with unprecedented activity, and thus statements which were in accordance with the best information at the beginning of the period were found to need modification before it was ended. As a whole European ornithologists are all but unanimously grateful to Mr Dresser for the way in which he performed the enormous labour he had undertaken.

Coming now to works on British Birds only, the first of the British present century that requires remark is Montagu's *Ornithological Isles*. *Dictionary* (2 vols. 8vo, 1802; supplement 1813), the merits of which have been so long and so fully acknowledged both abroad and at home that no further comment is here wanted. In 1831

¹ *Journal für Ornithologie*, 1869, pp. 107, 241, 281. One may almost say an English translation also, for Major Feilden's contribution to the *Zoologist* for 1872 on the same subject gives the most essential part of Herr Müller's information.

² This is of course no complete list of German ornithologists. Some of the most eminent of them have written scarcely a line on the Birds of their own country, as Calanis (editor since 1863 of the *Journal für Ornithologie*), Finseh, Hartlaub, Prince Max of Wied, A. B. Meyer, Nathusius, Nehrkorn, Reichenbach, Reichenow, and Schadow among others.

³ A useful ornithological bibliography of the Hungarian-Austrian dominions was printed in the *Verhandlungen* of the Zoological and Botanical Society of Vienna for 1878, by Victor Ritter von Tschusi zu Schmidofen. A similar bibliography of Russian Ornithology by Alexander Brande was printed at St Petersburg in 1877 or 1878.

⁴ A useful compendium of Greek and Turkish Ornithology by Drs Krüper and Hartlaub is contained in Mommsen's *Griechische Jahrbücher* for 1875 (Heft II.). For other countries in the Levant there are Canon Tristram's *Fauna and Flora of Palestine* (4to, 1854) and Capt. Shelley's *Handbook to the Birds of Egypt* (8vo, 1872).

⁵ In the final chapter of this work the author gives a list of Portuguese Birds, including besides those observed by him those recorded by Prof. Barboza du Bocage in the *Gaceta Médica de Lisboa*, 1861, pp. 17-21.

Rennie brought out a modified edition of it (reissued in 1833), and Newman another in 1866 (reissued in 1883); but those who wish to know the author's views had better consult the original. Next in order come the very inferior *British Ornithology of Graves* (3 vols. 8vo, 1811-21), and a work with the same title by Hunt (3 vols. 8vo, 1815-22), published at Norwich, but never finished. Then we have Selby's *Illustrations of British Ornithology*, two folio volumes of coloured plates engraved by himself, between 1821 and 1833, with letterpress also in two volumes (8vo, 1825-33), a second edition of the first volume being also issued (1838), for the author, having yielded to the pressure of the "Quinarian" doctrines then in vogue, thought it necessary to adjust his classification accordingly, and it must be admitted that for information the second edition is best. In 1828 Fleming brought out his *History of British Animals* (8vo), in which the Birds are treated at considerable length (pp. 41-146), though not with great success. In 1835 Mr Jenyns (now Blomefield) produced an excellent *Manual of British Vertebrate Animals*, a volume (8vo) executed with great scientific skill, the Birds again receiving due attention (pp. 49-286), and the descriptions of the various species being as accurate as they are terse. In the same year began the *Coloured Illustrations of British Birds and their Eggs* of H. L. Meyer (4to), which was completed in 1843, whereof a second edition (7 vols. 8vo, 1842-50) was brought out, and subsequently (1852-57) a reissue of the latter. In 1836 appeared Eyton's *History of the rarer British Birds*, intended as a sequel to Bewick's well-known volumes, to which no important additions had been made since the issue of 1821. The year 1837 saw the beginning of two remarkable works by Macgillivray and Yarrell respectively, and each entitled *A History of British Birds*. Of the first, undoubtedly the more original and in many respects the more minutely accurate, mention will again have to be made (page 24), and, save to state that its five volumes were not completed till 1852, nothing more needs now to be added. The second has unquestionably become the standard work on British Ornithology, a fact due in part to its numerous illustrations, many of them indeed ill drawn, though all carefully engraved, but much more to the breadth of the author's views and the judgment with which they were set forth. In practical acquaintance with the internal structure of Birds, and in the perception of its importance in classification, he was certainly not behind his rival; but he well knew that the British public in a Book of Birds not only did not want a series of anatomical treatises, but would even resent their introduction. He had the art to conceal his art, and his work was therefore a success, while the other was unhappily a failure. Yet with all his knowledge he was deficient in some of the qualities which a great naturalist ought to possess. His conception of what his work should be seems to have been perfect, his execution was not equal to the conception. However, he was not the first nor will he be the last to fall short in this respect. For him it must be said that, whatever may have been done by the generation of British ornithologists now becoming advanced in life, he educated them to do it; nay, his influence even extends to a younger generation still, though they may hardly be aware of it. Of Yarrell's work in three volumes, a second edition was published in 1845, a third in 1856, and a fourth, begun in 1871, and almost wholly rewritten, is still unfinished. Of the compilations based upon this work, without which they could not have been composed, there is no need to speak. One of the few appearing since, with the same scope, that are not borrowed is Jardine's *Birds of Great Britain and Ireland* (4 vols. 8vo, 1838-43), forming part of his *Naturalist's Library*; and Gould's *Birds of Great Britain* has been already mentioned.

A considerable number of local works deserving of notice have also to be named. The first three volumes of Thompson's *Natural History of Ireland* (8vo, 1849-51) contain an excellent account of the Birds of that island, and Mr Watters's *Birds of Ireland* (8vo, 1853) has also to be mentioned. For North Britain there is Mr Robert Gray's *Birds of the West of Scotland* (8vo, 1871), which virtually is an account of those of almost the whole of that part of the kingdom. To these may be added Dunn's *Ornithologist's Guide to Orkney and Shetland* (8vo, 1837), the unfinished *Historia Naturalis Orcadensis* of Baikie and Hebble (8vo, 1848), and Saxby's *Birds of Shetland* (8vo, 1874), while the sporting works of Charles St John contain much information on the Ornithology of the Highlands.² The local works on English Birds are still more numerous, but among them may be especially named Dillwyn's *Fauna and Flora of Swansea* (1848), Mr Knox's *Ornithological Rambles in Sussex* (1849), Mr Stevenson's *Birds of Norfolk* (1866-70), Mr Cecil Smith's *Birds of Somerset* (1869) and *Birds of*

Guernsey (1879), Mr Cordeaux's *Birds of the Hamber District* (1872), Mr John Hancock's *Birds of Northumberland and Durham* (1874), *The Birds of Nottinghamshire* by Messrs Sterland and Whitaker (1879), Rodd's *Birds of Cornwall* edited by Mr Harting (1880), and the *Vertebrate Fauna of Yorkshire* (1881), of which the "Birds" are by Mr W. E. Clarke.

The good effects of "Faunal" works such as those named in the foregoing rapid survey none can doubt. "Every kingdom, every province, should have its own monographer," wrote Gilbert White more than one hundred years ago, and experience has proved the truth of his assertion. In a former article (*BIRDS*, iii. pp. 736-764) the attempt has been made to shew how the labours of monographers of this kind, but on a more extended scale, can be brought together, and the valuable results that thence follow. Important as they are, they do not of themselves constitute Ornithology as a science; and an enquiry, no less wide and far more recondite, still remains. By whatever term we choose to call it—Classification, Arrangement, Systematizing, or Taxonomy—that enquiry which has for its object the discovery of the natural groups into which Birds fall, and the mutual relations of those groups, has always been one of the deepest interest, and to it we must now recur.

But nearly all the authors above named, it will have been seen, trod the same ancient paths, and in the works of scarcely one of them had any new spark of intelligence been struck out to enlighten the gloom which surrounded the investigator. It is now for us to trace the rise of the present more advanced school of ornithologists whose labours, preliminary as we must still regard them to be, yet give signs of far greater promise. It would probably be unsafe to place its origin further back than a few scattered hints contained in the "Pterographische Fragments" of CHRISTIAN LUDWIG NITZSCH, published in the *Nitzsch. Magazin für den neuesten Zustand der Naturkunde* (edited by Voigt) for May 1806 (xi. pp. 393-417), and even these might be left to pass unnoticed, were it not that we recognize in them the germ of the great work which the same admirable zoologist subsequently accomplished. In these "Fragments," apparently his earliest productions, we find him engaged on the subject with which his name will always be especially identified, the structure and arrangement of the feathers that form the proverbial characteristic of Birds. But, though the observations set forth in this essay were sufficiently novel, there is not much in them that at the time would have attracted attention, for perhaps no one—not even the author himself—could have then foreseen to what important end they would, in conjunction with other investigations, lead future naturalists; but they are marked by the same close and patient determination that eminently distinguishes all the work of their author; and, since it will be necessary for us to return to this part of the subject later, there is here no need to say more of them. In the following year another set of hints—of a kind so different that probably no one then living would have thought it possible that they should ever be brought in correlation with those of Nitzsch—are contained in a memoir on Fishes contributed to the tenth volume of the *Annales du Muséum d'histoire naturelle* of Paris by ÉTIENNE GEOFFROY ST-HILAIRE in 1807.³ Here we have É. G. St-Hilaire. it stated as a general truth (p. 100) that young birds have the sternum formed of five separate pieces—one in the middle, being its keel, and two "annexes" on each side to which the ribs are articulated—all, however, finally uniting to form the single "breast-bone." Further on (pp. 101, 102) we find observations as to the number of ribs which are attached to each of the "annexes"—there being some-

¹ Though contravening our plan, we must for its great merits notice here Mr More's series of papers in *The Ibis* for 1865, "On the Distribution of Birds in Great Britain during the Nesting Season."

² Did our scheme permit us, we should be glad to mention in detail the various important communications on Scottish Birds of Alston, Messrs Buckley, Harvie-Brown, Lumsden, and others.

³ In the *Philosophie Anatomique* (i. pp. 69-101, and especially pp. 135, 136), which appeared in 1818, Geoffroy St-Hilaire explained the views he had adopted at greater length.

times more of them articulated to the anterior than to the posterior, and in certain forms no ribs belonging to one, all being applied to the other. Moreover, the author goes on to remark that in adult birds trace of the origin of the sternum from five centres of ossification is always more or less indicated by sutures, and that, though these sutures had been generally regarded as ridges for the attachment of the sternal muscles, they indeed mark the extreme points of the five primary bony pieces of the sternum.

In 1810 appeared at Heidelberg the first volume of TIEDEMANN'S carefully-wrought *Anatomie und Naturgeschichte der Vögel*—which shows a remarkable advance upon the work which Cuvier did in 1805, and in some respects is superior to his later production of 1817. It is, however, only noticed here on account of the numerous references made to it by succeeding writers, for neither in this nor in the author's second volume (not published until 1814) did he propound any systematic arrangement of the Class. More germane to our present subject are the *Osteographische Beiträge zur Naturgeschichte der Vögel* of Nitzsch, printed at Leipzig in 1811—a miscellaneous set of detached essays on some peculiarities of the skeleton or portions of the skeleton of certain Birds—one of the most remarkable of which is that on the component parts of the foot (pp. 101-105) pointing out the aberration from the ordinary structure exhibited by the Goatsucker (*Caprimulgus*) and the Swift (*Cypselus*)—an aberration which, if rightly understood, would have conveyed a warning to those ornithological systematists who put their trust in Birds' toes for characters on which to erect a classification, that there was in them much more of importance, hidden in the integument, than had hitherto been suspected; but the warning was of little avail, if any, till many years had elapsed. However, Nitzsch had not as yet seen his way to proposing any methodical arrangement of the various groups of Birds, and it was not until some eighteen months later that a scheme of classification in the main anatomical was attempted.

This scheme was the work of BLASIUS MERREM, who, in a communication to the Academy of Sciences of Berlin on the 10th December 1812, which was published in its *Abhandlungen* for the following year (pp. 237-259), set forth a *Tentamen Systematis naturalis Avium*, no less modestly entitled than modestly executed. The attempt of Merrem must be regarded as the virtual starting-point of the latest efforts in Systematic Ornithology, and in that view its proposals deserve to be stated at length. Without pledging ourselves to the acceptance of all its details—some of which, as is only natural, cannot be sustained with our present knowledge, resulting from the information accumulated by various investigators throughout more than seventy years—it is certainly not too much to say that Merrem's merits are almost incomparably superior to those of any of his predecessors as well as to those of the majority of his successors for a long time to come; while the neglect of his treatise by many (perhaps it would not be erroneous to say by most) of those who have since written on the subject seems inexcusable save on the score of inadvertence. Premising then that the chief characters assigned by this ill-appreciated systematist to his several groups are drawn from almost all parts of the structure of Birds, and are supplemented by some others of their more prominent peculiarities, we present the following abstract of his scheme:¹—

I. AVES CARINATÆ.

1. Aves acree.

A. Rapaces.—*a. Accipitres*—*Vultur, Falco, Sagittarius.*

b. Strix.

B. Hymenopodes.—*a. Chelidones: a. C. nocturnæ—Caprimulgus; b. C. diurnæ—Hirundo.*

b. Oscines: a. O. conirostræ—Loxia, Fringilla, Emberiza, Tangara; b. O. tenuirostræ—Alauda, Motacilla, Muscicapa, Todus, Lanius, Ampelis, Turdus, Parus, Sitta, Certhia, Coracias, Oriolus, Gracula, Coracias, Corvus, Pipra, Parus, Sitta, Certhia, quaedam.

C. Mellisugæ.—*Trochilus, Certhia et Upupa plurima.*

D. Dendrocolaptes.—*Picus, Yunc.*

E. Brevilingues.—*a. Upupa; b. Isipida.*

F. Levirostræ.—*a. Ramphastus, Scythrops?; b. Psittacus.*

G. Coccyges.—*Cuculus, Trogon, Bucco, Crotophaga.*

2. Aves terrestres.

A. Columba.

B. Gallinæ.

3. Aves aquaticæ.

A. Odontorhynchi: *a. Boscades—Anas; b. Mergus; c. Phani-copterus.*

B. Platyrrhynchi.—*Pelicanus, Phacton, Plotus.*

C. Aptenodytes.

D. Urinatrices: *a. Cephpi—Alca, Colymbi pedibus palmatis; b. Podiceps, Colymbi pedibus lobatis.*

E. Stenorrhynchi.—*Procellaria, Diomedea, Larus, Sterna, Rhynchops.*

4. Aves palustræ.

A. Rusticolæ: *a. Phalarides—Rallus, Fulica, Parra; b. Limosugæ—Namenius, Scolopax, Tringa, Charadrius, Recurvirostra.*

B. Grallæ: *a. Erolia—Ardea ungue intermedio serrato, Ciconerina; b. Pelargi—Ciconia, Mygaleia, Pentalia quidam, Scopus, Patalea; c. Gerani—Ardea cristata, Grues, Psophia.*

C. Otis.

II. AVES RATIÆ.—*Struthio.*

The most novel feature, and one the importance of which most ornithologists of the present day are fully prepared to admit, is of course the separation of the Class *Aves* into two great Divisions, which from one of the most obvious distinctions they present were called by its author *Carinata*² and *Ratita*,³ according as the sternum possesses a keel (*crista* in the phraseology of many anatomists) or not. But Merrem, who subsequently communicated to the Academy of Berlin a more detailed memoir on the "flat-breasted" Birds,⁴ was careful not here to rest his Divisions on the presence or absence of their sternal character alone. He concisely cites (p. 238) no fewer than eight other characters of more or less value as peculiar to the Carinate Division, the first of which is that the feathers have their barbs furnished with hooks, in consequence of which the barbs, including those of the wing-quills, cling closely together; while among the rest may be mentioned the position of the furcula and coracoids,⁵ which keep the wing-bones apart; the limitation of the number of the lumbar vertebra to fifteen, and of the carpals to two; as well as the divergent direction of the iliac bones,—the corresponding characters peculiar to the Ratite Division being (p. 259) the disconnected condition of the barbs of the feathers, through the absence of any hooks whereby they might cohere; the non-existence of the furcula, and the coalescence of the coracoids with the scapulae (or, as he expressed it, the extension of the scapulae to supply the place of the coracoids, which he thought were wanting); the lumbar vertebrae being twenty and the carpals three in number; and the parallelism of the iliac bones.

² From *carina*, a keel.

³ From *rates*, a raft or flat-bottomed barge.

⁴ "Beschreibung der Gerippes eines Casuars nebst einigen beiläufigen Bemerkungen über die flachbrüstigen Vögel" — *Abhandl. der Berlin. Akademie, Phys. Klasse*, 1817, pp. 179-198, tabb. 1-iii.

⁵ Merrem, as did many others in his time, calls the coracoids "clavicula"; but it is now well understood that in Birds the real clavicular form the furcula or "merry-thought."

Tiedemann.

Nitzsch.

Merrem.

¹ The names of the genera are, he tells us, for the most part those of Linnaeus, as being the best-known, though not the best. To some of the Linnaean genera he dare not, however, assign a place, for instance, *Buceros*, *Hemiatopus*, *Merops*, *Glareola* (Gmelin's genus, by the bye), and *Palamedea*.

As for Merrem's partitioning of the inferior groups there is less to be said in its praise as a whole, though credit must be given to his anatomical knowledge for leading him to the perception of several affinities, as well as differences, that had never before been suggested by superficial systematists. But it must be confessed that (chiefly, no doubt, from paucity of accessible material) he overlooked many points, both of alliance and the opposite, which since his time have gradually come to be admitted. For instance, he seems not to have been aware of the distinction, already shown by Nitzsch (as above mentioned) to exist, between the Swallows and the Swifts; and, by putting the genus *Coracias* among his *Oscines Tenuirostres*¹ without any remark, proved that he was not in all respects greatly in advance of his age; but on the other hand he most righteously judged that some species hitherto referred to the genera *Certhia* and *Upupa* required removal to other positions, and it is much to be regretted that the very concise terms in which his decisions were given to the world make it impossible to determine with any degree of certainty the extent of the changes in this respect which he would have introduced. Had Merrem published his scheme on an enlarged scale, it seems likely that he would have obtained for it far more attention, and possibly some portion of acceptance. He had deservedly attained no little reputation as a descriptive anatomist, and his claims to be regarded as a systematic reformer would probably have been admitted in his lifetime. As it was his scheme apparently fell flat, and not until many years had elapsed were its merits at all generally recognized.

Notice has next to be taken of a Memoir on the Employment of Sternal Characters in establishing Natural Families among Birds, which was read by DE BLAINVILLE before the Academy of Sciences of Paris in 1815,² but not published in full for more than five years later (*Journal de Physique . . . et des Arts*, xii. pp. 185-216), though an abstract forming part of a *Prodrome d'une nouvelle distribution du Règne Animal* appeared earlier (*op. cit.*, lxxxiii. pp. 252, 253, 258, 259; and *Bull. Soc. Philomath. de Paris*, 1816, p. 110). This is a very disappointing performance, since the author observes that, notwithstanding his new classification of Birds is based on a study of the form of the sternal apparatus, yet, because that lies wholly within the body, he is compelled to have recourse to such outward characters as are afforded by the proportion of the limbs and the disposition of the toes—even as had been the practice of most ornithologists before him! It is evident that the features of the sternum on which De Blainville chiefly relied were those drawn from its posterior margin, which no very extensive experience of specimens is needed to show are of comparatively slight value; for the number of "échancrures"—notches as they have sometimes been called in English—when they exist, goes but a very short way as a guide, and is so variable in some very natural groups as to be even in that short way occasionally misleading.³ There is no appearance of his having at all taken into consideration the far more trustworthy characters furnished by the anterior part of the sternum, as well as by the coracoids and the furcula. Still De Blainville made some advance in a right direction, as for instance by elevating the Parrots⁴ and the Pigeons as "Ordres," equal in rank to that of the Birds-of-Prey and some others.

¹ He also placed the genus *Tolus* in the same group, but it must be borne in mind that in his time a great many Birds were referred to that genus which (according to modern ideas) certainly do not belong to it, and it may well have been that he never had the opportunity of examining a specimen of the genus as nowadays restricted.

² Not 1812, as has sometimes been stated.

³ Cf. *Philos. Transactions*, 1869, p. 337, note.

⁴ This view of them had been long before taken by Willughby, but abandoned by all later authors.

According to the testimony of L'Herminier (for whom see later) he divided the "*Passereaux*" into two sections, the "*faux*" and the "*vrais*"; but, while the latter were very correctly defined, the former were most arbitrarily separated from the "*Grimpeurs*." He also split his *Grallatores* and *Natatores* (practically identical with the *Grallæ* and *Anseres* of Linnæus) each into four sections; but he failed to see—as on his own principles he ought to have seen—that each of these sections was at least equivalent to almost any one of his other "*Ordres*." He had, however, the courage to act up to his own professions in collocating the Rollers (*Coracias*) with the Bee-eaters (*Merops*), and had the sagacity to surmise that *Menura* was not a Gallinaceous Bird. The greatest benefit conferred by this memoir is probably that it stimulated the efforts, presently to be mentioned, of one of his pupils, and that it brought more distinctly into sight that other factor, originally discovered by Merrem, of which it now clearly became the duty of systematizers to take cognizance.

Following the chronological order we are here adopting, we next have to recur to the labours of NITZSCH, who, in 1820, in a treatise on the Nasal Glands of Birds—a subject that had already attracted the attention of JACOBSON (*Novv. Bull. Soc. Philomath. de Paris*, iii. pp. Jacob-267-269)—first put forth in Meckel's *Deutsches Archiv*^{son.} für die Physiologie (vi. pp. 251-269) a statement of his general views on ornithological classification which were based on a comparative examination of those bodies in various forms. It seems unnecessary here to occupy space by giving an abstract of his plan,⁵ which hardly includes any but European species, because it was subsequently elaborated with no inconsiderable modifications in a way that must presently be mentioned at greater length. But the scheme, crude as it was, possesses some interest. It is not only a key to much of his later work—to nearly all indeed that was published in his lifetime—but in it are founded several definite groups (for example, *Passerina* and *Picaria*) that subsequent experience has shewn to be more or less natural; and it further serves as additional evidence of the breadth of his views, and his trust in the teachings of anatomy; for it is clear that, if organs so apparently insignificant as these nasal glands were found worthy of being taken into account, and capable of forming a base of operations, in drawing up a system, it would almost follow that there can be no part of a Bird's organization that by proper study would not help to supply some means of solving the great question of its affinities. This seems to the present writer to be one of the most certain general truths in Zoology, and is probably admitted in theory to be so by most zoologists, but their practice is opposed to it; for, whatever group of animals be studied, it is found that one set or another of characters is the chief favourite of the authors consulted—each generally taking a separate set, and that to the exclusion of all others, instead of effecting a combination of all the sets and taking the aggregate.⁶

That Nitzsch took this extended view is abundantly proved by the valuable series of ornithological observations which he must have been for some time accumulating,

⁵ This plan, having been repeated by Schöpp in 1829 (*op. cit.*, xii. p. 73), became known to Sir R. Owen in 1835, who then drew to it the attention of Kirby (*Seventh Bridgewater Treatise*, ii. pp. 444, 445), and in the next year referred to it in his own article "Aves" in Todd's *Cyclopædia of Anatomy* (i. p. 266), so that Englishmen need no excuse for not being aware of one of Nitzsch's labours, though his more advanced work of 1829, presently to be mentioned, was not referred to by Sir R. Owen.

⁶ A very remarkable instance of this may be seen in the *Systema Avium*, promulgated in 1830 by Wagler (a man with great knowledge of Birds) in his *Natürliches System der Amphibien* (pp. 77-125). He took the tongue as his chief guide, and found it indeed an unruly member.

and almost immediately afterwards began to contribute to the younger Naumann's excellent *Naturgeschichte der Vögel Deutschlands*, already noticed above (page 9). Besides a concise general treatise on the Organization of Birds to be found in the Introduction to this work (i. pp. 23-52), a brief description from Nitzsch's pen of the peculiarities of the internal structure of nearly every genus is incorporated with the author's prefatory remarks, as each passed under consideration, and these descriptions being almost without exception so drawn up as to be comparative are accordingly of great utility to the student of classification, though they have been so greatly neglected. Upon these descriptions he was still engaged till death, in 1837, put an end to his labours, when his place as Naumann's assistant for the remainder of the work was taken by Rudolph Wagner; but, from time to time, a few more, which he had already completed, made their posthumous appearance in it, and, even in recent years, some selections from his unpublished papers have through the care of Giebel been presented to the public. Throughout the whole of this series the same marvellous industry and scrupulous accuracy are manifested, and attentive study of it will show how many times Nitzsch anticipated the conclusions at which it has taken some modern taxonomers fifty years to arrive. Yet over and over again his determination of the affinities of several groups even of European Birds was disregarded; and his labours, being contained in a bulky and costly work, were hardly known at all outside of his own country, and within it by no means appreciated so much as they deserved—for even Naumann himself, who gave them publication, and was doubtless in some degree influenced by them, utterly failed to perceive the importance of the characters offered by the song-muscles of certain groups, though their peculiarities were all duly described and recorded by his coadjutor, as some indeed had been long before by Cuvier in his famous dissertation² on the organs of voice in Birds (*Leçons d'anatomie comparée*, iv. pp. 450-491). Nitzsch's name was subsequently dismissed by Cuvier without a word of praise, and in terms which would have been applicable to many another and inferior author, while Temminck, terming Naumann's work an "*ouvrage de luxe*,"—it being in truth one of the cheapest for its contents ever published,—effectually shut it out from the realms of science. In Britain it seems to have been positively unknown until quoted some years after its completion by a catalogue-compiler on account of some peculiarities of nomenclature which it presented.³

L'Herm.
minier.

Now we must return to France, where, in 1827, L'HERMINIER, a creole of Guadaloupe and a pupil of De Blainville's, contributed to the *Actes* of the Linnean Society of Paris for that year (vi. pp. 3-93) the "*Recherches sur l'appareil sternal des Oiseaux*," which the precept and example of his master had prompted him to undertake, and Cuvier had found for him the means of executing. A second and considerably enlarged edition of this very remarkable treatise was published as a separate work in the following year. We have already seen that De Blainville, though fully persuaded of the great value of sternal features as a method of classification, had been compelled to fall back upon the old pedal characters so often employed before; but now the scholar had learnt to excel his teacher, and not only to form an at least provi-

sional arrangement of the various members of the Class, based on sternal characters, but to describe these characters at some length, and so give a reason for the faith that was in him. There is no evidence, so far as we can see, of his having been aware of Merrem's views; but like that anatomist he without hesitation divided the Class into two great "*coupes*," to which he gave, however, no other names than "*Oiseaux Normaux*" and "*Oiseaux Anormaux*,"—exactly corresponding with his predecessor's *Curvata* and *Ratita*—and, moreover, he had a great advantage in founding these groups, since he had discovered, apparently from his own investigations, that the mode of ossification in each was distinct; for hitherto the statement of there being five centres of ossification in every Bird's sternum seems to have been accepted as a general truth, without contradiction, whereas in the Ostrich and the Rhea, at any rate, L'Herminier found that there were but two such primitive points,⁴ and from analogy he judged that the same would be the case with the Cassowary and the Emu, which, with the two forms mentioned above, made up the whole of the "*Oiseaux Anormaux*" whose existence was then generally acknowledged.⁵ These are the forms which composed the Family previously termed *Cursorae* by De Blainville; but L'Herminier was able to distinguish no fewer than thirty-four Families of "*Oiseaux Normaux*," and the judgment with which their separation and definition were effected must be deemed on the whole to be most creditable to him. It is to be remarked, however, that the wealth of the Paris Museum, which he enjoyed to the full, placed him in a situation incomparably more favourable for arriving at results than that which was occupied by Merrem, to whom many of the most remarkable forms were wholly unknown, while L'Herminier had at his disposal examples of nearly every type then known to exist. But the latter used this privilege wisely and well—not, after the manner of De Blainville and others subsequent to him, relying solely or even chiefly on the character afforded by the posterior portion of the sternum, but taking also into consideration those of the anterior, as well as of the in some cases still more important characters presented by the pre-sternal bones, such as the furcula, coracoids, and scapula. L'Herminier thus separated the Families of "Normal Birds":—

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|--|--|
| 1. "Accipitres" — <i>Accipitres</i> , Linn. | 18. "Passereaux" — <i>Passercs</i> , Linn. |
| 2. "Serpentaires" — <i>Gypocircanus</i> , Illiger. | 19. "Pigeons" — <i>Columba</i> , Linn. |
| 3. "Chouettes" — <i>Strix</i> , Linn. | 20. "Gallinae" — <i>Gallinacea</i> . |
| 4. "Touacous" — <i>Oryzopsis</i> , Vieillot. | 21. "Tinamous" — <i>Tinamus</i> , Latham. |
| 5. "Petroquets" — <i>Psittacus</i> , Linn. | 22. "Foules ou Poules d'eau" — <i>Fulica</i> , Linn. |
| 6. "Colibris" — <i>Trochilus</i> , Linn. | 23. "Grues" — <i>Grus</i> , Pallas. |
| 7. "Martinets" — <i>Cypselus</i> , Illiger. | 24. "Hérodions" — <i>Herodias</i> , Illiger. |
| 8. "Engoulevents" — <i>Caprimulgus</i> , Linn. | 25. No name given, but said to include "les ibis et les spatules." |
| 9. "Coucous" — <i>Cuculus</i> , Linn. | 26. "Gralles ou Échassiers" — <i>Gralla</i> . |
| 10. "Couroucous" — <i>Trogon</i> , Linn. | 27. "Mouettes" — <i>Larus</i> , Linn. |
| 11. "Rolliers" — <i>Galgulus</i> , Brisson. | 28. "Pétrels" — <i>Procellaria</i> , Linn. |
| 12. "Guépiers" — <i>Mergus</i> , Linn. | 29. "Pélicans" — <i>Pelecanus</i> , Linn. |
| 13. "Martins-Pêcheurs" — <i>Alcedo</i> , Linn. | 30. "Canards" — <i>Anas</i> , Linn. |
| 14. "Calaos" — <i>Buceros</i> , Linn. | 31. "Grèbes" — <i>Podiceps</i> , Latham. |
| 15. "Toucaons" — <i>Ramphastos</i> , Linn. | 32. "Plongeurs" — <i>Columbus</i> , Latham. |
| 16. "Pies" — <i>Picus</i> , Linn. | 33. "Pingouins" — <i>Alca</i> , Latham. |
| 17. "Épopsides" — <i>Epopides</i> , Vieillot. | 34. "Manchots" — <i>Aptenodytes</i> , Forster. |

¹ Their value was, however, understood by Gloger, who, in 1834, as will presently be seen, expressed his regret at not being able to use them.

² Cuvier's first observations on the subject seem to have appeared in the *Magasin Encyclopédique* for 1795 (ii. pp. 330, 358).

³ However, to this catalogue-compiler the present writer's gratitude is due, for thereby he became acquainted with the work and its merits.

⁴ This fact in the Ostrich appears to have been known already to Geoffrey St-Hilaire from his own observation in Egypt, but does not seem to have been published by him.

⁵ Considerable doubts were at that time, as said elsewhere (KIWI, vol. xiv. p. 104), entertained in Paris as to the existence of the *Apteryx*.

The preceding list is given to shew the very marked agreement of L'Hermier's results compared with those obtained fifty years later by another investigator, who approached the subject from an entirely different, though still osteological, basis. The sequence of the Families adopted is of course open to much criticism; but that would be wasted upon it at the present day; and the cautious naturalist will remember that it is generally difficult and in most cases absolutely impossible to deploy even a small section of the Animal Kingdom into line. So far as a linear arrangement will permit, the above list is very creditable, and will not only pass muster, but cannot easily be surpassed for excellence even at this moment. Experience has shewn that a few of the Families are composite, and therefore require further splitting; but examples of actually false grouping cannot be said to occur. The most serious fault perhaps to be found is the intercalation of the Ducks (No. 30) between the Pelicans and the Grebes—but every systematist must recognize the difficulty there is in finding a place for the Ducks in any arrangement we can at present contrive that shall be regarded as satisfactory. Many of the excellencies of L'Hermier's method could not be pointed out without too great a sacrifice of space, because of the details into which it would be necessary to enter; but the trenchant way in which he showed that the "Passereaux"—a group of which Cuvier had said "Son caractère semble d'abord purement négatif," and had then failed to define the limits—differed so completely from every other assemblage, while maintaining among its own innumerable members an almost perfect essential homogeneity, is very striking, and shews how admirably he could grasp his subject. Not less conspicuous are his merits in disposing of the groups of what are ordinarily known as Water-birds, his indicating the affinity of the Rails (No. 22) to the Cranes (No. 23), and the severing of the latter from the Herons (No. 24). His union of the Snipes, Sandpipers, and Plovers into one group (No. 26) and the alliance, especially dwelt upon, of that group with the Gulls (No. 27) are steps which, though indicated by Merrem, are here for the first time clearly laid down; and the separation of the Gulls from the Petrels (No. 28)—a step in advance already taken, it is true, by Illiger—is here placed on indefeasible ground. With all this, perhaps on account of all this, L'Hermier's efforts did not find favour with his scientific superiors, and for the time things remained as though his investigations had never been carried on.¹

Nitzsch.

Two years later Nitzsch, who was indefatigable in his endeavour to discover the Natural Families of Birds, and had been pursuing a series of researches into their vascular system, published the result, at Halle in Saxony, in his *Observations de Avium arteria carotide communi*, in which is included a classification drawn up in accordance with the variation of structure which that important vessel presented in the several groups that he had opportunities of examining. By this time he had visited several of the principal museums on the Continent, among others Leyden (where Temminck resided) and Paris (where he had frequent intercourse with Cuvier), thus becoming acquainted with a considerable number of exotic forms that had hitherto been inaccessible to him. Consequently his labours had attained to a certain degree of completeness in this direction, and it may therefore be expedient here to name the different groups which he thus thought himself entitled to consider established. They are as follows:—

¹ With the exception of a brief and wholly inadequate notice in the *Edinburgh Journal of Natural History* (i. p. 90), the present writer is not aware of attention having been directed to L'Hermier's labours by British ornithologists for several years after; but considering how they were employing themselves at the time (as is shewn in another place) this is not surprising.

I. AVES CARINATÆ [L'H. "Oiseaux Normaux"].

A. AVES CARINATÆ aereæ.

1. *Accipitrinæ* [L'H. 1, 2 partim, 3]; 2. *Passerinae* [L'H. 18]; 3. *Macrochiræ* [L'H. 6, 7]; 4. *Otulinæ* [L'H. 8, 9, 10 (qu. 11, 12)]; 5. *Picinæ* [L'H. 15, 16]; 6. *Psittacinae* [L'H. 5]; 7. *Lipoglossæ* [L'H. 13, 14, 17]; 8. *Amphibolæ* [L'H. 4].

B. AVES CARINATÆ terrestres.

1. *Columbinæ* [L'H. 19]; 2. *Gallinacæ* [L'H. 20].

C. AVES CARINATÆ aquaticæ.

Grallæ.

1. *Alectorides* (= *Dicholophus* + *Otis*) [L'H. 2 partim, 26 partim]; 2. *Gruinæ* [L'H. 23]; 3. *Fulicariæ* [L'H. 22]; 4. *Herodiæ* [L'H. 24 partim]; 5. *Pelargi* [L'H. 24 partim, 25]; 6. *Odontoglossi* (= *Phenicopterus*) [L'H. 26 partim]; 7. *Limicolæ* [L'H. 26 pæne omnes].

Palmatæ.

8. *Longipennes* [L'H. 27]; 9. *Nasutæ* [L'H. 28]; 10. *Unquirostres* [L'H. 30]; 11. *Steganopodes* [L'H. 29]; 12. *Pygopodes* [L'H. 31, 32, 33, 34].

II. AVES RATTIÆ [L'H. "Oiseaux Anomaux"].

To enable the reader to compare the several groups of Nitzsch with the Families of L'Hermier, the numbers applied by the latter to his Families are suffixed in square brackets to the names of the former; and, disregarding the order of sequence, which is here immaterial, the essential correspondence of the two systems is worthy of all attention, for it obviously means that these two investigators, starting from different points, must have been on the right track, when they so often coincided as to the limits of what they considered to be, and what we are now almost justified in calling, Natural Groups.² But it must be observed that the classification of Nitzsch, just given, rests much more on characters furnished by the general structure than on those furnished by the carotid artery only. Among all the species (188, he tells us, in number) of which he examined specimens, he found only four variations in the structure of that vessel, namely:—

1. That in which both a right carotid artery and a left are present. This is the most usual fashion among the various groups of Birds, including all the "aerial" forms excepting *Passerinae*, *Macrochiræ*, and *Picinæ*.

2. That in which there is but a single carotid artery, springing from both right and left trunk, but the branches soon coalescing, to take a midway course, and again dividing near the head. This form Nitzsch was only able to find in the Bittern (*Ardeia stellaris*).

3. That in which the right carotid artery alone is present, of which, according to our author's experience, the Flamingo (*Phenicopterus*) was the sole example.

4. That in which the left carotid artery alone exists, as found in all other Birds examined by Nitzsch, and therefore as regards species and individuals much the most common—since into this category come the countless thousands of the Passerine Birds—a group which outnumbers all the rest put together.

Considering the enormous stride in advance made by L'Hermier, it is very disappointing for the historian to have to record that the next inquirer into the osteology of Birds achieved a disastrous failure in his attempt to throw light on their arrangement by means of a comparison of their sternum. This was BERTHOLD, who devoted Berthold. a long chapter of his *Zeitraug zur Anatomie*, published at Göttingen in 1831, to a consideration of the subject. So far as his introductory chapter went—the development of the sternum—he was, for

² Whether Nitzsch was cognizant of L'Hermier's views is in no way apparent. The latter's name seems not to be even mentioned by him, but Nitzsch was in Paris in the summer of 1827, and it is almost impossible that he should not have heard of L'Hermier's labours, unless the relations between the followers of Cuvier, to whom Nitzsch attached himself, and those of De Blainville, whose pupil L'Hermier was, were such as to forbid any communication between the rival schools. Yet we have L'Hermier's evidence that Cuvier gave him every assistance. Nitzsch's silence, both on this occasion and afterwards, is very curious; but he cannot be accused of plagiarism, for the scheme given above is only an amplification of that foreshadowed by him (as already mentioned) in 1820—a scheme which seems to have been equally unknown to L'Hermier, perhaps through linguistic difficulty.

his time, right enough and somewhat instructive. It was only when, after a close examination of the sternal apparatus of one hundred and thirty species, which he carefully described, that he arrived (pp. 177-183) at the conclusion—astonishing to us who know of L'Herminier's previous results—that the sternum of Birds cannot be used as a help to their classification on account of the egregious anomalies that would follow the proceeding—such anomalies, for instance, as the separation of *Cypselus* from *Hirundo* and its alliance with *Trochilus*, and the grouping of *Hirundo* and *Fringilla* together. He seems to have been persuaded that the method of Linnæus and his disciples was indisputably right, and that any method which contradicted it must therefore be wrong. Moreover, he appears to have regarded the sternal structure as a mere function of the Bird's habit, especially in regard to its power of flight, and to have wholly overlooked the converse position that this power of flight must depend entirely on the structure. Good descriptive anatomist as he certainly was, he was false to the anatomist's creed; but it is plain, from reading his careful descriptions of sternums, that he could not grasp the essential characters he had before him, and, attracted only by the more salient and obvious features, had not capacity to interpret the meaning of the whole. Yet he did not amiss by giving many figures of sternums hitherto unrepresented. We pass from him to a more lively theme.

Cuvier
and
Geoffroy.

At the very beginning of the year 1832 Cuvier laid before the Academy of Sciences of Paris a memoir on the progress of ossification in the sternum of Birds, of which memoir an abstract will be found in the *Annales des Sciences Naturelles* (xxv. pp. 260-272). Herein he treated of several subjects with which we are not particularly concerned at present, and his remarks throughout were chiefly directed against certain theories which Étienne Geoffroy St-Hilaire had propounded in his *Philosophie Anatomique*, published a good many years before, and need not trouble us here; but what does signify to us now is that Cuvier traced in detail, illustrating his statements by the preparations he exhibited, the progress of ossification in the sternum of the Fowl and of the Duck, pointing out how it differed in each, and giving his interpretation of the differences. It had hitherto been generally believed that the mode of ossification in the Fowl was that which obtained in all Birds—the Ostrich and its allies (as L'Herminier, we have seen, had already shewn) excepted. But it was now made to appear that the Struthious Birds in this respect resembled, not only the Duck, but a great many other groups—Waders, Birds-of-Prey, Pigeons, Passerines, and perhaps all Birds not Gallinaceous,—so that, according to Cuvier's view, the five points of ossification observed in the *Gallina*, instead of exhibiting the normal process, exhibited one quite exceptional, and that in all other Birds, so far as he had been enabled to investigate the matter, ossification of the sternum began at two points only, situated near the anterior upper margin of the side of the sternum, and gradually crept towards the keel, into which it presently extended; and, though he allowed the appearance of detached portions of calcareous matter at the base of the still cartilaginous keel in Ducks at a certain age, he seemed to consider this an individual peculiarity. This fact was fastened upon by Geoffroy in his reply, which was a week later presented to the Academy, but was not published in full until the following year, when it appeared in the *Annales du Muséum* (ser. 3, ii. pp. 1-22). Geoffroy here maintained that the five centres of ossification existed in the Duck just as in the Fowl, and that the real difference of the process lay in the period at which they made their appearance, a circumstance, which, though virtually proved by the preparations Cuvier had used, had been by him overlooked or misinterpreted. The Fowl possesses all five ossifications at birth, and for a long while the middle piece forming the keel is by far the largest. They all grow slowly, and it is not until the animal is about six months old that they are united into one firm bone. The Duck on the other hand, when newly hatched, and for nearly a month after, has the sternum wholly cartilaginous.

Then, it is true, two lateral points of ossification appear at the margin, but subsequently the remaining three are developed, and when once formed they grow with much greater rapidity than in the Fowl, so that by the time the young Duck is quite independent of its parents, and can shift for itself, the whole sternum is completely bony. Nor, argued Geoffroy, was it true to say, as Cuvier had said, that the like occurred in the Pigeons and true Passerines. In their case the sternum begins to ossify from three very distinct points—one of which is the centre of ossification of the keel. As regards the Struthious Birds, they could not be likened to the Duck, for in them at no age was there any indication of a single median centre of ossification, as Geoffroy had satisfied himself by his own observations made in Egypt many years before. Cuvier seems to have acquiesced in the corrections of his views made by Geoffroy, and attempted no rejoinder; but the attentive and impartial student of the discussion will see that a good deal was really wanting to make the latter's reply effective, though, as events have shewn, the former was hasty in the conclusions at which he arrived, having trusted too much to the first appearance of centres of ossification, for, had his observations in regard to other Birds been carried on with the same attention to detail as in regard to the Fowl, he would certainly have reached some very different results.

In 1834 GLOGER brought out at Breslau the first (and unfortunately the only) part of a *Vollständiges Handbuch der Naturgeschichte der Vogel Europa's*, treating of the Land-birds. In the Introduction to this book (p. xxxviii., note) he expressed his regret at not being able to use as fully as he could wish the excellent researches of Nitzsch which were then appearing (as has been above said) in the successive parts of Naumann's great work. Notwithstanding this, to Gloger seems to belong the credit of being the first author to avail himself in a book intended for practical ornithologists of the new light that had already been shed on Systematic Ornithology; and accordingly we have the second Order of his arrangement, the *Aves Passerinae*, divided into two Suborders:—Singing Passerines (*melodiosa*), and Passerines without an apparatus of Song-muscles (*anomala*)—the latter including what some later writers called *Picavie*. For the rest his classification demands no particular remark; but that in a work of this kind he had the courage to recognize, for instance, such a fact as the essential difference between Swallows and Swifts lifts him considerably above the crowd of other ornithological writers of his time.

An improvement on the old method of classification by purely external characters was introduced to the Academy of Sciences of Stockholm by SUNDEVALL in 1835, and was published the following year in its *Handlinger* (pp. 43-130). This was the foundation of a more extensive work of which, from the influence it still exerts, it will be necessary to treat later at some length, and there will be no need now to enter much into details respecting the earlier performance. It is sufficient here to remark that the author, even then a man of great erudition, must have been aware of the turn which taxonomy was taking; but, not being able to divest himself of the older notion that external characters were superior to those furnished by the study of internal structure, and that Comparative Anatomy, instead of being a part of Zoology, was something distinct from it, he seems to have endeavoured to form a scheme which, while not running wholly counter to the teachings of Comparative Anatomists, should yet rest ostensibly on external characters. With this view he studied the latter most laboriously, and in some measure certainly not without success, for he brought into prominence several points that had hitherto escaped the notice of his predecessors. He also admitted among his characteristics a physiological consideration (apparently derived from Oken¹) dividing the class *Aves* into two sections *Altrices* and *Precesores*, according as the young were fed by their parents or, from the first, fed themselves. But at this time he was encumbered with the hazy doctrine of analogies, which, if it did not act to his detriment, was assuredly of no service to him. He prefixed an "Idea Systematis" to his "Expositio"; and the former, which appears to represent his real opinion, differs in arrangement very considerably from the latter. Like Gloger, Sundevall in his ideal system separated the true Passerines from all other Birds, calling them *Voluteres*; but he took a step further, for he assigned to them the highest rank, wherein

¹ He says from Oken's *Naturgeschichte für Schulen*, published in 1821, but the division is to be found in that author's earlier *Lehrbuch der Zoologie* (ii. p. 371), which appeared in 1816.

nearly every recent authority agrees with him; out of them, however, he chose the Thrushes and Warblers to stand first as his ideal "Centrum"—a selection which, though in the opinion of the present writer erroneous, is still largely followed.

L'Herminier and Isidore Geoffroy St-Hilaire.

The points at issue between Cuvier and Étienne Geoffroy St-Hilaire before mentioned naturally attracted the attention of L'HERMINIER, who in 1836 presented to the French Academy the results of his researches into the mode of growth of that bone which in the adult Bird he had already studied to such good purpose. Unfortunately the full account of his diligent investigations was never published. We can best judge of his labours from an abstract printed in the *Comptes Rendus* (iii. pp. 12-20) and reprinted in the *Annales des Sciences Naturelles* (ser. 2, vi. pp. 107-115), and from the report upon them by ISIDORE GEOFFROY ST-HILAIRE, to whom with others they were referred. This report is contained in the *Comptes Rendus* for the following year (iv. pp. 565-574), and is very critical in its character. It were useless to conjecture why the whole memoir never appeared, as the reporter recommended that it should; but, whether, as he suggested, the author's observations failed to establish the theories he advanced or not, the loss of his observations in an extended form is greatly to be regretted, for no one seems to have continued the investigations he began and to some extent carried out; while, from his residence in Guadeloupe, he had peculiar advantages in studying certain types of Birds not generally available, his remarks on them could not fail to be valuable, quite irrespective of the interpretation he was led to put upon them. L'Herminier arrived at the conclusion that, so far from there being only two or three different modes by which the process of ossification in the sternum is carried out, the number of different modes is very considerable—almost each natural group of Birds having its own. The principal theory which he hence conceived himself justified in propounding was that instead of *five* being (as had been stated) the maximum number of centres of ossification in the sternum, there are no fewer than *nine* entering into the composition of the perfect sternum of Birds in general, though in every species some of these nine are wanting, whatever be the condition of development at the time of examination. These nine theoretical centres or "pieces" L'Herminier deemed to be disposed in *three* transverse series (*rangées*), namely the anterior or "prosteral," the middle or "mesosternal," and the posterior or "metasternal"—each series consisting of *three* portions, one median piece and two side-pieces. At the same time he seems, according to the abstract of his memoir, to have made the somewhat contradictory assertion that sometimes there are more than three pieces in each series, and in certain groups of Birds as many as six.¹ It would occupy more space than can here be allowed to give even the briefest abstract of the numerous observations which follow the statement of his theory and on which it professedly rests. They extend to more than a score of natural groups of Birds, and nearly each of them presents some peculiar characters. Thus of the first series of pieces he says that when all exist they may be developed simultaneously, or that the two side-pieces may precede the median, or again that the median may precede the side-pieces—according to the group of Birds, but that the second mode is much the commonest. The same variations are observable in the second or middle series, but its side-pieces are said to exist in all groups of Birds without exception. As to the third or posterior series, when it is complete the three constituent pieces are developed almost simultaneously;

but its median piece is said often to originate in two, which soon unite, especially when the side-pieces are wanting. By way of examples of L'Herminier's observations, what he says of the two groups that had been the subject of Cuvier's and the elder Geoffroy's contest may be mentioned. In the *Gallinae* the five well-known pieces or centres of ossification are said to consist of the two side-pieces of the second or middle series, and the three of the posterior. On two occasions, however, there was found in addition, what may be taken for a representation of the first series, a little "*noyau*" situated between the coracoids—forming the only instance of all three series being present in the same Bird. As regards the Ducks, L'Herminier agreed with Cuvier that there are commonly only two centres of ossification—the side-pieces of the middle series; but as these grow to meet one another a distinct median "*noyau*," also of the same series, sometimes appears, which soon forms a connexion with each of them. In the Ostrich and its allies no trace of this median centre of ossification ever occurs; but with these exceptions its existence is invariable in all other Birds. Here the matter must be left; but it is undoubtedly a subject which demands further investigation, and naturally any future investigator of it should consult the abstract of L'Herminier's memoir and the criticisms upon it of the younger Geoffroy.

Hitherto it will have been seen that our present business has lain wholly in Germany and France, for, as is elsewhere explained, the chief ornithologists of Britain were occupying themselves at this time in a very useless way—not but that there were several distinguished men in this country who were paying due heed at this time to the internal structure of Birds, and some excellent descriptive memoirs on special forms had appeared from their pens, to say nothing of more than one general treatise on ornithic anatomy.² Yet no one in Britain seems to have attempted to found any scientific arrangement of Birds on other than external characters until, in 1837, WILLIAM MacMACGILLIVRAY issued the first volume of his *History of gillivray. British Birds*, wherein, though professing (p. 19) "not to add a new system to the many already in partial use, or that have passed away like their authors," he propounded (pp. 16-18) a scheme for classifying the Birds of Europe at least founded on a "consideration of the digestive organs, which merit special attention, on account, not so much of their great importance in the economy of birds, as the nervous, vascular, and other systems are not behind them in this respect; but because, exhibiting great diversity of form and structure, in accordance with the nature of the food, they are more obviously qualified to afford a basis for the classification of the numerous species of birds" (p. 52). Experience has again and again exposed the fallacy of this last conclusion, but it is no disparagement of its author, writing nearly fifty years ago, to say that in this passage, as well as in others that might be quoted, he was greater as an anatomist than as a logician.

² Sir Richard Owen's celebrated article "Aves," in Todd's *Cyclopaedia of Anatomy and Physiology* (i. pp. 265-368), appeared in 1836, and, as giving a general view of the structure of Birds, needs no praise here; but its object was not to establish a classification, or throw light especially on systematic arrangement. So far from that being the case, its distinguished author was content to adopt, as he tells us, the arrangement proposed by Kirby in the *Seventh Bridgewater Treatise* (ii. pp. 445-474), being that, it is true, of an estimable zoologist, but of one who had no special knowledge of Ornithology. Indeed it is, as the latter says, that of Linnaeus, improved by Cuvier, with an additional modification of Illiger's—all these three authors having totally ignored any but external characters. Yet it was regarded "as being the one which facilitates the expression of the leading anatomical differences which obtain in the class of Birds, and which therefore may be considered as the most natural."

¹ We shall perhaps be justified in assuming that this apparent inconsistency, and others which present themselves, would be explicable if the whole memoir with the necessary illustrations had been published.

He was indeed thoroughly grounded in anatomy,¹ and though undoubtedly the digestive organs of Birds have a claim to the fullest consideration, yet Macgillivray himself subsequently became aware of the fact that there were several other parts of their structure as important from the point of view of classification. He it was, apparently, who first detected the essential difference of the organs of voice presented by some of the New-World Passerines (subsequently known as *Clamatores*), and the earliest intimation of this seems to be given in his anatomical description of the Arkansas Flycatcher, *Tyrannus verticalis*, which was published in 1838 (*Ornithol. Biography*, iv. p. 425), though it must be admitted that he did not—because he then could not—perceive the bearing of their difference, which was reserved to be shown by the investigation of a still greater anatomist, and of one who had fuller facilities for research, and thereby almost revolutionized, as will presently be mentioned, the views of systematists as to this Order of Birds. There is only space here to say that the second volume of Macgillivray's work was published in 1839, and the third in 1840; but it was not until 1852 that the author, in broken health, found an opportunity of issuing the fourth and fifth. His scheme of classification, being as before stated partial, need not be given in detail. Its great merit is that it proved the necessity of combining another and hitherto much-neglected factor in any natural arrangement, though vitiated as so many other schemes have been by being based wholly on one class of characters.

Blyth.

But a bolder attempt at classification was that made in 1838 by BLYTH in the New Series (Mr Charlesworth's) of the *Magazine of Natural History* (ii. pp. 256-268, 314-319, 351-361, 420-426, 589-601; iii. pp. 76-84). It was limited, however, to what he called *Inesores*, being the group upon which that name had been conferred by Vigors (*Trans. Linn. Society*, xiv. p. 405) in 1823 (see above, p. 15), with the addition, however, of his *Raptors*, and it will be unnecessary to enter into particulars concerning it, though it is as equally remarkable for the insight shown by the author into the structure of Birds as for the philosophical breadth of his view, which comprehends almost every kind of character that had been at that time brought forward. It is plain that Blyth saw, and perhaps he was the first to see it, that Geographical Distribution was not unimportant in suggesting the affinities and differences of natural groups (pp. 258, 259); and, undeterred by the precepts and practice of the hitherto dominant English school of Ornithologists, he declared that "anatomy, when aided by every character which the manner of propagation, the progressive changes, and other physiological data supply, is the only sure basis of classification."² He was quite aware of the taxonomic value of the vocal organs of some groups of Birds, presently to be especially mentioned, and he had himself ascertained the presence and absence of *cæca* in a not inconsiderable number of groups, drawing thence very justifiable inferences. He knew at least the earlier investigations of

L'Herminier, and, though the work of Nitzsch, even if he had ever heard of it, must (through ignorance of the language in which it was written) have been to him a sealed book, he had followed out and extended the hints already given by Temminck as to the differences which various groups of Birds display in their moult. With all this it is not surprising to find, though the fact has been generally overlooked, that Blyth's proposed arrangement in many points anticipated conclusions that were subsequently reached, and were then regarded as fresh discoveries. It is proper to add that at this time the greater part of his work was carried on in conjunction with Mr BARTLETT, the present Superintendent of the Zoological Society's Gardens, and that, without his assistance, Blyth's opportunities, slender as they were compared with those which others have enjoyed, must have been still smaller. Considering the extent of their materials, which was limited to the bodies of such animals as they could obtain from dealers and the several menageries that then existed in or near London, the progress made in what has since proved to be the right direction is very wonderful. It is obvious that both these investigators had the genius for recognizing and interpreting the value of characters; but their labours do not seem to have met with much encouragement; and a general arrangement of the Class laid by Blyth before the Zoological Society at this time² does not appear in its publications, possibly through his neglect to reduce his scheme to writing and deliver it within the prescribed period. But even if this were not the case, no one need be surprised at the result. The scheme could hardly fail to be a crude performance—a fact which nobody would know better than its author; but it must have presented much that was objectionable to the opinions then generally prevalent. Its line to some extent may be partly made out—very clearly, for the matter of that, so far as its details have been published in the series of papers to which reference has been given—and some traces of its features are probably preserved in his *Catalogue* of the specimens of Birds in the Museum of the Asiatic Society of Bengal, which, after several years of severe labour, made its appearance at Calcutta in 1849; but, from the time of his arrival in India, the onerous duties imposed upon Blyth, together with the want of sufficient books of reference, seem to have hindered him from seriously continuing his former researches, which, interrupted as they were, and born out of due time, had no appreciable effect on the views of systematizers generally.

Next must be noticed a series of short treatises communicated by JOHANN FRIEDRICH BRANDT, between the years 1836 and 1839, Brandt, to the Academy of Sciences of St Petersburg, and published in its *Mémoires*. In the year last mentioned the greater part of these was separately issued under the title of *Beiträge zur Kenntniss der Naturgeschichte der Vögel*. Herein the author first assigned anatomical reasons for rearranging the Order *Anseres* of Linnaeus and *Nataores* of Illiger, who, so long before as 1811, had proposed a new distribution of it into six Families, the definitions of which, as was his wont, he had drawn from external characters only. Brandt now retained very nearly the same arrangement as his predecessor; but, notwithstanding that he could trust to the firmer foundation of internal framework, he took at least two retrograde steps. First he failed to see the great structural difference between the Penguins (which Illiger had placed as a group, *Impennes*, of equal rank to his other Families) and the Auks, Divers, and Grebes, *Pygopodes*—combining all of them to form a "Typus" (to use his term) *Urinatores*; and secondly he admitted among the *Nataores*, though as a distinct "Typus" *Podoides*, the genera *Podoa* and *Fulica*, which are now known to belong to the *Rallidae*—the latter indeed (see COOPE, vol. vi. p. 341) being but very slightly removed from the MOO-HIEN (vol. xvii. p. 808). At the same time he corrected the error made by Illiger in associating the PHALAROPES (*q. v.*) with these forms, rightly declaring their

¹ This is not the place to expatiate on Macgillivray's merits; but the writer may perhaps be excused for here uttering the opinion that, after Willughby, Macgillivray was the greatest and most original ornithological genius save one (who did not live long enough to make his powers widely known) that this island has produced. The exact amount of assistance he afforded to Audubon in his *Ornithological Biography* will probably never be ascertained; but, setting aside "all the anatomical descriptions, as well as the sketches by which they are sometimes illustrated," that on the latter's own statement (*op. cit.*, iv., Introduction, p. xxiii) are the work of Macgillivray, no impartial reader can compare the style in which the *History of British Birds* is written with that of the *Ornithological Biography* without recognizing the similarity of the two. On this subject some remarks of Prof. Coues (*Bull. Nat. Ornithol. Club*, 1880, p. 201) may well be consulted.

² An abstract is contained in the Minute-book of the Scientific Meetings of the Zoological Society, 26th June and 10th July 1838. The Class was to contain fifteen Orders, but only three were dealt with in any detail.

relationship to *Tringa* (see SANDPIPER), a point of order which other systematists were long in admitting. On the whole Brandt's labours were of no small service in asserting the principle that consideration must be paid to osteology; for his position was such as to gain more attention to his views than some of his less favourably placed brethren had succeeded in doing.

In the same year (1839) another slight advance was made in the classification of the true Passerines. KEYSERLING and BLASTUS briefly pointed out in the *Archiv für Naturgeschichte* (v. pp. 332-334) that, while all the other Birds provided with perfect song-muscles had the "plate" or hind part of the "tarsus" covered with two long and undivided horny plates, the Larks (vol. xiv. p. 316) had this part divided by many transverse sutures, so as to be scutellated behind as well as in front; just as is the case in many of the Passerines which have not the singing-apparatus, and also in the Hoopoe (vol. xii. p. 154). The importance of this singular but superficial departure from the normal structure has been so needlessly exaggerated as a character that at the present time its value is apt to be unduly depreciated. In so large and so homogeneous a group as that of the true Passerines, a constant character of this kind is not to be despised as a practical mode of separating the Birds which possess it; and, more than this, it would appear that the discovery thus announced was the immediate means of leading to a series of investigations of a much more important and lasting nature—those of Johannes Müller to be presently mentioned.

Again we must recur to that indefatigable and most original investigator NITZSCH, who, having never intermitted his study of the particular subject of his first contribution to science, long ago noticed, in 1833 brought out at Halle, where he was Professor of Zoology, an essay with the title *Pterylographia Avium Pars prior*. It seems that this was issued as much with the object of inviting assistance from others in view of future labours, since the materials at his disposal were comparatively scanty, as with that of making known the results to which his researches had already led him. Indeed he only communicated copies of this essay to a few friends, and examples of it are comparatively scarce. Moreover, he stated subsequently that he thereby hoped to excite other naturalists to share with him the investigations he was making on a subject which had hitherto escaped notice or had been wholly neglected, since he considered that he had proved the disposition of the feathered tracts in the plumage of Birds to be the means of furnishing characters for the discrimination of the various natural groups as significant and important as they were new and unexpected.¹ There was no need for us here to quote this essay in its chronological place, since it dealt only with the generalities of the subject, and did not enter upon any systematic details. These the author reserved for a second treatise which he was destined never to complete. He kept on diligently collecting materials, and as he did so

¹ It is still a prevalent belief among nearly all persons but well-informed ornithologists, that feathers grow almost uniformly over the whole surface of a Bird's body; some indeed are longer and some are shorter, but that is about all the difference perceptible to most people. It is the easiest thing for anybody to satisfy himself that this, except in a few cases, is altogether an erroneous supposition. In all but a small number of forms the feathers are produced in very definite clumps or tracts, called by Nitzsch *pterylae* (πτερυλαί, γενναί, ἄλν, σylvae), a rather fanciful term it is true, but one to which no objection can be taken. Between these *pterylae* are spaces bare of feathers, which he named *apteria*. Before Nitzsch's time the only men who seem to have noticed this fact were the great John Hunter and the accurate Macartney. But the observations of the former on the subject were not given to the world until 1836, when Sir R. Owen introduced them into his *Catalogue of the Museum of the College of Surgeons in London* (vol. iii. pt. ii. p. 311), and therein is no indication of the fact having a taxonomical bearing. The same may be said of Macartney's remarks, which, though subsequent in point of time, were published earlier, namely, in 1819 (Rees's *Cyclopaedia*, xiv., art. "Feathers"). Ignorance of this simple fact has led astray many celebrated painters, among them Sir Edwin Landseer, whose pictures of Birds nearly always shew an unnatural representation of the plumage that at once betrays itself to the trained eye, though of course it is not perceived by spectators generally, who regard only the correctness of attitude and force of expression, which in that artist's work commonly leave little to be desired. Every draughtsman of Birds to be successful should study the plan on which their feathers are disposed.

was constrained to modify some of the statements he had published. He consequently fell into a state of doubt, and before he could make up his mind on some questions which he deemed important he was overtaken by death.² Then his papers were handed over to his friend and successor Prof. BURMEISTER, now and for many years past of Buenos Aires, who, with much skill elaborated from them the excellent work known as Nitzsch's *Pterylographie*, which was published at Halle in 1840. There can be no doubt that Prof. Burmeister (fortunately yet spared to us) discharged his editorial duty with the most conscientious scrupulousity; but, from what has been just said, it is certain that there were important points on which Nitzsch was as yet undecided—some of them perhaps of which no trace appeared in his manuscripts, and therefore as in every case of works posthumously published, unless (as rarely happens) they have received their author's "imprimatur," they cannot be implicitly trusted as the expression of his final views. It would consequently be unsafe to ascribe positively all that appears in this volume to the result of Nitzsch's mature consideration. Moreover, as Prof. Burmeister states in his preface, Nitzsch by no means regarded the natural sequence of groups as the highest problem of the systematist, but rather their correct limitation. Again the arrangement followed in the *Pterylographie* was of course based on pterylographical considerations, and we have its author's own word for it that he was persuaded that the limitation of natural groups could only be attained by the most assiduous research into the species of which they are composed from every point of view. The combination of these three facts will of itself explain some defects, or even retrogressions, observable in Nitzsch's later systematic work when compared with that which he had formerly done. On the other hand some manifest improvements are introduced, and the abundance of details into which he enters in his *Pterylographie* render it far more instructive and valuable than the older performance. As an abstract of that has already been given, it may be sufficient here to point out the chief changes made in his newer arrangement. To begin with, the three great sections of Aerial, Terrestrial, and Aquatic Birds are abolished. The "Accipitres" are divided into two groups, Diurnal and Nocturnal; but the first of these divisions is separated into three sections:—(1) the Vultures of the New World, (2) those of the Old World, and (3) the genus *Falco* of Linnaeus. The "Passerinae," that is to say, the true *Passeres*, are split into eight Families, not wholly with judgment;³ but of their taxonomy more is to be said presently. Then a new Order "Picarie" is instituted for the reception of the *Macrochlores*, *Cuculinae*, *Picinae*, *Psittacinae*, and *Anophibolae* of his old arrangement, to which are added three others—*Caprimulginae*, *Todidae*, and *Lipoglossae*—the last consisting of the genera *Buceros*, *Upupa*, and *Alcedo*. The association of *Alcedo* with the

² Though not relating exactly to our present theme, it would be improper to dismiss Nitzsch's name without reference to his extraordinary labours in investigating the insect and other external parasites of Birds, a subject which as regards British species was subsequently elaborated by DENYS in his *Monographia Anophororum Britanniae* (1842) and in his list of the specimens of British *Anophora* in the collection of the British Museum.

³ A short essay by Nitzsch on the general structure of the Passerines, written, it is said, in 1836, was published in 1862 (*Zeitschr. Ges. Naturwissensch. Berl.*, xix. pp. 389-408). It is probably to this essay that Prof. Burmeister refers in the *Pterylographie* (p. 102, note; English translation, p. 72, note) as forming the basis of the article "Passerinae" which he contributed to Ersch and Gruber's *Encyclopädie* (sect. iii. bd. xiii. pp. 139-144), and published before the *Pterylographie*.

⁴ By the numbers prefixed it would look as if there should be four new members of this Order; but that seems to be due rather to a slip of the pen or to a printer's error.

Keyser-
ling and
Blastus.

Bur-
meister.

Nitzsch.

other two is no doubt a misplacement, but the alliance of *Bucero* to *Upupa*, already suggested by Gould and Blyth in 1838¹ (*Mag. Nat. History*, ser. 2, ii. pp. 422 and 589), though apparently unnatural, has been corroborated by many later systematizers; and taken as a whole the establishment of the *Picariæ* was certainly a commendable proceeding. For the rest there is only one considerable change, and that forms the greatest blot on the whole scheme. Instead of recognizing, as before, a Subclass in the *Ratitæ* of Merrem, Nitzsch now reduced them to the rank of an Order under the name "*Platysternæ*," placing them between the "*Gallinacæ*" and "*Grallæ*," though admitting that in their pterylosis they differ from all other Birds, in ways that he is at great pains to describe, in each of the four genera examined by him—*Struthio*, *Rhea*, *Dromæus*, and *Casuarus*.² It is significant that notwithstanding this he did not figure the pterylosis of any one of them, and the thought suggests itself that, though his editor assures us he had convinced himself that the group must be here shoved in (*eingeschoben* is the word used), the intrusion is rather due to the necessity which Nitzsch, in common with most men of his time (the Quinarians excepted), felt for deploying the whole series of Birds into line, in which case the proceeding may be defensible on the score of convenience. The extraordinary merits of this book, and the admirable fidelity to his principles which Prof. Burmeister shewed in the difficult task of editing it, were unfortunately overlooked for many years, and perhaps are not sufficiently recognized now. Even in Germany, the author's own country, there were few to notice seriously what is certainly one of the most remarkable works ever published on the science, much less to pursue the investigations that had been so laboriously begun.³ Andreas Wagner, in his report on the progress of Ornithology, as might be expected from such a man as he was, placed the *Pterylographie* at the summit of those publications the appearance of which he had to record for the years 1839 and 1840, stating that for "Systematic" it was of the greatest importance.⁴ On the other hand Oken (*Isis*, 1842, pp. 391-394), though giving a summary of Nitzsch's results and classification, was more sparing of his praise, and prefaced his remarks by asserting that he could not refrain from laughter when he looked at the plates in Nitzsch's work, since they reminded him of the plucked fowls hanging in a poulterer's shop—it might as well be urged as an objection to the plates in many an anatomical book that they called to mind a butcher's—and goes on to say that, as the author always had the luck to engage in researches of which nobody thought, so had he the luck to print them where nobody sought them. In Sweden

¹ This association is one of the most remarkable in the whole series of Blyth's remarkable papers on classification in the volume cited above. He states that Gould suspected the alliance of these two forms "from external structure and habits alone;" otherwise one might suppose that he had obtained an intimation to that effect on one of his Continental journeys. Blyth "arrived at the same conclusion, however, by a different train of investigation," and this is beyond doubt.

² He does not mention *Apteryx*, at that time so little known on the Continent.

³ Some excuse is to be made for this neglect. Nitzsch had of course exhausted all the forms of Birds commonly to be obtained, and specimens of the less common forms were too valuable from the curator's or collector's point of view to be subjected to a treatment that might end in their destruction. Yet it is said, on good authority, that Nitzsch had the patience so to manipulate the skins of many rare species that he was able to ascertain the characters of their pterylosis by the inspection of their inside only, without in any way damaging them for the ordinary purpose of a museum. Nor is this surprising when we consider the marvellous skill of Continental and especially German taxidermists, many of whom have elevated their profession to a height of art inconceivable to most Englishmen, who are only acquainted with the miserable mockery of Nature which is the most sublime result of all but a few "bird-stuffers."

⁴ *Archiv für Naturgeschichte*, vii. 2, pp. 60, 61.

Sundevall, without accepting Nitzsch's views, accorded them a far more appreciative greeting in his annual reports for 1840-42 (i. pp. 152-160); but of course in England and France⁵ nothing was known of them beyond the scantiest notice, generally taken at second hand, in two or three publications. Thanks to Mr Sclater, the Ray Society was induced to publish, in 1867, an excellent translation by Mr Dallas of Nitzsch's *Pterylography*, and thereby, however tardily, justice was at length rendered by British ornithologists to one of their greatest foreign brethren.⁶

The treatise of KESSLER on the osteology of Birds' feet, published Kessler, in the *Bulletin* of the Moscow Society of Naturalists for 1841, next claims a few words, though its scope is rather to shew differences than affinities; but treatment of that kind is undoubtedly useful at times in indicating that alliances generally admitted are unnatural; and this is the case here, for, following Cuvier's method, the author's researches prove the artificial character of some of its associations. While furnishing—almost unconsciously, however—additional evidence for overthrowing that classification, there is, nevertheless, no attempt made to construct a better one; and the elaborate tables of dimensions, both absolute and proportional, suggestive as is the whole tendency of the author's observations, seem not to lead to any very practical result, though the systematist's need to look beneath the integument, even in parts that are so comparatively little hidden as Birds' feet, is once more made beyond all question apparent.

It has already been mentioned that MACGILLIVRAY contributed to Audubon's *Ornithological Biography* a series of descriptions of some parts of the anatomy of American Birds, from subjects supplied to him by that enthusiastic naturalist, whose zeal and prescience, it may be called, in this respect merits all praise. Thus he (prompted very likely by Macgillivray) wrote:—"I believe the time to be approaching when much of the results obtained from the inspection of the exterior alone will be laid aside; when museums filled with stuffed skins will be considered insufficient to afford a knowledge of birds; and when the student will go forth, not only to observe the habits and haunts of animals, but to preserve specimens of them to be carefully dissected" (*Ornith. Biography*, iv., Introduction, p. xxiv). As has been stated, the first of this series of anatomical descriptions appeared in the fourth volume of his work, published in 1838, but they were continued until its completion with the fifth volume in the following year, and the whole was incorporated into what may be termed its second edition, *The Birds of America*, which appeared between 1840 and 1844 (see p. 11). Among the many species whose anatomy Macgillivray thus partly described from autopsy were at least half a dozen⁷ of those now referred to the Family *Tyrannidae* (see KING-BIRD, vol. xiv. p. 80), but then included, with many others, according to the irrational, vague, and rudimentary notions of classification of the time, in what was termed the Family "*Muscicapinæ*." In all these species he found the vocal organs to differ essentially in structure from those of other Birds of the Old World, which we now call Passerine, or to be still more precise, Oscinian. But by him these last were most arbitrarily severed, dissociated from their allies, and wrongly combined with other forms by no means nearly related to them (*Brit. Birds*, i. pp. 17, 18) which

⁵ In 1836 JACQUEMIN communicated to the French Academy (*Comptes Rendus*, ii. pp. 374, 375, and 472) some observations on the order in which feathers are disposed on the body of Birds; but, however general may have been the scope of his investigations, the portion of them published refers only to the Crow, and there is no mention made of Nitzsch's former work.

⁶ The Ray Society had the good fortune to obtain the ten original copper-plates, all but one drawn by the author himself, wherewith the work was illustrated. It is only to be regretted that the Society did not also stick to the quarto size in which it appeared, for by issuing their English version in folio they needlessly put an impediment in the way of its common and convenient use.

⁷ These are, according to modern nomenclature, *Tyrannus carolinensis* and (as before mentioned) *T. verticalis*, *Myiarchus crinitus*, *Sayornis fuscus*, *Contopus virens*, and *Empidonax caedivus*.

Johannes
Müller.

he also examined; and he practically, though not literally,¹ asserted the truth, when he said that the general structure, but especially the muscular appendages, of the lower larynx was "similarly formed in all other birds of this family" described in Audubon's work. Macgillivray did not, however, assign to this essential difference any systematic value. Indeed he was so much prepossessed in favour of a classification based on the structure of the digestive organs that he could not bring himself to consider vocal muscles to be of much taxonomic use, and it was reserved to JOHANNES MÜLLER to point out that the contrary was the fact. This the great German comparative anatomist did in two communications to the Academy of Sciences of Berlin, one on the 26th June 1845 and the other on the 14th May 1846, which, having been first briefly published in the Academy's *Monatsbericht*, were afterwards printed in full, and illustrated by numerous figures, in its *Abhandlungen*, though in this latter and complete form they did not appear in public until 1847. This very remarkable treatise forms the groundwork of almost all later or recent researches in the comparative anatomy and consequent arrangement of the *Passeres*, and, though it is certainly not free from imperfections, many of them, it must be said, arise from want of material, notwithstanding that its author had command of a much more abundant supply than was at the disposal of Nitzsch. Carrying on the work from the anatomical point at which he had left it, correcting his errors, and utilizing to the fullest extent the observations of Keyserling and Blasius, to which reference has already been made, Müller, though hampered by mistaken notions of which he seems to have been unable to rid himself, propounded a scheme for the classification of this group, the general truth of which has been admitted by all his successors, based, as the title of his treatise expressed, on the hitherto unknown different types of the vocal organs in the *Passerines*. He freely recognized the prior discoveries of, as he thought, Audubon, though really, as has since been ascertained, of Macgillivray; but Müller was able to perceive their systematic value, which Macgillivray did not, and taught others to know it. At the same time Müller shewed himself, his power of discrimination notwithstanding, to fall behind Nitzsch in one very crucial point, for he refused to the latter's *Picariæ* the rank that had been claimed for them, and imagined that the groups associated under that name formed but a third "Tribe"—*Picariæ*—of a great Order *Insessores*, the others being (1) the *Oscines* or *Polymyodi*—the Singing Birds by emphasis, whose inferior larynx was endowed with the full number of five pairs of song-muscles, and (2) the *Tracheophones*, composed of some South-American Families. Looking on Müller's labours as we now can, we see that such errors as he committed are chiefly due to his want of special knowledge of Ornithology, combined with the absence in several instances of sufficient materials for investigation. Nothing whatever is to be said against the composition of his first and second "Tribes"; but the third is an assemblage still more heterogeneous than that which Nitzsch brought together under a name so like that of Müller—for the fact must never be allowed to go out of sight that the extent of the *Picariæ* of the latter is not at all that of the *Picariæ* of the former.² For instance, Müller places in his

third "Tribe" the group which he called *Ampelidæ*, meaning thereby the peculiar forms of South America that are now considered to be more properly named *Cotingidæ*, and herein he was clearly right, while Nitzsch, who (misled by their supposed affinity to the genus *Ampelis*—peculiar to the Northern Hemisphere, and a purely Passerine form) had kept them among his *Passerinae*, was as clearly wrong. But again Müller made his third "Tribe" *Picariæ* also to contain the *Tyrannidæ*, of which mention has just been made, though it is so obvious as now to be generally admitted that they have no very intimate relationship to the other Families with which they are there associated. There is no need here to criticize more minutely his projected arrangement, and it must be said that, notwithstanding his researches, he seems to have had some misgivings that, after all, the separation of the *Insessores* into those "Tribes" might not be justifiable. At any rate he wavered in his estimate of their taxonomic value, for he gave an alternative proposal, arranging all the genera in a single series, a proceeding in those days thought not only defensible and possible, but desirable or even requisite, though now utterly abandoned. Just as Nitzsch had laboured under the disadvantage of never having any example of the abnormal *Passeres* of the New World to dissect, and therefore was wholly ignorant of their abnormality, so Müller never succeeded in getting hold of an example of the genus *Pitta* for the same purpose, and yet, acting on the clew furnished by Keyserling and Blasius, he did not hesitate to predict that it would be found to fill one of the gaps he had to leave, and this to some extent it has been since proved to do.

The result of all this is that the *Oscines* or true *Passeres* are found to be a group in which the vocal organs not only attain the greatest perfection, but are nearly if not quite as uniform in their structure as is the sternal apparatus; while at the same time each set of characters is wholly unlike that which exists in any other group of Birds. In nearly all Birds the inferior larynx, or syrinx, which is, as proved long ago by the experiments of Cuvier, the seat of their vocal powers, is at the bottom of the trachea or windpipe, and is formed by the more or less firm union of several of the bony rings of which that tube is composed. In the *Lalage*, the genus *Rheca* excepted, and in one group of *Carinatae*, the American Vultures *Cathartidæ*, but therein it is believed only, there is no special modification of the trachea into a syrinx;³ but usually, at a little distance from the lungs, the trachea is somewhat enlarged, and here is found a thicker and stouter bony ring, which is bisected axially by a *septum* or partition extending from behind forwards, and thus dividing the pipe,⁴ each half of which swells out below the ring and then rapidly contracts to enter the lung on its own side. The halves of the pipe thus formed are the *bronchi*, tubes whose inner side is flattened and composed of the *membrana tympaniformis*, on the change of form and length of which some of the varieties of intonation depend, while the outer and curved side is supported by bony half-hoops, connected by membrane just as are the entire hoops of the upper part of the trachea. The whole of this apparatus is extremely flexible, and is controlled by muscles, the real vocal muscles of which mention has previously been so frequently made. These vary in number in different groups of Birds, and reach their maximum in the *Oscines*, which have always five pairs, or even more according to some authorities.⁵ But supposing five to be the number of pairs, as it is generally allowed to be in this group of them, two pairs have a common origin about the middle of the trachea, and, descending on its outside, divide at a short distance above the lower end of the tube; one of them, the *tensor posterior longus*, being directed downward and backward, is inserted at the extreme posterior end of the first half-ring of the bronchus, while its counterpart, the *tensor anterior longus*, passing from the place of separation downward and forward, is inserted below the extreme point of the last ring of the trachea. Within the angle formed by the divergence of each of these pairs of muscles, a third slender muscle—the *sterno-trachealis*—is given off

¹ Not literally, because a few other forms such as the genera *Poliophtila* and *Ptilonopus*, now known to have no relation to the *Tyrannidæ*, were included, though these forms, it would seem, had never been dissected by him. On the other hand he declares that the American Reilstart, *Muscicapa*, or, as it now stands, *Setophaga ruticilla*, when young, has its vocal organs like the rest—an extraordinary statement which is worthy the attention of the many able American ornithologists.

² It is not needless to point out this fine distinction, for more than one modern author would seem to have overlooked it.

³ See BIRDS, vol. iii. p. 726; but cf. Forbes, *Proc. Zool. Society*, 1831, pp. 778, 788.

⁴ In a few forms belonging to the *Spheniscidæ* and *Procellariidæ*, this *septum* is prolonged upwards, to what purpose is of course unknown. On the other hand, the Parrots have no *septum* (see BIRDS, *ut supra*).

⁵ See BIRDS, vol. iii. p. 726.

on each side and is attached to the sternum.¹ The fourth pair, the *tensorae posteriores breves*, is the smallest of all, and, arising near the middle of the lower end of the trachea, has its fibres inserted on the extremity of the first of the incomplete rings of the bronchi. The fifth pair, the *tensorae anteriores*, originates like the last from the middle of the trachea, but is somewhat larger and thicker, appearing as though made up of several small muscles in close contact, and by some ornithologists is believed to be of a compound nature. Its direction is obliquely downward and forward, and, attached by a broad base to the last ring of the trachea and cartilage immediately below, reaches the first or second of the half-rings of the bronchi—in the normal *Oscines* at their extremity; but, in another section of that group, which it will be necessary to mention later, it is found to be attached to their middle. There is no question of its being by the action of the syringeal muscles just described that the expansion of the bronchi, both as to length and diameter, is controlled, and, as thereby the sounds uttered by the Bird are modified, they are properly called the Song-muscles.

It must not be supposed that the muscles just defined were first discovered by Müller; on the contrary they had been described long before, and by many writers on the anatomy of Birds. To say nothing of foreigners, or the authors of general works on the subject, an excellent account of them had been given to the Linnean Society by YARRELL in 1829, and published with elaborate figures in its *Transactions* (xvi. pp. 305-321, pls. 17, 18), an abstract of which was subsequently given in the article "Raven" in his *History of British Birds*, and Macgillivray also described and figured them with the greatest accuracy ten years later in his work with the same title (ii. pp. 21-37, pls. x.-xii.), while Blyth and Nitzsch had (as already mentioned) seen some of their value in classification. But Müller has the merit of clearly outstriking his predecessors, and with his accustomed perspicuity made the way even plainer for his successors to see than he himself was able to see it. What remains to add is that the extraordinary celebrity of its author actually procured for the first portion of his researches notice in England (*Ann. Nat. History*, xvii. p. 499), though it must be confessed not then to any practical purpose; but more than thirty years after there appeared an English translation of his treatise by Prof. Jeffrey Bell, with an appendix by Garrod containing a summary of the latter's own continuation of the same line of research, and thus once more Mr Sclater, for it was at his instigation that the work was undertaken, had the satisfaction of rendering proper tribute to one who by his investigations had so materially advanced the study of Ornithology.²

Cornay. It is now necessary to revert to the year 1842, in which Dr CORNAY of Rochefort communicated to the French Academy of Sciences a memoir on a new Classification of Birds, of which, however, nothing but a notice has been preserved (*Comptes Rendus*, xiv. p. 164). Two years later this was followed by a second contribution from him on the same subject, and of this only an extract appeared in the official organ of the Academy (*ut supra*, xvi. pp. 94, 95), though an abstract was inserted in one scientific journal (*L'Institut*, xii. p. 21), and its first portion in another (*Journal des Découvertes*, i. p. 260). The *Revue Zoologique* for 1847 (pp. 360-369) contained the whole, and enabled naturalists to consider the merits of the author's project, which was to found a new Classification of Birds on the form of the anterior palatal bones, which he declared to be subjected more evidently than any other to certain fixed laws. These laws, as formulated by him, are that (1) there is a coincidence of form of the anterior palatal and of the cranium in Birds of the same Order; (2) there is a likeness between the anterior palatal bones in Birds of the same Order; (3) there are relations of likeness between the anterior palatal bones in groups of Birds which are near to one another. These laws, he added, exist in regard to all

¹ According to Blyth (*Mag. Nat. History*, ser. 2, ii. p. 264), Yarrell ascertained that this pair of muscles was wanting in "the mina genus" (sq. *Gracula* ?), a statement that requires attention either for confirmation or contradiction.

² The title of the English translation is *Johannes Müller on Certain Variations in the Vocal Organs of the Passeres that have hitherto escaped notice*. It was published at Oxford in 1878. By some unaccountable accident, the date of the original communication to the Academy of Berlin is wrongly printed. It has been rightly given above.

parts that offer characters fit for the methodical arrangement of Birds, but it is in regard to the anterior palatal bone that they unquestionably offer the most evidence. In the evolution of these laws Dr Cornay had most laudably studied, as his observations prove, a vast number of different types, and the upshot of his whole labours, though not very clearly stated, was such as to wholly subvert the classification at that time generally adopted by French ornithologists. He of course knew the investigations of L'Hermier and De Blainville on sternal formation, and he also seems to have been aware of some pterylogical differences exhibited by Birds—whether those of Nitzsch or those of Jacquemin is not stated. True it is the latter were never published in full, but it is quite conceivable that Dr Cornay may have known their drift. Be that as it may, he declares that characters drawn from the sternum or the pelvis—hitherto deemed to be, next to the bones of the head, the most important portions of the Bird's framework—are scarcely worth more, from a classificatory point of view, than characters drawn from the bill or the legs; while pterylogical considerations, together with many others to which some systematists had attached more or less importance, can only assist, and apparently must never be taken to control, the force of evidence furnished by this bone of all bones—the anterior palatal.

That Dr Cornay was on the brink of making a discovery of considerable merit will be by and by apparent; but, with every disposition to regard his investigations favourably, it cannot be said that he accomplished it. No account need be taken of the criticism which dignified his attempt "unphilosophical and one-sided," nor does it signify that his proposals either attracted no attention or were generally received with indifference. Such is commonly the fate of any deep-seated reform of classification proposed by a comparatively unknown man, unless it happen to possess some extraordinarily taking qualities, or be explained with an abundance of pictorial illustration. This was not the case here. Whatever proofs Dr Cornay may have had to satisfy himself of his being on the right track, these proofs were not adduced in sufficient number nor arranged with sufficient skill to persuade a somewhat stiff-necked generation of the truth of his views—for it was a generation whose leaders, in France at any rate, locked with suspicion upon any one who professed to go beyond the bounds which the genius of Cuvier had been unable to overpass, and regarded the notion of upsetting any of the positions maintained by him as verging almost upon profanity. Moreover, Dr Cornay's scheme was not given to the world with any of those adjuncts that not merely please the eye but are in many cases necessary, for, though on a subject which required for its proper comprehension a series of plates, it made even its final appearance unadorned by a single explanatory figure, and in a journal, respectable and well-known indeed, but one not of the highest scientific rank. Add to all this that its author, in his summary of the practical results of his investigations, committed a grave sin in the eyes of rigid systematists by ostentatiously arranging the names of the forty types which he selected to prove his case wholly without order, and without any intimation of the greater or less affinity any one of them might bear to the rest. That success should attend a scheme so inconclusively elaborated could not be expected.

The same year which saw the promulgation of the crude scheme just described, as well as the publication of the final researches of Müller, witnessed also another attempt at the classification of Birds, much more limited indeed in scope, but, so far as it went, regarded by most ornithologists of the time as almost final in its operation. Under the vague title of "Ornithologische Notizen" Prof. Cabanis Calanis. of Berlin contributed to the *Archiv für Naturgeschichte* (xiii. 1, pp. 186-256, 308-352) an essay in two parts, wherein, following the researches of Müller³ on the syrinx, in the course of which a correlation had been shown to exist between the whole or divided condition of the *planta* or hind part of the "tarsus," first noticed, as has been said, by Keyserling and Blasius, and the presence or absence of the perfect song-apparatus, the younger author found an agreement which seemed almost invariable in this respect, and he also pointed out that the *planta* of the different groups of Birds in which it is divided is divided in different modes, the mode of division being generally characteristic of the group. Such a coincidence of the internal and external features of Birds was naturally deemed a discovery of the greatest value by those ornithologists who thought most highly of the latter, and it was unquestionably of no little practical utility. Further examination also revealed the fact⁴ that

³ On the other hand, Müller makes several references to the labours of Prof. Cabanis. The investigations of both authors must have been proceeding simultaneously, and it matters little which actually appeared first.

⁴ This seems to have been made known by Prof. Cabanis the preceding year to the *Gesellschaft der Naturforschender Freunde* (cf. Müller, *Stimmorgan der Passerinen*, p. 65). Of course the variation to which the number of primaries was subject had not escaped the observation of Nitzsch, but he had scarcely used it as a classificatory character.

in certain groups the number of "primaries," or quill-feathers growing from the *uncus* or distal segment of the wing, formed another characteristic easy of observation. In the *Oscines* or *Polynoyadi* of Müller the number was either nine or ten—and if the latter the outermost of them was generally very small. In two of the other groups of which Prof. Cabanis especially treated—groups which had been hitherto more or less confounded with the *Oscines*—the number of primaries was invariably ten, and the outermost of them was comparatively large. This observation was also hailed as the discovery of a fact of extraordinary importance; and, from the results of these investigations, taken altogether, Ornithology was declared by Sundevall, undoubtedly a man who had a right to speak with authority, to have made greater progress than had been achieved since the days of Cuvier. The final disposition of the "Subclass *Insectores*"—all the perching Birds, that is to say, which are neither Birds-of-Prey nor Pigeons—proposed by Prof. Cabanis, was into four "Orders," as follows:—

1. *Oscines*, equal to Müller's group of the same name;
2. *Clamatores*, being a majority of that division of the *Picariæ* of Nitzsch, so called by Andreas Wagner, in 1841,¹ which have their feet normally constructed;
3. *Strisores*, a group now separated from the *Clamatores* of Wagner, and containing those forms which have their feet abnormally constructed; and
4. *Scansores*, being the *Grimpears* of Cuvier, the *Zygodactyli* of several other systematists.

The first of these four "Orders" had been already indefeasibly established as one perfectly natural, but respecting its details more must presently be said. The remaining three are now seen to be obviously artificial associations, and the second of them, *Clamatores*, in particular, containing a very heterogeneous assemblage of forms; but it must be borne in mind that the internal structure of some of them was at that time still more imperfectly known than now. Yet even then enough had been ascertained to have saved what are now recognized as the Families *Toxidae* and *Tyrannidae* from being placed as "Subfamilies" in the same "Family *Coleopteridae*"; and several other instances of unharmonious combination in this "Order" might be adduced were it worth while to particularize them. More than that, it would not be difficult to shew, only the present is not exactly the place for it, that some groups or Families which in reality are not far distant from one another are distributed, owing to the dissimilarity of their external characters, throughout these three Orders. Thus the *Podarginae* are associated with the *Coraciidae* under the head *Clamatores*, while the *Corynulinidae*, to which they are clearly most allied, if they do not form part of that Family (GOATSUCKER, vol. x. p. 711), are placed with the *Strisores*; and again the *Mitsophagiidae* also stand as *Strisores*, while the *Cuculidae*, which modern systematists think to be their nearest relations, are considered to be *Scansores*.

But to return to the *Oscines*, the arrangement of which in the classification now under review has been deemed its greatest merit, and consequently has been very generally followed. That by virtue of the perfection of their vocal organs, and certain other properties—though some of these last have perhaps never yet been made clear enough—they should stand at the head of the whole Class, may here be freely admitted, but the respective rank assigned to the various component Families of the group is certainly open to question, and to the present writer seems, in the methods of several systematists, to be based upon a fallacy. This respective rank of the different Families appears to have been assigned on the principle that, since by reason of one character (namely, the more complicated structure of their syrinx) the *Oscines* form a higher group than the *Clamatores*, therefore all the concomitant features which the former possess and the latter do not must be equally indicative of superiority. Now one of the features in which most of the *Oscines* differ from the lower "Order" is the having a more or less undivided *planta*, and accordingly it has been assumed that the Family of *Oscines* in which this modification of the *planta* is carried to its extreme point must be the highest of that "Order." Since, therefore, this extreme modification of the *planta* is

exhibited by the Thrushes and their allies, it is alleged that they must be placed first, and indeed at the head of all Birds. The groundlessness of this reasoning ought to be apparent to everybody. In the present state of anatomy at any rate, it is impossible to prove that there is more than a coincidence in the facts just stated, and in the association of two characters—one deeply seated and affecting the whole life of the Bird, the other superficially, and so far as we can perceive without effect upon its organism. Because the *Clamatores*, having no song-muscles, have a divided *planta*, it cannot be logical to assume that among the *Oscines*, which possess song-muscles, such of them as have an undivided *planta* must be higher than those that have it divided. The argument, if it can be called an argument, is hardly one of analogy; and yet no stronger ground has been occupied by those who invest the Thrushes, as do the majority of modern systematists, with the most dignified position in the whole Class. But passing from general to particular considerations, so soon as a practical application of the principle is made its inefficacy is manifest. The test of perfection of the vocal organs must be the perfection of the notes they enable their possessor to utter. There cannot be a question that, sing admirably as do some of the Birds included among the Thrushes,² the Larks, as a Family, infinitely surpass them. Yet the Larks form the very group which, as has been already shewn (LARK, vol. xiv. p. 314), have the *planta* more divided than any other among the *Oscines*. It seems hardly possible to adduce anything that would more conclusively demonstrate the independent nature of each of these characters—the complicated structure of the syrinx and the asserted inferior formation of the *planta*—which are in the *Alaudidae* associated.³ Moreover, this same Family affords a very valid protest against the extreme value attached to the presence or absence of the outermost quill-feather of the wings, and in this work it has been before shewn (*ut supra*) that almost every stage of magnitude in this feather is exhibited by the Larks from its rudimentary or almost abortive condition in *Alauda arvensis* to its very considerable development in *Melanocorypha calandra*. Indeed there are many genera of *Oscines* in which the proportion that the outermost primary bears to the rest is at best but a specific character, and certain exceptions are allowed by Prof. Cabanis (p. 313) to exist. Some of them it is now easy to explain, inasmuch as in a few cases the apparently aberrant genera have elsewhere found a more natural position, a contingency to which he himself was fully awake. But as a rule the allocation and ranking of the different Families of *Oscines* by this author must be deemed arbitrary.⁴ Yet the value of his *Ornithologische Notizen* is great, not only as evidence of his extraordinarily extensive acquaintance with different forms, which is proclaimed in every page, but in leading to a far fuller appreciation of characters that certainly should on no account be neglected, though

² Prof. Cabanis would have strengthened his position had he included in the same Family with the Thrushes, which he called *Ithacnemidae*, the Birds commonly known as Warblers, *Sylviidae*, which the more advanced of recent systematists are inclined with much reason to unite with the Thrushes, *Turdidae*; but instead of that he, trusting to the plantar character, segregated the Warblers, including of course the Nightingale, and did not even allow them the second place in his method, putting them below the Family called by him *Sylviocolidae*, consisting chiefly of the American forms now known as *Amniotillidae*, none of which as songsters approach those of the Old World.

³ It must be observed that Prof. Cabanis does not place the *Alaudidae* lowest of the seventeen Families of which he makes the *Oscines* to be composed. They stand eleventh in order, while the *Corviidae* are last—a matter on which something has to be said in the sequel.

⁴ By a curious error, probably of the press, the number of primaries assigned to the *Paradiseidae* and *Corviidae* is wrong (pp. 334, 335). In each case 10 should be substituted for 19 and 14.

¹ *Archiv für Naturgeschichte*, vii. 2, pp. 93, 94. The division seems to have been instituted by this author a couple of years earlier in the second edition of his *Handbuch der Naturgeschichte* (a work not seen by the present writer), but not then to have received a scientific name. It included all *Picariæ* which had not "zygodactylous" feet, that is to say, toes placed in pairs, two before and two behind.

too much importance may easily be, and already has been, assigned to them.¹

This will perhaps be the most convenient place to mention another kind of classification of Birds, which, based on a principle wholly different from those that have just been explained, requires a few words, though it has not been productive, nor is likely, from all that appears, to be productive of any great effect. So long ago as 1831, BONAPARTE, in his *Saggio di una distribuzione metodica degli Animalii Vertebrati*, published at Rome, and in 1837 communicated to the Linnean Society of London, "A new Systematic Arrangement of Vertebrated Animals," which was subsequently printed in that Society's *Transactions* (xviii, pp. 247-304), though before it appeared there was issued at Bologna, under the title of *Synopsis Vertebratorum Systematis*, a Latin translation of it. Herein he divided the Class *Aves* into two Subclasses, to which he applied the names of *Insectores* and *Grallatores* (hitherto used by their inventors Vigors and Illiger in a different sense), in the latter work relying chiefly for this division on characters which had not before been used by any systematist, namely, that in the former group Monogamy generally prevailed and the helpless nestlings were fed by their parents, while the latter group were mostly Polygamous, and the chicks at birth were active and capable of feeding themselves. This method, which in process of time was dignified by the title of a Physiological Arrangement, was insisted upon with more or less pertinacity by the author throughout a long series of publications, some of them separate books, some of them contributed to the memoirs issued by many scientific bodies of various European countries, ceasing only at his death, which in July 1857 found him occupied upon a *Conspectus Generum Avium*, that in consequence remains unfinished (see p. 14). In the course of this series, however, he saw fit to alter the name of his two Subclasses, since those which he at first adopted were open to a variety of meanings, and in a communication to the French Academy of Sciences in 1853 (*Comptes Rendus*, xxvii, pp. 641-647) the denomination *Insectores* was changed to *Altrices*, and *Grallatores* to *Proceres*—the terms now preferred by him being taken from Sundevall's treatise of 1835 already mentioned. The views of Bonaparte were, it appears, also shared by an ornithological amateur of some distinction, HOGG, who propounded a scheme which, as he subsequently stated (*Zoologist*, 1850, p. 2797), was founded strictly in accordance with them; but it would seem that, allowing his convictions to be warped by other considerations, he abandoned the original "physiological" basis of his system, so that this, when published in 1846 (*Edinb. N. Philosoph. Journal*, xli, pp. 50-71), was found to be established on a single character of the feet only; though he was careful to point out, immediately after formulating the definition of his Subclasses *Constrictipedes* and *Inconstrictipedes*, that the former "make, in general, compact and well-built nests, wherein they bring up their very weak, blind, and mostly naked young, which they feed with care, by bringing food to them for many days, until they are fledged and sufficiently strong to leave their nest," observing also that they "are principally monogamous" (pp. 55, 56); while of the latter he says that they "make either a poor and rude nest, in which they lay their eggs, or else none, depositing them on the bare ground. The young are generally born with their full sight, covered with down, strong, and capable of running or swimming immediately after they leave the egg-shell." He adds that the parents, which "are mostly polygamous," attend their young and direct them where to find their food (p. 63). The numerous errors in these assertions hardly need pointing out. The Herons, for instance, are much more "Constrictipedes" than are the Larks or the Kingfishers, and so far from the majority of "Inconstrictipedes" being polygamous, there is scarcely any evidence of polygamy obtaining as a habit among Birds in a state of nature except in certain of the *Gallinæ* and a very few others. Furthermore, the young of the Goatsuckers are at hatching far more developed than are those of the Herons or the Cormorants; and, in a general way, nearly every one of the asserted peculiarities of the two Subclasses breaks down under careful examination. Yet the idea of a "physiological" arrangement on the same kind of principle found another follower, or, as he thought, inventor, in NEWMAN, who in 1850 communicated to the Zoological Society of London a plan published in its *Proceedings* for that year (pp. 46-48), and reprinted also in his own journal *The Zoologist* (pp. 2780-2782), based on exactly the same considerations, dividing Birds into two groups, "Hæthogenous"—a word so vicious in formation as to be incapable of amendment, but intended to signify those that were hatched with a clothing of down—and "Gymnogenous," or those that were hatched naked. These three systems are essentially identical; but, plausible as they may be at

the first aspect, they have been found to be practically useless, though such of their characters as their upholders have advanced with truth deserve attention. Physiology may one day very likely assist the systematist; but it must be real physiology and not a sham.

In 1856 PROF. GERVAYS, who had already contributed to the *Zoologie* of M. de CASTELNAU's *Expédition dans les parties centrales de l'Amérique du Sud* some important memoirs describing the anatomy of the HOACZTIN (vol. xii, p. 28) and certain other Birds of doubtful or anomalous position, published some remarks on the characters which could be drawn from the sternum of Birds (*Ann. Sc. Nat. Zoologie*, ser. 4, vi, pp. 5-15). The considerations are not very striking from a general point of view; but the author adds to the weight of evidence which some of his predecessors had brought to bear on certain matters, particularly in aiding to abolish the artificial groups "Dœodactyls," "Syndactyls," and "Zygodactyls," on which so much reliance had been placed by many of his countrymen; and it is with him a great merit that he was the first apparently to recognize publicly that characters drawn from the posterior part of the sternum, and particularly from the "chœnourcs," commonly called in English "notches" or "emarginations," are of comparatively little importance, since their number is apt to vary in forms that are most closely allied, and even in species that are usually associated in the same genus or unquestionably belong to the same Family,² while these "notches" sometimes become simple *foramina*, as in certain Pigeons, or on the other hand *foramina* may exceptionally change to "notches," and not infrequently disappear wholly. Among his chief systematic determinations we may mention that he refers the Titmouse to the Rails, because apparently of their deep "notches," but otherwise takes a view of that group more correct according to modern notions than did most of his contemporaries. The Bustards he would place with the "Limicoles," as also *Dromas* and *Chionis*, the SHEATH-BILL (*q.v.*), *Phaethon*, the TROPIC-BIRD (*q.v.*), he would place with the "Laridés" and not with the "Falconidés," which it only resembles in its feet having all the toes connected by a web. Finally Divers, Auks, and Penguins, according to him, form the last term in the series, and it seems fit to him that they should be regarded as forming a separate Order. It is a curious fact that even at a date so late as this, and by an investigator so well informed, doubt should still have existed whether *Apteryx* (Krw., vol. xiv, p. 104) should be referred to the group containing the Cassowary and the Ostrich. On the whole the remarks of this esteemed author do not go much beyond such as might occur to any one who had made a study of a good series of specimens; but many of them are published for the first time, and the author is careful to insist on the necessity of not resting solely on sternal characters, but associating with them those drawn from other parts of the body. Three years later in the same journal (vol. xi, pp. 11-145, pls. 2-4) BLANCHARD published some *Recherches sur les caractères ostéologiques des Oiseaux* appliquées à la Classification naturelle de ces animaux, strongly urging the superiority of such characters over those drawn from the bill or feet, which, he remarks, though they have sometimes given correct notions, have mostly led to mistakes, and, if observations of habits and food have sometimes afforded happy results, they have often been deceptive; so that, should more be wanted than to draw up a mere inventory of creation or trace the distinctive outline of each species, zoology without anatomy would remain a barren study. At the same time he states that authors who have occupied themselves with the sternum alone have often produced uncertain results, especially when they have neglected its anterior for its posterior part; for in truth every bone of the skeleton ought to be studied in all its details. Yet this distinguished zoologist selects the sternum as furnishing the key to his primary groups or "Orders" of the Class, adopting, as Merrem had done long before, the same two divisions *Carinata* and *Ratix*, naming, however, the former *Tropidosternii* and the latter *Hemalosternii*.³ Some unkind fate has hitherto hindered him from making known to the world the rest of his researches in regard to the other bones of the skeleton till he reached the head, and in the memoir cited he treats of the sternum of only a portion of his first "Order." This is the more to be regretted by all ornithologists, since he intended to conclude with what to them would have been a very great boon—the shewing in what way external characters coincided with those presented by Osteology. It was also within the scope of his plan to have continued on a more extended scale the researches on ossification begun by L'Herminier, and thus M.

² Thus he cites the cases of *Machetes pugnaz* and *Scelopax rusticola* among the "Limicoles," and *Larus catarractes* among the "Laridés," as differing from their nearest allies by the possession of only one "notch" on either side of the keel. Several additional instances are cited in *Philos. Transactions*, 1859, p. 337, note.

³ These terms were explained in his great work *L'Organisation du Règne Animal, Oiseaux* (p. 16), begun in 1855, and still (1884) no further advanced than its fourth part, comprehending in all but thirty-two pages of letter-press, to mean exactly the same as those applied by Merrem to his two primary divisions.

¹ A much more extensive and detailed application of his method was begun by Prof. Cabanis in the *Museum Heinemannianum*, a very useful catalogue of specimens in the collection of Herr Oberamtman Heine, of which the first part was published at Halberstadt in 1850, and the last which has appeared, the work being still unfinished, in 1863.

Bonaparte.

Hogg.

Newman.

Blanchard's investigations, if completed, would obviously have taken extraordinarily high rank among the highest contributions to ornithology. As it is, so much of them as we have are of considerable importance; for, in this unfortunately unfinished memoir, he describes in some detail the several differences which the sternum in a great many different groups of his *Tropidosterni* presents, and to some extent makes a methodical disposition of them accordingly. Thus he separates the Birds-of-Prey into three great groups—(1) the ordinary Diurnal forms, including the *Falconidae* and *Falculidae* of the systematist of his time, but distinguishing the American Vultures from those of the Old World; (2) *Gypogeoranus*, the SECRETARY-BIRD (*q.v.*); and (3) the Owls (*infra*, p. 83). Next he places the PARROTS (*q.v.*), and then the vast assemblage of "Passereaux"—which he declares to be all of one type, even genera like *Pipra* (MANAKIN, vol. xv. p. 455) and *Ptila*—and concludes with the somewhat heterogeneous conglomeration of forms, beginning with *Cypselus* (SWIFT, *q.v.*), to so many systematists have been accustomed to call *Picaria*, though to them as a group he assigns no name. A continuation of the treatise was promised in a succeeding part of the *Annales*, but a quarter of a century has passed without its appearance.

Important as are the characters afforded by the sternum, that bone even with the whole sternal apparatus should obviously not be considered alone. To aid ornithologists in their studies in this respect, EYTON, who for many years has been forming a collection of Birds' skeletons, began the publication of a series of plates representing them. The first part of this work, *Osteologia Avium*, appeared early in 1859, and a volume was completed in 1867. A Supplement was issued in 1869, and a Second Supplement, in three parts, between 1873 and 1875. The whole work contains a great number of figures of Birds' skeletons and detached bones; but they are not so drawn as to be of much practical use, and the accompanying letter-press is too brief to be satisfactory.

That the eggs laid by Birds should offer to some extent characters of utility to systematists is only to be expected, when it is considered that those from the same nest generally bear an extraordinary family-likeness to one another, and also that in certain groups the essential peculiarities of the egg-shell are constantly and distinctively characteristic. Thus no one who has ever examined the egg of a Duck or of a Tinamou would ever be in danger of not referring another Tinamou's egg or another Duck's, that he might see, to its proper Family, and so on with many others. Yet, as has been stated on a former occasion (BIRDS, vol. iii. p. 772), the expectation held out to oologists, and by them, of the benefits to be conferred upon Systematic Ornithology from the study of Birds' eggs, so far from being fulfilled, has not unfrequently led to disappointment. But at the same time many of the shortcomings of Oology in this respect must be set down to the defective information and observation of its votaries, among whom some have been very lax, not to say incautious, in not ascertaining on due evidence the parentage of their specimens, and the author next to be named is open to this charge. After several minor notices that appeared in journals at various times, DES MURS in 1860 brought out at Paris his ambitious *Traité général d'Oologie Ornithologique au point de vue de la Classification*, which contains (pp. 529-538) a "Systema Oologicum" as the final result of his labours. In this scheme Birds are arranged according to what the author considered to be their natural method and sequence; but the result exhibits some unions as ill-assorted as can well be met with in the whole range of tentative arrangements of the Class, together with some very unjustifiable divorces. Its basis is the classification of Cuvier, the modifications of which by Des Murs will seldom commend themselves to systematists whose opinion is generally deemed worth having. Few, if any, of the faults of that classification are removed, and the improvements suggested, if not established by his successors, those especially of other countries than France, are ignored, or, as is the case with some of those of L'Herminier, are only cited to be set aside. Oologists have no reason to be thankful to Des Murs, notwithstanding his zeal in behalf of their study. It is perfectly true that in several or even in many instances he acknowledges and deprecates the poverty of his information, but this does not excuse him for making assertions (and such assertions are not unfrequent) based on evidence that is either wholly untrustworthy or needs further enquiry before it can be accepted (*Ibis*, 1860, pp. 331-335). This being the case, it would seem useless to take up further space by analysing the several proposed modifications of Cuvier's arrangement. The great merit of the work is that the author shews the necessity of taking Oology into account when investigating the classification of Birds; but it also proves that in so doing the paramount consideration lies in the thorough sifting of evidence as to the parentage of the eggs which are to serve as the building stones of the fabric to be erected. The attempt of Des Murs was

praiseworthy; but in effect it has utterly failed, notwithstanding the encomiums passed upon it by friendly critics (*Rev. de Zoologie*, 1860, pp. 176-183, 313-325, 370-373).²

Until about this time systematists, almost without exception, may be said to have been wandering with no definite purpose. At least their purpose was indefinite compared with that which they now have before them. No doubt they all agreed in saying that they were prosecuting a search for what they called the True System of Nature; but that was nearly the end of their agreement, for in what that True System consisted the opinions of scarcely any two would coincide, unless to own that it was some shadowy idea beyond the present power of mortals to reach or even comprehend. The Quinarians, who boldly asserted that they had fathomed the mystery of Creation, had been shewn to be no wiser than other men, if indeed they had not utterly befooled themselves; for their theory at best could give no other explanation of things than that they were because they were. The conception of such a process as has now come to be called by the name of Evolution was certainly not novel; but except to two men the way in which that process was or could be possible had not been revealed.³ Here there is no need to enter into details of the history of Evolution; but the annalist in every branch of Biology must record the eventful 1st of July 1859, when the now celebrated views of DARWIN and Mr WALLACE were first laid before the scientific world,⁴ and must also notice the appearance towards the end of the following year of the former's *Origin of Species*, which has effected the greatest revolution of human thought in this or perhaps in any century. The majority of biologists who had schooled themselves on other principles were of course slow to embrace the new doctrine; but their hesitation was only the natural consequence of the caution which their scientific training enjoined. A few there were who felt as though scales had suddenly dropped from their eyes, when greeted by the idea conveyed in the now familiar phrase "Natural Selection"; but even those who had hitherto believed, and still continued to believe, in the sanctity of "Species" at once perceived that their life-long study had undergone a change, that their old position was seriously threatened by a perilous siege, and that to make it good they must find new means of defence. Many bravely maintained their posts, and for them not a word of blame ought to be expressed. Some few pretended, though the contrary was notorious, that they had always been on the side of the new philosophy, so far as they allowed it to be philosophy at all, and for them hardly a word of blame is too severe. Others after due deliberation, as became men who honestly desired the truth and nothing but the truth, yielded wholly or almost wholly to arguments which they gradually found to be irresistible. But, leaving generalities apart, and restricting ourselves to what is here our proper business, there was possibly no branch of Zoology in which so many of the best informed and consequently the most advanced of its workers sooner accepted the principles of Evolution than Ornithology, and of course the effect upon its study was very marked. New spirit was given to it. Ornithologists now felt they had something before them that was really worth investigating. Questions of Affinity, and the details of Geographical Distribution, were endowed with a real interest, in comparison with

² In this historical sketch of the progress of Ornithology it has not been thought necessary to mention other oological works, since they have not a taxonomic bearing, and the chief of them have been already named (BIRDS, vol. iii. p. 774, note 1).

³ Neither Lamarck nor Robert Chambers (the now acknowledged author of *Vestiges of Creation*), though thorough evolutionists, rationally indicated any means whereby, to use the old phrase, "the transmutation of species" could be effected.

⁴ *Journal of the Proceedings of the Linnean Society*, vol. iii., Zoology, pp. 45-62.

¹ M. Blanchard's animal-versions on the employment of external characters, and on trusting to observations on the habits of Birds, called forth a rejoinder from Mr Wallace (*Ibis*, 1864, pp. 36-41), who successfully shewed that they are not altogether to be despised.

which any interest that had hitherto been taken was a trifling pastime. Classification assumed a wholly different aspect. It had up to this time been little more than the shuffling of cards, the ingenious arrangement of counters in a pretty pattern. Henceforward it was to be the serious study of the workings of Nature in producing the beings we see around us from beings more or less unlike them, that had existed in bygone ages and had been the parents of a varied and varying offspring—our fellow-creatures of today. Classification for the first time was something more than the expression of a fancy, not that it had not also its imaginative side. Men's minds began to figure to themselves the original type of some well-marked genus or Family of Birds. They could even discern dimly some generalized stock whence had descended whole groups that now differed strangely in habits and appearance—their discernment aided, may be, by some isolated form which yet retained undeniable traces of a primitive structure. More dimly still visions of what the first Bird may have been like could be reasonably entertained; and, passing even to a higher antiquity, the Reptilian parent whence all Birds have sprung was brought within reach of man's consciousness. But, relieved as it may be by reflexions of this kind—dreams some may perhaps still call them—the study of Ornithology has unquestionably become harder and more serious; and a corresponding change in the style of investigation, followed in the works that remain to be considered, will be immediately perceptible.

That this was the case is undeniably shewn by some remarks of Canon TRISTRAM, who, in treating of the *Alaudide* and *Saxicolina* of Algeria (whence he had recently brought a large collection of specimens of his own making), stated (*Ibis*, 1859, pp. 429-433) that he could "not help feeling convinced of the truth of the views set forth by Messrs Darwin and Wallace," adding that it was "hardly possible, I should think, to illustrate this theory better than by the Larks and Chats of North Africa." It is unnecessary to continue the quotation; the few words just cited are enough to assure to their author the credit of being (so far as is known) the first ornithological specialist who had the courage publicly to recognize and receive the new and at that time unpopular philosophy.¹ But greater work was at hand. In June 1860 Prof. PARKER broke, as most will allow, entirely fresh ground, and ground that he has since continued to till more deeply perhaps than any other zoologist, by communicating to the Zoological Society a memoir "On the Osteology of *Balaniceps*," subsequently published in that Society's *Transactions* (iv. pp. 269-351). Of this contribution to science, as of all the rest which have since proceeded from him, may be said in the words he himself has applied (*loc. cit. supra*, p. 271) to the work of another labourer in a not distant field:—"This is a model paper for unbiassed observation, and freedom from that pleasant mode of supposing instead of ascertaining what is the true nature of an anatomical element."² Indeed the study of this memoir, limited though it be in scope, could not fail to convince any one that it proceeded from the mind of one who taught with the authority derived directly from original knowledge, and not from association with the scribes—a conviction that has become strengthened as, in a series of successive memoirs, the stores of more than twenty years' silent observation and unremitting research

were unfolded, and, more than that, the hidden forces of the science of Morphology were gradually brought to bear upon almost each subject that came under discussion. These different memoirs, being technically monographs, have strictly no right to be mentioned in this place; but there is scarcely one of them, if one indeed there be, that does not deal with the generalities of the study; and the influence they have had upon contemporary investigation is so strong that it is impossible to refrain from noticing them here, though want of space forbids us from enlarging on their contents.³ Moreover, the doctrine of Descent with variation is preached in all—seldom, if ever, conspicuously, but perhaps all the more effectively on that account. There is no reflective thinker but must perceive that Morphology is the lamp destined to throw more light than that afforded by any other kind of study on the obscurity that still shrouds the genealogy of Birds as of other animals; and, though as yet its illuminating power is admittedly far from what is desired, it has perhaps never shone more brightly than in Prof. Parker's hands. The great fault of his series of memoirs, if it may be allowed the present writer to criticize them, is the indifference of their author to formulating his views, so as to enable the ordinary taxonomer to perceive how far he has got, if not to present him with a fair scheme. But this fault is possibly one of those that are "to merit near allied," since it would seem to spring from the author's hesitation to pass from observation to theory, for to theory at present belong, and must for some time belong, all attempts at Classification. Still it is not the less annoying and disappointing to the systematist to find that the man whose life-long application would enable him, better than any one else, to declare the effect of the alliances and differences that have been shewn to exist among various members of the Class should yet be so reticent, or that when he speaks he should rather use the language of Morphology, which those who are not morphologists find difficult of correct interpretation, and wholly inadequate to allow of zoological deductions.⁴

³ It may be convenient to our readers that a list of Prof. Parker's works which treat of ornithological subjects, in addition to the two above mentioned, should here be given. They are as follows:—In the Zoological Society's *Transactions*, 25th November 1862, "On the Osteology of the Gallinaceous Birds and Tinamous," v. pp. 149-241; 12th December 1865, "On some fossil Birds from the Zebbug Cave," vi. pp. 119-124; 9th January 1868, "On the Osteology of the Kagu," vi. pp. 501-521; 18th February 1873, "On the Ægithognathus Birds," Pt. I. ix. pp. 289-352; 15th February 1876, "On the Skull of the Ægithognathus Birds," Pt. II. x. pp. 251-314. In the *Proceedings* of the same Society, 8th December 1863, "On the systematic position of the Crested Screamer," pp. 511-518; 28th February 1865, "On the Osteology of *Microglossa alecto*," pp. 235-238. In the *Philosophical Transactions of the Royal Society*, 9th March 1865, "On the Structure and Development of the Skull in the Ostrich Tribe," pp. 113-183; 11th February 1869, "On the Structure and Development of the Skull of the Common Fowl," pp. 755-807. In the *Linnean Society's Transactions*, 2d April 1874, "On the Morphology of the Skull in the Woodpeckers and Wrynecks," ser. 2, Zoology, i. pp. 1-22; 16th December 1875, "On the Structure and Development of the Bird's Skull," *tom. cit.*, pp. 99-154. In the *Monthly Microscopical Journal* for 1872, "On the Structure and Development of the Crow's Skull," pp. 217-253; for 1873, "On the Development of the Skull in the genus *Turdus*," pp. 102-107, and "On the Development of the Skull in the Tit and Sparrow Hawk," parts i. and ii., pp. 6-11, 45-50. There is besides the great work published by the Ray Society in 1868, *A Monograph on the Structure and Development of the Shoulder-girdle and Sternum*, of which pp. 142-191 treat of these parts in the Class Aves; and our readers will hardly need to be reminded of the article BIRDS in the present work (vol. iii. pp. 699-728). Nearly every one of this marvellous series of contributions is copiously illustrated by plates from drawings made by the author himself.

⁴ As an instance, take the passages in which *Turdus* and *Thinocorus* are apparently referred to the *Ægithognathus* (*Trans. Zool. Society*, ix. pp. 291 *et seq.*, and *supra*, vol. iii. p. 700), a view which, as shewn by the author (*Transactions*, x. p. 310), is not that really intended by him.

For some time past rumours of a discovery of the highest interest had been agitating the minds of zoologists, Wagner. for in 1861 ANDREAS WAGNER had sent to the Academy of Sciences of Munich (*Sitzungsberichte*, pp. 146-154; *Ann. Nat. History*, ser. 3, ix. pp. 261-267) an account of what he conceived to be a feathered Reptile (assigning to it the name *Griphosaurus*), the remains of which had been found in the lithographic beds of Solenhofen; but he himself, through failing health, had been unable to see the fossil. In 1862 the slabs containing the remains were acquired by the British Museum, and towards the end of that year Sir R. OWEN communicated a detailed description of them to the *Philosophical Transactions* (1863, pp. 33-47), proving their Bird-like nature, and referring them to the genus *Archæopteryx* of Hermann von Meyer, hitherto known only by the impression of a single feather from the same geological beds. Wagner foresaw the use that would be made of this discovery by the adherents of the new Philosophy, and, in the usual language of its opponents at the time, strove to ward off the "misinterpretations" that they would put upon it. His protest, it is needless to say, was unavailing, and all who respect his memory must regret that the sunset of life failed to give him that insight into the future which is poetically ascribed to it. To Darwin and those who believed with him scarcely any discovery could have been more welcome; but that is beside our present business. It was quickly seen—even by those who held *Archæopteryx* to be a Reptile—that it was a form intermediate between existing Birds and existing Reptiles—while those who were convinced by Sir R. Owen's researches of its ornithic affinity saw that it must belong to a type of Birds wholly unknown before, and one that in any future for the arrangement of the Class must have a special rank reserved for it.¹ It has been already briefly described and figured in this work (*Birds*, vol. iii. pp. 728, 729).

Lilljeborg.

It behoves us next to mention the "Outlines of a Systematic Review of the Class of Birds," communicated by Prof. LILLJEBORG to the Zoological Society in 1866, and published in its *Proceedings* for that year (pp. 5-20), since it was immediately after reprinted by the Smithsonian Institution, and with that authorization has exercised a great influence on the opinions of American ornithologists. Otherwise the scheme would hardly need notice here. This paper is indeed little more than an English translation of one published by the author in the annual volume (*Arsskrift*) of the Scientific Society of Upsala for 1860, and belonging to the pre-Darwinian epoch should perhaps have been more properly treated before, but that at the time of its original appearance it failed to attract attention. The chief merit of the scheme perhaps is that, contrary to nearly every precedent, it begins with the lower and rises to the higher groups of Birds, which is of course the natural mode of proceeding, and one therefore to be commended. Otherwise the "principles" on which it is founded are not clear to the ordinary zoologist. One of them is said to be "irritability," and, though this is explained to mean, not "muscular strength alone, but vivacity and activity generally,"² it does not seem to form a character that can be easily appreciated either as to quantity or quality; in fact, most persons would deem it quite immeasurable, and, as such, removed from practical consideration. Moreover, Prof. Lilljeborg's scheme, being actually an adaptation of that of Sundevall, of which we shall have to speak at some length almost immediately, may possibly be left for the present with these remarks.

Huxley.

In the spring of the year 1867 Prof. HUXLEY, to the delight of an appreciative audience, delivered at the Royal College of Surgeons of England a course of lectures on Birds, and it is much to be regretted that his many engagements hindered him from publishing in its entirety his elucidation of the anatomy of the Class, and the results

¹ This was done shortly afterwards by Prof. Hæckel, who proposed the name *Saurura* for the group containing it.

² On this ground it is stated that the *Passeres* should be placed highest in the Class. But those who know the habits and demeanour of many of the *Linnæidae* would no doubt rightly claim for them much more "vivacity and activity" than is possessed by most *Passeres*.

which he drew from his investigations of it; for never assuredly had the subject been attacked with greater skill and power, or, since the days Buffon, had Ornithology been set forth with greater eloquence. To remedy, in some degree, this unavoidable loss, and to preserve at least a portion of the fruits of his labours, Prof. Huxley, a few weeks after, presented an abstract of his researches to the Zoological Society, in whose *Proceedings* for the same year it will be found printed (pp. 415-472) as a paper "On the Classification of Birds, and on the taxonomic value of the modifications of certain of the cranial bones observable in that Class." Starting from the basis (which, undeniably true as it is, not a little shocked many of his ornithological hearers) "that the phrase 'Birds are greatly modified Reptiles' would hardly be an exaggerated expression of the closeness" of the resemblance between the two Classes, which he had previously brigaded under the name of *Sauropsida* (as he had brigaded the *Pisces* and *Amphibia* as *Ichthyopsida*), he drew in bold outline both their likenesses and their differences, and then proceeded to inquire how the *Aves* could be most appropriately subdivided into Orders, Suborders, and Families. In this course of lectures he had already dwelt at some length on the insufficiency of the characters on which such groups as had hitherto been thought to be established were founded; but for the consideration of this part of his subject there was no room in the present paper, and the reasons why he arrived at the conclusion that new means of philosophically and successfully separating the Class must be sought are herein left to be inferred. The upshot, however, admits of no uncertainty: the Class *Aves* is held to be composed of three "Orders"—(I.) SAURURÆ, Hæckel; (II.) RATITÆ, Merrem; and (III.) CARINATÆ, Merrem. The *Saururæ* have the metacarpals well developed and not encyclosed, and the caudal vertebrae are numerous and large, so that the caudal region of the spine is longer than the body. The furcula is complete and strong, the feet very Passerine in appearance. The skull and sternum were at the time unknown, and indeed the whole Order, without doubt entirely extinct, rested exclusively on the celebrated fossil, then unique, *Archæopteryx* (*Birds*, vol. iii. pp. 728, 729). The *Ratitæ* comprehend the Struthious Birds, which differ from all others now extant in the combination of several peculiarities, some of which have been mentioned in the preceding pages. The sternum has no keel, and ossifies from lateral and paired centres only; the axes of the scapula and coracoid have the same general direction; certain of the cranial bones have characters very unlike those possessed by the next Order—the vomer, for example, being broad posteriorly and generally intervening between the basisphenoidal rostrum and the palatals and pterygoids; the barbs of the feathers are disconnected; there is no syrinx or inferior larynx; and the diaphragm is better developed than in other Birds.³ The *Ratitæ* are divided into five groups, separated by very trenchant characters, principally osteological, and many of them afforded by the cranial bones. These groups consist of (i.) *Struthio* (OSTRICH, *infra*, p. 62), (ii.) RHEA (*q. v.*), (iii.) *Casuarus* and *Dromæus* (EMEU, vol. viii. 171), (iv.) *Dinornis*, and (v.) *Apteryx* (KIWI, vol. xiv. p. 104); but no names are here given to them. The *Carinatae* comprise all other existing Birds. The sternum has more or less of a keel, and is said to ossify, with the possible exception of *Strigops* (KAKAPO, vol. xiii. p. 825), from a median centre as well as from paired and lateral centres. The axes of the scapula and coracoid meet at an acute, or, as in *Didus* (DODO, vol. vii. p. 321) and *Ocydromus* (OCYDROME, vol. xvii. p. 222), at a slightly obtuse angle, while the vomer is

³ This peculiarity had led some zoologists to consider the Struthious Birds more nearly allied to the *Mammalia* than any others.

comparatively narrow and allows the pterygoids and palatals to articulate directly with the basisphenoidal rostrum. The *Carinatæ* are divided, according to the formation of the palate, into four "Suborders," and named (i.) *Dromæognathæ*, (ii.) *Schizognathæ*, (iii.) *Desmognathæ*, and (iv.) *Ægithognathæ*.¹ The *Dromæognathæ* resemble the *Ratitæ*, and especially the genus *Dromæus*, in their palatal structure, and are composed of the TINAMOUS (*q.v.*). The *Schizognathæ* include a great many of the forms belonging to the Linnean Orders *Gallinæ*, *Grallæ*, and *Anseres*. In them the vomer, however variable, always tapers to a point anteriorly, while behind it includes the basisphenoidal rostrum between the palatals; but neither these nor the pterygoids are borne by its posterior divergent ends. The maxillo-palatals are usually elongated and lamellar, uniting with the palatals, and bending backward along their inner edge, leave a cleft (whence the name given to the "Suborder") between the vomer and themselves. Six groups of *Schizognathæ* are distinguished with considerable minuteness:—(1) *Charadriomorphæ*, containing *Charadriidæ* (PLOVER, *q.v.*), *Otididæ* (BUSTARD, vol. iv. p. 578), and *Scolopaciidæ*; (2) *Geranomorphæ*, including *Gruidæ* (CRANE, vol. vi. p. 546) and *Rallidæ*, between which *Psophiidæ* and *Rhinocetidæ* are intermediate, while the *SERIEMA* (*q.v.*) would also seem to belong here; (3) *Coccomorphæ*, comprising *Laridæ* (GULL, vol. xi. p. 274), *Procellariidæ* (PETREL, *q.v.*), *Colymbidæ* (DIVER, vol. vii. p. 292), and *Alcidæ* (GUILLEMOT, vol. xi. p. 262); (4) *Spheniscormorphæ*, composed of the PENGUINS (*q.v.*); (5) *Alectoromorphæ* (FOWL, vol. ix. p. 491), being all the *Gallinæ* except the Tinamous; and finally (6) *Peristeromorphæ*, consisting of the DOVES (vol. vii. p. 379) and PIGEONS (*q.v.*). In the third of these Suborders, the *Desmognathæ*, the vomer is either abortive or so small as to disappear from the skeleton. When it exists it is always slender, and tapers to a point anteriorly. The maxillo-palatals are bound together (whence the name of the "Suborder") across the middle line, either directly or by the ossification of the nasal septum. The posterior ends of the palatals and anterior of the pterygoids articulate directly with the rostrum. The groups of *Desmognathæ* are characterized as carefully as are those of the preceding "Suborder," and are as follows:—(1) *Chenomorpha*, consisting of the *Anatidæ* (DUCK, vol. vii. p. 505; GOOSE, vol. x. p. 777) with *Palamedæ*, the SCREAMER (*q.v.*); (2) *Anaphimorphæ*, the FLAMINGOES (vol. ix. p. 286); (3) *Pelargomorphæ*, containing the *Ardeidæ* (HERON, vol. xi. p. 760), *Ciconiidæ* (STORK, *q.v.*), and *Tantalidæ*; (4) *Dysporomorphæ*, the CORMORANTS (vol. vi. p. 407), FRIGATE-BIRDS (vol. ix. p. 786), GANNETS (vol. x. p. 70), and PELICANS (*q.v.*); (5) *Aetomorphæ*, comprising all the Birds-of-Prey; (6) *Psittacomorphæ*, the PARROTS (*q.v.*); and lastly (7) *Coccygomorphæ*, which are held to include four groups, viz., (a) *Coliuidæ* (MOUSE-BIRD, vol. xvii. p. 6); (b) *Musoplagidæ* (PLANTAIN-EATERS and TOURNAKOS, *q.v.*); *Cuculidæ* (CUCKOW, vol. vi. p. 685), *Bucconidæ*, *Rhamphastidæ* (TOUCANS, *q.v.*), *Capitonidæ*, *Gabulidæ* (JACAMAR, vol. xiii. p. 531); (c) *Alcedinidæ* (KING-FISHER, xiv. p. 81), *Bucerotidæ* (HOENBILL, xii. p. 169), *Upupidæ* (HOOPOE, xii. p. 154), *Meropidæ*, *Momotidæ* (MOTMOT, xviii. p. 3), *Coraciidæ* (ROLLER, *q.v.*); and (d) *Trogonidæ* (TROGON, *q.v.*). Next in order come the *Celeomorphæ* or WOODPECKERS (*q.v.*), a group respecting the exact position of which Prof. Huxley was uncertain;²

though he inclined to think its relations were with the next group, *Ægithognathæ*, the fourth and last of his "Suborders," characterized by a form of palate in some respects intermediate between the two preceding. The vomer is broad, abruptly truncated in front, and deeply cleft behind, so as to embrace the rostrum of the sphenoid; the palatals have produced postero-external angles; the maxillo-palatals are slender at their origin, and extend obliquely inwards and forwards over the palatals, ending beneath the vomer in expanded extremities, not united either with one another or with the vomer, nor does the latter unite with the nasal septum, though that is frequently ossified. Of the *Ægithognathæ* two divisions are made—(1) *Cypselomorphæ*, including *Trochilidæ* (HUMMING-BIRD, vol. xii. p. 357), *Cypselidæ* (SWIFT, *q.v.*), and *Caprimulgidæ* (GOAT-STECKER, vol. x. p. 711); and (2) *Coracomorphæ*, which last are separable into two groups, one (a) formed of the genus *Menura* (LYRE-BIRD, vol. xv. p. 115), which then seemed to stand alone, and the other (b) made up of *Polymyodæ*, *Tracheophonæ*, and *Oligomyzodæ*, sections founded on the syringeal structure, but declared to be not natural.

The above abstract³ shows the general drift of this very remarkable contribution to Ornithology, and it has to be added that by far the greater number of his minor groups Prof. Huxley relies solely on the form of the palatal structure, the importance of which Dr. Cornay, as already stated (p. 29), had before urged, though to so little purpose. That the palatal structure must be taken into consideration by taxonomers as affording hints of some utility there can no longer be a doubt; but the present writer is inclined to think that the characters drawn thence owe more of their worth to the extraordinary perspicuity with which they have been presented by Prof. Huxley than to their own intrinsic value, and that if the same power had been employed to elucidate in the same way other parts of the skeleton—say the bones of the sternal apparatus or even of the pelvic girdle—either set could have been made to appear quite as instructive and perhaps more so. Adventitious value would therefore seem to have been acquired by the bones of the palate through the fact that so great a master of the art of exposition selected them as fitting examples upon which to exercise his skill.⁴ At the same time it must be stated this selection was not premeditated by Prof. Huxley, but forced itself upon him as his investigations proceeded.⁵ In reply to some critical remarks (*Ibis*, 1868, pp. 85–96), chiefly aimed at shewing the inexpediency of relying solely on one set of characters, especially when those afforded by the palatal bones were not, even within the limits of Families, wholly diagnostic, the author (*Ibis*, 1868, pp. 357–362) announced a slight modification of his original scheme, by introducing three more groups into it, and concluded by indicating how its bearings upon the great question of "Genetic Classification" might be represented so far as the different groups of *Carinatæ* are concerned:—

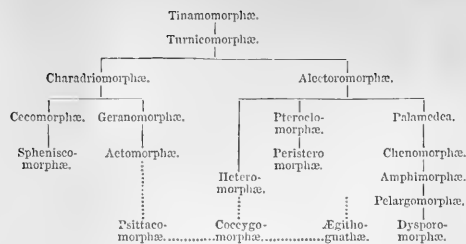
³ This is adapted from that given in the *Record of Zoological Literature* (iv. pp. 46–49), which is believed to have not inadequately represented the author's views.

⁴ The notion of the superiority of the palatal bones to all others for purposes of classification has pleased many persons, from the fact that these bones are not unfrequently retained in the dried skins of Birds sent home by collectors in foreign countries, and are therefore available for study, while such bones as the sternum and pelvis are rarely preserved. The common practice of ordinary collectors, until at least very recently, has been tersely described to the present writer as being to "shoot a bird, take off its skin, and throw away its characters."

⁵ Perhaps this may be partially explained by the fact that the Museum of the College of Surgeons, in which these investigations were chiefly carried on, like most other museums of the time, contained a much larger series of the heads of Birds than of their entire skeletons, or of any other portion of the skeleton. Consequently the materials available for the comparison of different forms consisted in great part of heads only.

¹ These names are compounded respectively of *Dromæus*, the generic name applied to the Emeu, *σχιζα*, a split or cleft, *δέμα*, a bond or tying, *αἰγίθια*, a Finch, and, in each case, *γνάθος*, a jaw.

² Prof. Parker subsequently advanced the Woodpeckers to a higher rank under the name of *Suxomorphæ* (*Monthly Microscop. Journal*, 1872, p. 219, and *Tr. Linn. Soc.*, ser. 2, Zoology, i. p. 2).



The above scheme, in Prof. Huxley's opinion, nearly represents the affinities of the various Carinate groups,—the great difficulty being to determine the relations to the rest of the *Coccygomorphæ*, *Psittacomorphæ*, and *Ægithognathæ*, which he indicated "only in the most doubtful and hypothetic fashion." Almost simultaneously with this he expounded more particularly before the Zoological Society, in whose *Proceedings* (1868, pp. 294-319) his results were soon after published, the groups of which he believed the *Alectoromorpha* to be composed and the relations to them of some outlying forms usually regarded as Gallinaceous, the *Tarnicidæ* and *Pterocidæ*, as well as the singular HOACTZIN (vol. xii. p. 28), for all three of which he had to institute new groups—the last forming the sole representative of his *Heteromorphæ*. More than this, he entered upon their Geographical Distribution, the facts of which important subject are here, almost for the first time, since the attempt of Blyth already mentioned,¹ brought to bear practically on Classification, as has been previously hinted (BIRDS, vol. iii. pp. 736, 737); but, that subject having been already treated at some length, there is no need to enter upon it here.

Nevertheless it is necessary to mention here the intimate connexion between Classification and Geographical Distribution as revealed by the paleontological researches of Prof. ALPHONSE MILNE-EDWARDS, whose magnificent *Oiseaux Fossiles de la France* began to appear in 1867, and was completed in 1871—the more so, since the exigencies of his undertaking compelled him to use materials that had been almost wholly neglected by other investigators. A large proportion of the fossil remains the determination and description of which was his object were what are very commonly called the "long bones," that is to say, those of the limbs. The recognition of these, minute and fragmentary as many were, and the referring them to their proper place, rendered necessary an attentive study of the comparative osteology and myology of Birds in general, that of the "long bones," whose sole characters were often a few muscular ridges or depressions, being especially obligatory. Hence it became manifest that a very respectable Classification can be found in which characters drawn from these bones play a rather important part. Limited by circumstances as is that followed by M. Milne-Edwards, the details of his arrangement do not require setting forth here. It is enough to point out that we have in his work another proof of the multiplicity of the factors which must be taken into consideration by the systematist, and another proof of the fallacy of trusting to one set of characters alone. But this is not the only way in which the author has rendered service to the advanced student of Orni-

¹ It is true that from the time of Bullen, though he scorned any regular Classification, Geographical Distribution had been occasionally held to have something to do with systematic arrangement; but the way in which the two were related was never clearly put forth, though people who could read between the lines might have guessed the secret from Darwin's *Journal of Researches*, as well as from his introduction to the *Zoology of the "Beagle" Voyage*.

thology. The unlooked-for discovery in France of remains which he has referred to forms now existing it is true, but existing only in countries far removed from Europe, forms such as *Collocalia*, *Leptosomus*, *Psittacus*, *Serpentarius*, and *Trogon*, is perhaps even more suggestive than the finding that France was once inhabited by forms that are wholly extinct, of which, as has been already mentioned (BIRDS, vol. iii. pp. 730, 731), in the older formations there is abundance. Unfortunately none of these, however, can be compared for singularity with *Archæopteryx* or with some American fossil forms next to be noticed, for their particular bearing on our knowledge of Ornithology will be most conveniently treated here.

In November 1870 Prof. MARSH, by finding the im-Marsh. perfect fossilized tibia of a Bird in the Middle Cretaceous shale of Kansas, began a series of wonderful discoveries which will ever be associated with his name,² and, making us acquainted with a great number of forms long since vanished from among the earth's inhabitants, has thrown a comparatively broad beam of light upon the darkness that, broken only by the solitary spark emitted on the recognition of *Archæopteryx*, had hitherto brooded over our knowledge of the genealogy of Birds, and is even now for the most part palpable. Subsequent visits to the same part of North America, often performed under circumstances of discomfort and occasionally of danger, brought to this intrepid and energetic explorer the reward he had so fully earned. Brief notices of his spoils appeared from time to time in various volumes of the *American Journal of Science and Arts* (Silliman's), but it is unnecessary here to refer to more than a few of them. In that *Journal* for May 1872 (ser. 3, iii. p. 360) the remains of a large swimming Bird (nearly 6 feet in length, as afterwards appeared) having some affinity, it was thought, to the *Columbidæ* were described under the name of *Hesperornis regalis*, and a few months later (iv. p. 344) a second fossil Bird from the same locality was indicated as *Ichthyornis dispar*—from the fish-like, biconcave form of its vertebrae. Further examination of the enormous collections gathered by the author, and preserved in the Museum of Yale College at New Haven in Connecticut, shewed him that this last Bird, and another to which he gave the name of *Apatornis*, had possessed well-developed teeth implanted in sockets in both jaws, and induced him to establish (v. pp. 161, 162) for their reception a "Subclass" *Odontornithes* and an Order *Ichthyornithes*. Two years more and the originally found *Hesperornis* was discovered also to have teeth, but these were inserted in a groove. It was accordingly regarded as the type of a distinct Order *Odontolex* (x. pp. 403-408), to which were assigned as other characters vertebrae of a saddle-shape and not biconcave, a keelless sternum, and wings consisting only of the humerus. In 1880 Prof. Marsh brought out a grand volume, *Odontornithes*, being a monograph of the extinct toothed Birds of North America. Herein remains, attributed to no fewer than a score of species, which were referred to eight different genera, are fully described and sufficiently illustrated, and, instead of the ordinal name *Ichthyornithes* previously used, that of *Odontornithes* was proposed. In the author's concluding summary he remarks on the fact that, while the *Odontolex*, as exhibited in *Hesperornis*, had teeth inserted in a continuous groove—a low and generalized character as shewn by Reptiles, they had, however, the strongly differentiated saddle-shaped vertebrae such as all modern Birds possess. On the other hand the *Odontornithes*, as exemplified in *Ichthyornis*, having the primitive biconcave vertebrae, yet possessed the highly

² It will of course be needless to remind the general zoologist of Prof. Marsh's no less wonderful discoveries of wholly unlooked-for types of Reptiles and Mammals.

specialized feature of teeth in distinct sockets. *Hesperornis* too, with its keelless sternum, had aborted wings but strong legs and feet adapted for swimming, while *Ichthyornis* had a keeled sternum and powerful wings, but diminutive legs and feet. These and other characters separate the two forms so widely as quite to justify the establishment of as many Orders for their reception, and the opposite nature of the evidence they afford illustrates one fundamental principle of evolution, namely, that an animal may attain to great development of one set of characters and at the same time retain other features of a low ancestral type. Prof. Marsh states that he had fully satisfied himself that *Archæopteryx* belonged to the *Odontornithes*, which he thought it advisable for the present to regard as a Subclass, separated into three Orders—*Odontolea*, *Odontornis*, and *Saurux*—all well marked, but evidently not of equal rank, the last being clearly much more widely distinguished from the first two than they are from one another. But that these three oldest-known forms of Birds should differ so greatly from each other unmistakably points to a great antiquity for the Class. All are true Birds; but the Reptilian characters they possess converge towards a more generalized type. He then proceeds to treat of the characters which may be expected to have occurred in their common ancestor, whose remains may yet be hoped for from the Palæozoic rocks if not from the Permian beds that in North America are so rich in the fossils of a terrestrial fauna. Birds, he believes, branched off by a single stem, which gradually lost its Reptilian as it assumed the Ornithic type; and in the existing *Ratitæ* we have the survivors of this direct line. The lineal descendants of this primal stock doubtless at an early time attained feathers and warm blood, but, in his opinion, never acquired the power of flight, which probably originated among the small arboreal forms of Reptilian Birds. In them even rudimentary feathers on the fore-limbs would be an advantage, as they would tend to lengthen a leap from branch to branch, or break the force of a fall in leaping to the ground. As the feathers increased, the body would become warmer and the blood more active. With still more feathers would come increased power of flight as we see in the young Birds of to-day. A greater activity would result in a more perfect circulation. A true Bird would doubtless require warm blood, but would not necessarily be hot-blooded, like the Birds now living. Whether *Archæopteryx* was on the true Carinate line cannot as yet be determined, and this is also true of *Ichthyornis*; but the biconcave vertebrae of the latter suggest its being an early offshoot, while it is probable that *Hesperornis* came off from the main "Struthious" stem and has left no descendants.

Bold as are the speculations above summarized, there seems no reason to doubt the probability of their turning out to be, if not the exact truth, yet something very like it.

From this bright vision of the poetic past—a glimpse, some may call it, into the land of dreams—we must relapse into a sober contemplation of the prosaic present—a subject quite as difficult to understand. The former efforts at classification made by Sundevall have already several times been mentioned, and a return to their consideration was promised. In 1872 and 1873 he brought out at Stockholm a *Methodi Naturalis Avium Dispositionum Tentamen*, two portions of which (those relating to the Diurnal Birds-of-Prey and the "*Cichlomorpha*," or forms related to the Thrushes) he found himself under the necessity of revising and modifying in the course of 1874, in as many communications to the Swedish Academy of Sciences (*K. V.-Ak. Förhandlingar*, 1874, No. 2, pp. 21-30; No. 3, pp. 27-30). This *Tentamen*, containing the

latest complete method of classifying Birds in general, has naturally received much attention, the more so perhaps, since, with its appendices, it was nearly the last labour of its respected author, whose industrious life came to an end in the course of the following year. From what has before been said of his works it may have been gathered that, while professedly basing his systematic arrangement of the groups of Birds on their external features, he had hitherto striven to make his schemes harmonize if possible with the dictates of internal structure as evinced by the science of anatomy, though he uniformly and persistently protested against the inside being better than the outside. In thus acting he proved himself a true follower of his great countryman Linnæus; but, without disparagement of his efforts in this respect, it must be said that when internal and external characters appeared to be in conflict he gave, perhaps with unconscious bias, a preference to the latter, for he belonged to a school of zoologists whose natural instinct was to believe that such a conflict always existed. Hence his efforts, praiseworthy as they were from several points of view, and particularly so in regard to some details, failed to satisfy the philosophic taxonomer when generalizations and deeper principles were concerned, and in his practice in respect of certain technicalities of classification he was, in the eyes of the orthodox, a transgressor. Thus instead of contenting himself with terms that had met with pretty general approval, such as Class, Subclass, Order, Suborder, Family, Subfamily, and so on, he introduced into his final scheme other designations, "Agmen," "Cohors," "Phalanx," and the like, which to the ordinary student of Ornithology convey an indefinite meaning, if any meaning at all. He also carried to a very extreme limit his views of nomenclature, which were certainly not in accordance with those held by most zoologists, though this is a matter so trifling as to need no details in illustration. It is by no means easy to set forth briefly, and at the same time intelligibly, to any but experts, the final scheme of Sundevall, owing to the number of new names introduced by him, nevertheless the attempt must be made; but it must be understood that in the following paradigm, in which his later modifications are incorporated, only the most remarkable or best-known forms are cited as examples of his several groups, for to give the whole of them would, if any explanations were added, occupy far more space than the occasion seems to justify, and without such explanations the list would be of use only to experts, who would rather consult the original work.

First, Sundevall would still make two grand divisions ("Agmina") of Birds, even as had been done nearly forty years before; but, having found that the names, *Altrices* and *Præcoes*, he had formerly used were not always applicable, or the groups thereby indicated naturally disposed, he at first distinguished them as *Psitopædes* and *Ptilopædes*. Then, seeing that the great similarity of these two words would produce confusion both in speaking and writing, he changed them (p. 158) into the equivalent *Gymnopædes* and *Dasyopædes*, according as the young were hatched naked or clothed. The *Gymnopædes* are divided into two "Orders"—*Oscines* and *Volucres*—the former intended to be identical with the group of the same name established by older authors, and, in accordance with the observations of Keyserling and Blasius already mentioned, divided into two "Series"—*Laminiplantares*, having the hinder part of the "tarsus" covered with two horny plates, and *Scutelliplantares*, in which the same part is scutellated. These *Laminiplantares* are composed of six Cohorts as follows:—

Cohors 1. *Cichlomorphæ*.

Phalanx 1. *Oceatæ*.—7 Families: the Nightingales standing first, and therefore at the head of all Birds, with the Redbreast, Redstart, and the American Blue-bird; after them the Chats,

Thrushes proper, Dippers, Water-Chats (*Heleiaurus*), Bush-Chats, and (under the name of *Euclyptus*) the singular group commonly known as Pittas or Water-Thrushes.

Phalanx 2. *Novempennatae*.—6 Families: Pipits, Wagtails, American Fly-catching Warblers, and Australian Diamond-birds (*Parulotus*).

Phalanx 3. *Sylviiformes*.—17 Families: divided geographically (3) into two groups—the Old-World forms, and those of the New. The first is further broken up into three sections—(a) 4 Families with moderately long wings and a slender bill, containing what may be called perhaps the normal Warblers, as the Willow-Wrens, Whitethroats, Sedge-birds, and others; (b) 5 Families, with short wings and a slender bill, what are often called by Indian and African writers Bush-babblers (*Eudryops*, *Gratopus*, and others); (c) 3 Families, with a somewhat stout or blunt bill, the Thick-heads of some writers (*Pachycephalus*) and Timouze Family. The second or American group comprehends 5 Families, Vireos, Cat-birds, Wrens (not, by the way, peculiar to America), and some other forms for which it is impossible to find names that will pass as English.

Phalanx 4. *Brachyptera*.—3 Families: the short-winged Wren-warblers, with long tails, of the Australian (*Malurus*), Indian, and Ethiopian Regions.

Phalanx 5. *Latirostris*.—7 Families: the true Flycatchers (*Muscicapæ*), and several others of fly-catching habits.

Phalanx 6. *Brachypteres*.—8 Families: Waxwings, Orioles, Swallow-Flycatchers (*Artamus*), Caterpillar-catchers (*Campophaga*), and Drongos (*Dicrurus*).

Phalanx 7. *Dentirostris* or *Laniiformes*.—3 Families: Shrikes, Puff-backed Shrikes.

Phalanx 8. *Subcorviformes*.—1 Family: Bower-birds and some others.

Cohors 2. *Contirostris*.

Phalanx 1. *Decempennatae*.—3 Families: Weaver-birds (*Ploceus*), Whydah-birds (*Vidua*), and Hedge-Sparrows (*Acanthop.*).

Phalanx 2. *Amphipodales*.—2 Families: Grosbeaks, true Finches.

Phalanx 3. *Arctipalatales*.—6 Families: Crossbills, Buntings, Rice-birds, and many hard-billed forms which are usually placed among the Tanagers.

Phalanx 4. *Stimplicirostris*.—4 Families: Tanagers.

Cohors 3. *Columbomorphæ*.

Phalanx 1. *Novempennatae*.—3 Families: Grackles or American Starlings.

Phalanx 2. *Humilinaris*.—4 Families: True Starlings, Oxpeckers, Choughs.

Phalanx 3. *Altinaves*.—3 Families: Nuthatches, Jays, Crows.

Phalanx 4. *Idiodactylæ*.—5 Families: Crow-Shrikes, Birds-of-Paradise.

Cohors 4. *Certhiomorphæ*.—3 Families: Tree-creepers, Nuthatches.

Cohors 5. *Cyaniprimorphæ*.—5 Families: Sun-birds, Honey-suckers.

Cohors 6. *Chelidonomorphæ*.—1 Family: Swallows.

The *Scatellipalatales* include a much smaller number of forms, and, with the exception of the first "Cohort" and a few groups of the fourth and fifth, all are peculiar to America.

Cohors 1. *Holospideæ*.—2 Families: Larks, Hoopoes.

Cohors 2. *Endispideæ*.—3 Families—all Neotropical: Oven-birds (*Parnaxius*), *Synalaxis*, and the Piculets (*Dendrocolaptes*).

Cohors 3. *Euspidæ*.—4 Families: the first two separated as *Lysodactylæ*, including the King-birds or Tyrants, of which twelve groups are made; the remaining two as *Synodactylæ*, composed of the Todies and Manakins.

Cohors 4. *Pycnospidæ*.—3 Families: Cocks-of-the-Rock (*Rupicola*), to which the Indian genus *Calyptomena*, *Eurylaimus*, and some others are supposed to be allied, the Chatterers and Fruit-Crows (*Chasmorhynchus*, *Cephalopterus*, and others), as well as *Tityra* and *Lipaugus*.

Cohors 5. *Pycnospidæ*.—5 Families: the very singular Madagascar form *Phlegulus*; the Bush-Shrikes (*Thamnopithecus*), Ant-Thrushes (*Formicarius*), and Tapaculos (*Petrochelidon*) of the Neotropical Region; and the Australian Lyre-bird.

We then arrive at the Second Order *Falcores*, which is divided into two "Series." Of these the first is made to contain, under the name *Zygodactyli*,

Cohors 1. *Psittaci*.—6 Families: Parrots;

Cohors 2. *Picæ*.—6 Families: Woodpeckers, Piculets (*Picumnus*), and Wrenpecks;

Cohors 3. *Coccygæ*.—12 Families: divided into two groups—(1) *Altinaves*, containing the Honey-Guides, Harbets, Tonnans, Jacanars, Puff-birds, and the Madagascar genus *Leposomus*; and (2) *Humilinaris*, comprising all the forms commonly known as *Cuculida*, broken up, however, into three sections;

while to the second "Series" are referred, as *Anisodactyli*,

Cohors 4. *Cenomorphae*.—4 Families: Plantain-eaters or Touraous, Mouse-birds, Rollers, and the peculiar Madagascar forms *Atelornis* and *Brachypteracias*;

Cohors 5. *Amphigularis*.—1 Families: Trogons, Goatsuckers, and Swifts;

Cohors 6. *Longilingues* or *Mellisugæ*.—12 Families: Humming-birds, arranged in three "Series";

Cohors 7. *Synodactylæ*.—4 Families: Bee-eaters, Motmots, Kingfishers, and Hornbills;

Cohors 8. *Peristiroideæ*.—3 Families: *Didunculus*, with the Dodo, Pigeons, and the Crowned Pigeons (*Goura*) separated from the last.

The *Dasypteres* of Sundevall are separated into six "Orders"; but these will occupy us but a short while. The first of them, *Accipitres*, comprehending all the Birds-of-Prey, were separated into 4 "Cohorts" in his original work, but these were reduced in his appendix to two—*Nyctarhages* or Owls with 4 Families divided into 2 series, and *Heomeroarhages* containing all the rest, and comprising 10 Families (the last of which is the Sericima, *Dicholophus*) divided into 2 groups as *Rapaces* and *Saprophagi*—the latter including the Vultures. Next stands the Order *Gallinæ* with 4 "Cohorts":—(1) *Tetraonomorphae*, comprising 2 Families, the Sand-Grouse (*Pterocles*) and the Grouse proper, among which the Central-American *Oreophastis* finds itself; (2) *Phasianomorphae*, with 4 Families, Pheasants, Peacocks, Turkeys, Guinea Fowls, Partridges, Quails, and Hemipodes (*Turnix*); (3) *Macronyches*, the Megapodes, with 2 Families; (4) the *Duodempennatae*, the Curassows and Guans, also with 2 Families; (5) the *Strattoniformes*, composed of the Tinamous; and (6) the *Subgrallatores* with 2 Families, one consisting of the curious South-American genera *Thinocorus* and *Attagis* and the other of the Sheathbill (*Chionis*). The Fifth Order (the third of the *Dasypteres*) is formed by the *Grallatores*, divided into 2 "series"—(1) *Altinaves*, consisting of 2 "Cohorts," *Iherodii* with 1 Family, the Herons, and *Pelargi* with 4 Families, Spoonbills, Ibises, Storks, and the Umbre (*Scopus*), with *Balaniceps*; (2) *Humilinaris*, also consisting of 2 "Cohorts," *Limicola* with 2 Families, Sandpipers and Snipes, Stilts and Avocets, and *Cursores* with 8 Families, including Plovers, Bustards, Cranes, Rails, and all the other "Waders." The Sixth Order, *Natatores*, consists of all the Birds that habitually swim and a few that do not, containing 6 Cohorts:—*Longipennes* and *Pygopodes* with 3 Families each; *Tatipalmatae* with 1 Family; *Tubinaves* with 3 Families; *Impennes* with 1 Family, Penguins; and *Lamellirostris* with 2 Families, Flamingoes and Ducks. The Seventh Order, *Proceres*, is divided into 2 Cohorts—*Veri* with 2 Families, Ostriches and Emeus; and *Subnobiles*, consisting of the genus *Apteryx*. The Eighth Order is formed by the *Sauravæ*.

Such then is Sundevall's perfected system, which has in various quarters been so much praised, and has been partially recognized by so many succeeding writers, that it would have been impossible to pass it over here, though the present writer is confident that the best-informed ornithologists will agree with him in thinking that the compilation of the above abstract has been but so much waste of time, and its insertion here but so much waste of space. Without, however, some such abstract its shortcomings could not be made apparent, and it will be seen to what little purpose so many able men have laboured if arrangement and grouping so manifestly artificial—the latter often of forms possessing no real affinity—can pass as a natural method. We should be too sanguine to hope that it may be the last of its kind, yet any one accustomed to look deeper than the surface must see its numerous defects, and almost every one, whether so accustomed or not, ought by its means to be brought to the conclusion that, when a man of Sundevall's knowledge and experience

could not, by trusting only to external characters, do better than this, the most convincing proof is afforded of the inability of external characters alone to produce anything save ataxy. The principal merits it possesses are confined to the minor arrangement of some of the *Oscines*; but even here many of the alliances, such, for instance, as that of *Pitta* with the true Thrushes, are indefensible on any rational grounds, and some, as that of *Accentor* with the Weaver-birds and Whydah-birds, verge upon the ridiculous, while on the other hand the interpolation of the American Fly-catching Warblers, *Mniotiltidae*, between the normal Warblers of the Old World and the Thrushes is as bad—especially when the genus *Mniotilta* is placed, notwithstanding its different wing-formula, with the Tree-creepers, *Certhiidae*. The whole work unfortunately betrays throughout an utter want of the sense of proportion. In many of the large groups the effect of very slight differences is to keep the forms exhibiting them widely apart, while in most of the smaller groups differences of far greater kind are overlooked, so that the forms which present them are linked together in more or less close union. Thus, regarding only external characters, great as is the structural distinction between the Gannets, Cormorants, Frigate-birds, and Pelicans, it is not held to remove them from the limits of a single Family; and yet the Thrushes and the Chats, whose distinctions are barely sensible, are placed in separate Families, as are also the Chats and the Nightingales, wherein no structural distinctions at all can be traced. Again, even in one and the same group the equalization of characters indicative of Families is wholly neglected. Thus among the Pigeons the genera *Didus* and *Didunculus*, which differ, so far as we know it, in every external character of their structure, are placed in one Family, and yet on the slightest pretext the genus *Goura*, which in all respects so intimately resembles ordinary Pigeons, is set apart as the representative of a distinct Family. The only use of dwelling upon these imperfections here is the hope that thereby students of Ornithology may be induced to abandon the belief in the efficacy of external characters as a sole means of classification, and, by seeing how unmanageable they become unless checked by internal characters, be persuaded of the futility of any attempt to form an arrangement without that solid foundation which can only be obtained by a knowledge of anatomy. Where Sundevall failed no one else is likely to succeed; for he was a man gifted with intelligence of a rare order, a man of cultivation and learning, one who had devoted his whole life to science, who had travelled much, studied much and reflected much, a man whose acquaintance with the literature of his subject probably exceeded that of any of his contemporaries, and a man whose linguistic attainments rendered him the envy of his many friends. Yet what should have been the crowning work of his long life is one that all who respected him, and that comprehends all who knew him, must regret.

Garrod
and
Forbes.

Of the very opposite kind was the work of the two men next to be mentioned—GARROD and FORBES—both cut short in a career of promise¹ that among students of Ornithology has rarely been equalled and perhaps never surpassed. The present writer finds it difficult to treat of the labours of two pupils and friends from whose assistance he had originally hoped to profit in the preparation of this very article, the more so that, while fully recognizing the brilliant nature of some of their researches, he is compelled very frequently to dissent from the conclusions at which

they arrived, deeming them to have often been of a kind that, had their authors survived to a maturer age, they would have greatly modified. Still he well knows that learners are mostly wiser than their teachers; and, making due allowance for the haste with which, from the exigencies of the post they successively held, their investigations had usually to be published, he believes that much of the highest value underlies even the crudest conjectures contained in their several contributions to Ornithology. Putting aside the monographical papers by which each of them followed the excellent example set by their predecessor in the office they filled—Dr MURIE²—and beginning with Garrod's,³ those having a more general scope, all published in the Zoological Society's *Proceedings*, may be briefly considered. Starting from the level reached by Prof. Huxley, the first attempt made by the younger investigator was in 1873, "On the value in Classification of a Peculiarity in the anterior margin of the Nasal Bones in certain Birds." Herein he strove to prove that Birds ought to be divided into two Subclasses—one, called "Holorhinal," in which a straight line drawn transversely across the hindmost points of the external nasal apertures passes in front of the posterior ends of the nasal processes of the premaxilla, and the other, called "Schizorhinal," in which such a line passes behind those processes. If this be used as a criterion, the validity of Prof. Huxley's group *Schizognathae* is shaken; but there is no need to enlarge upon the proposal, for it was virtually abandoned by its author within little more than a twelvemonth. The next subject in connexion with Systematic Ornithology to which Garrod applied himself was an investigation of the Carotid Arteries, and here, in the same year, he made a considerable advance upon the labours of Nitzsch, as might well be expected, for the opportunities of the latter were very limited, and he was only able, as we have seen (page 22), to adduce four types of structure in them, while Garrod, with the superior advantages of his situation, raised the number to six. Nevertheless he remarks that their "disposition has not much significance among Birds, there being many Families in which, whilst the majority of the species have two, some have only one carotid." The exceptional cases cited by him are quite sufficient to prove that the condition of this artery has nearly no value from the point of view of general classification. If relied upon it would split up the Families *Bucerotidae* and *Cypselidae*, which no sane person would doubt to be homogeneous and natural. The femoral vessels formed another subject of investigation, and were found to exhibit as much exceptional conformation as those of the neck—for instance in *Centropus phasianus*, one of the Birds known as Coueals, the femoral artery accompanies the femoral vein, though it does not do so in another species of the genus, *C. rufipennis*, nor in any other of the *Cuculidae* (to which Family the genus *Centropus* has been always assigned) examined by Garrod. Nor are the results of the very great labour which he bestowed upon the muscular conformation of the thigh in Birds any more conclusive when they come to be impartially and carefully considered. Myology was with him always a favourite study, and he

² Dr Murie's chief papers having a direct bearing on Systematic Ornithology are:—in the Zoological Society's *Transactions* (vii. p. 465), "On the Dermal and Visceral Structures of the Kagu, Sun-Bittern, and Boatbill"; in the same Society's *Proceedings*—(1871, p. 647) "Additional Notice concerning the Powder-Downs of *Rhinocletus jubatus*," (1872, p. 664) "On the Skeleton of *Totius* with remarks as to its Allies," (1879, p. 552) "On the Skeleton and Lineage of *Freginopus varius*"; in *The Ibis*—(1872, p. 262) "On the genus *Colius*," (1872, p. 383) "Motmots and their affinities," (1873, p. 181) "Relationships of the *Upupidae*."

³ Garrod's *Scientific Papers* have been collected and published in a memorial volume, edited by Forbes. There is therefore no need to give a list of them here. Forbes's papers are to be edited by Prof. F. J. Bell.

¹ Alfred Henry Garrod, Prosecutor to the Zoological Society of London, died of consumption in 1879, aged thirty-three. His successor in that office, William Alexander Forbes, fell a victim to the deadly climate of the Niger in 1883, and in his twenty-eighth year.

may be not unreasonably supposed to have a strong feeling as to its efficacy for systematic ends. It was in favour of an arrangement based upon the muscles of the thigh, and elaborated by him in 1874, that he gave up the arrangement he had published barely more than a year before based upon the conformation of the nostrils. Nevertheless it appears that even the later of the two methods did not eventually content him, and this was only to be expected, though he is said by Forbes (*Ibis*, 1881, p. 28) to have remained "satisfied to the last as to the naturalness of the two main groups into which he there divided birds"—*Homalognatæ* and *Anomalognatæ*. The key to this arrangement lay in the presence or absence of the *ambiens* muscle, "not because of its own intrinsic importance, but because its presence is always associated with peculiarities in other parts never found in any *Anomalognatous* bird." Garrod thought that so great was the improbability of the same combination of three or four different characters (such as an accessory femoro-caudal muscle, a tufted oil-gland, and cæca) arising independently in different Birds that similar combinations of characters could only be due to blood-relationship. The ingenuity with which he found and expressed these combinations of characters is worthy of all praise; the regret is that time was wanting for him to think out all their consequences, and that he did not take also into account other and especially osteological characters. Every osteologist must recognize that the neglect of these makes Garrod's proposed classification as unnatural as any that had been previously drawn up, and more unnatural than many. So much is this the case that, with the knowledge we have that ere his death he had already seen the need of introducing some modifications into it, its reproduction here, even in the briefest abstract possible, would not be advisable. Two instances, however, of its failure to shew natural affinities or differences may be cited. The first Order *Galliformes* of his Subclass *Homalognatæ* is made to consist of three "Cohorts"—*Struthionæ*, *Gallinacæ*, and *Psittaci*—a somewhat astonishing alliance; but even if that be allowed to pass, we find the second "Cohort" composed of the Families *Palamedeidae*, *Gallinæ*, *Rallidae*, *Otididae* (containing two Subfamilies, the Bustards and the Flamingoes), *Musophagidae*, and *Cuculidae*. Again the Subclass *Anomalognatæ* includes three Orders—*Piciformes*, *Passeriformes*, and *Cypseliformes*—a preliminary to which at first sight no exception need be taken; but immediately we look into details we find the *Alcedinidae* placed in the first Order and the *Meropidae* in the second, together with the *Passeres* and a collection of Families almost every feature in the skeleton of which points to a separation. Common sense revolts at the acceptance of any scheme which involves so many manifest incongruities. With far greater pleasure we would leave these investigations, and those on certain other muscles, as well as on the Disposition of the deep plantar Tendons, and dwell upon his researches into the anatomy of the Passerine Birds with the view to their systematic arrangement. Here he was on much safer ground, and it can hardly be doubted that his labours will stand the test of future experience, for, though it may be that all his views will not meet with ultimate approval, he certainly made the greatest advance since the days of Müller, to the English translation of whose classical work he added (as already mentioned) an excellent appendix, besides having already contributed to the *Zoological Proceedings* between 1876 and 1878 four memoirs replete with observed facts which no one can gainsay. As his labours were continued exactly on the same lines by Forbes, who, between 1880 and 1882, published in the same journal six more memoirs on the subject, it will be convenient here to state generally, and

in a combined form, the results arrived at by these two investigators.

Instead of the divisions of Passerine Birds instituted by Müller, Garrod and Forbes having a wider range of experience consider that they have shewn that the *Passeres* consist of two primary sections, which the latter named respectively *Desmodactyli* and *Eleutherodactyli*, from the facts discovered by the former that in the *Euryglanidae*, or Broadbills, a small Family peculiar to some parts of the Indian Region, and consisting of some nine or ten species only, there is a strong band joining the muscles of the hind toe exactly in the same way as in many Families that are not Passerine, and hence the name *Desmodactyli*, while in all other Passerines the hind toe is free. This point settled, the *Eleutherodactyli* form two great divisions, according to the structure of their vocal organs; one of them, roughly agreeing with the *Clamatores* of some writers, is called *Mesomyodi*, and the other, corresponding in the main, if not absolutely, with the *Oscines*, *Polymyodi*, or true *Passeres* of various authors, is named *Acromyodi*—"an Acromyodian bird being one in which the muscles of the syrinx are attached to the extremities of the bronchial semi-rings, a Mesomyodian bird being one in which the muscles of the syrinx join the semi-rings in their middle." Furthermore, each of these groups is subdivided into two: the *Acromyodi* into "normal" and "abnormal," of which more presently; the *Mesomyodi* into *Homeomeri* and *Heteromeri*, according as the sciatic or the femoral artery of the thigh is developed—the former being the usual arrangement among Birds and the latter the exceptional. Under the head *Heteromeri* come only two Families the *Cotingidae* (Chatterers) and *Pipridæ* (MANAKINS, vol. xv. p. 455) of most ornithologists, but these Garrod was inclined to think should not be considered distinct. The *Homeomeri* form a larger group, and are at once separable, on account of the structure of their vocal organs, into *Tracheophonæ* (practically equivalent to the *Tracheophones* of Müller) and *Haplophonæ* (as Garrod named them)—the last being those *Passeres* which were by Müller erroneously included among his *Picarii*, namely, the *Tyrannidae* (see KING-BIRD, vol. xiv. p. 80) with *Rupicola*, the Cocks-of-the-Rock. To these are now added Families not examined by him,—but subsequently ascertained by Forbes to belong to the same group,—*Pittidae*, *Philepittidae*, and *Xenicidae* (more properly perhaps to be called *Acanthisittidae*), and it is remarkable that these last three Families are the only members of the *Mesomyodi* which are not peculiar to the New World—nay more, if we except the *Tyrannidae*, which in North America occur chiefly as migrants,—not peculiar to the Neotropical Region. The *Tracheophonæ* are held to contain five Families—*Farnariidae* (Oven-birds), *Pteroptochidae* (TAPACULOS, *q.v.*), *Dendrocolaptidae* (Piculules), *Conopophagidae*, and *Fornicariidae* (Ant-Thrushes). Returning now to the *Acromyodi*, which include, it has just been said, a normal and an abnormal section, the latter consists of birds agreeing in the main, though not absolutely, as to the structure of the syrinx with that of the former, yet differing so considerably in their osteology as to be most justifiably separated. At present only two types of these abnormal *Acromyodi* are known—*Meuura* (the LYRE-BIRD, vol. xv. p. 115) and *Atrichia* (the SCRUB-BIRD, *q.v.*), both from Australia, while all the remaining *Passeres*, that is to say, incomparably the greater number of Birds in general, belong to the normal section. Thus the whole scheme of the *Passeres*,¹ as worked out by Garrod and Forbes, can be

¹ It is right to observe that this scheme was not a little aided by a consideration of palatal characters, as well as from the disposition of some of the tendons of the wing-muscles.

briefly expressed as below; and this expression, so far as it goes, is probably very near the truth, though for simplicity's sake some of the intermediate group-names might perhaps be omitted:—

PASSERES,

ELEUTHERODACTYLI,

ACROMYODI,

NORMALES,

ABNORMALES, *Monura, Atrichia.*

MESOMYODI,

HOMOMERI,

Tracheophona,

Furnariidae, Pterotochidae, Dendrocolaptidae, Conop-
phagidae, Formicariidae.

Haplophona,

Tyrannidae, Rupicola, Pittidae, Philepittidae, Xenicidae.

HETEROMERI, *Cotingidae, Pipridae.*

DESMODACTYLI,

Eurylamidae.

It will be seen that no attempt is here made to separate the Normal Acromyodians into Families. Already, in *The Ibis* for 1874 (pp. 406–416), Mr WALLACE had published a plan, which, with two slight modifications that were manifestly improvements, he employed two years later in his great work on *The Geographical Distribution of Animals*, and this included a method of arranging the Families of this division. Being based, however, wholly on alar characters, it has of course a great similarity to the schemes of Dr Cabanis and of Sundevall, and, though simpler than either of those, there is no need here to enter much into its details. The Birds which would fall under the category of Garrod's *Acromyodi normales* are grouped in three series:—A. "Typical or Turdoid *Passeres*," having a wing with ten primaries, the first of which is always more or less markedly reduced in size, and to this 21 Families are allotted; B. "Tanagroid *Passeres*," having a wing with nine primaries, the first of which is fully developed and usually very long, and containing 10 Families; and C. "Sturnoid *Passeres*," having a wing with ten primaries, the first of which is "rudimentary," with only 4 Families. The remaining Families, 10 in number, which are not normally acromyodian are grouped as Series D. and called "Formicarioid *Passeres*."

Mr SCLATER. In *The Ibis* for 1880 (pp. 340–350, 399–411) Mr SCLATER made a laudable attempt at a general arrangement of Birds,¹ trying to harmonize the views of ornithotomists with those taken by the ornithologists who only study the exterior; but, as he explained, his scheme is really that of Prof. Huxley reversed, with some slight modifications mostly consequent on the recent researches of Prof. Parker and of Garrod, and (he might have added) a few details derived from his own extensive knowledge of the Class. Adopting the two Subclasses *Carniata* and *Ratita*, he recognized 3 "Orders" as forming the latter and 23 the former—a number far exceeding any that had of late years met with the approval of ornithologists. It is certainly difficult in the present state of our knowledge to get on with much fewer groups; whether we call them "Orders" or not is immaterial. First of them comes the *Passeres*, of which Mr Sclater would make four Suborders:—(1) the *Acromyodi normales* of Garrod under the older name of *Oscines*, to the further subdivision of which we must immediately return; (2) under Prof. Huxley's term *Oligomyodi*, all the *Haplophona*, *Heteromeri*, and *Desmodactyli* of Garrod, comprehending 8 Families—*Oxyrhamphidae*,² *Tyrannidae*, *Pipridae*, *Cotingidae*, *Phytomidae*,² *Pittidae*, *Philepittidae*, and *Eurylamidae*;³ (3) *Tracheophona*,

containing the same groups as in the older scheme, but here combined into 3 Families only—*Dendrocolaptidae*, *Formicariidae*, and *Pterotochidae*; and (4) the *Acromyodi abnormales* of Garrod, now elevated to the rank of a Suborder and called *Pseudoscines*.⁴ With regard to the *Acromyodi normales* or *Oscines*, Mr Sclater takes what seems to be quite the most reasonable view, when he states that they "are all very closely related to one another, and, in reality, form little more than one group, equivalent to other so-called families of birds," going on to remark that as there are some 4700 known species of them "it is absolutely necessary to subdivide them," and finally proceeding to do this nearly on the method of Sundevall's *Tentamen* (see above pp. 37, 38), merely changing the names and position of the groups in accordance with a plan of his own set forth in the *Nomenclator Avium Neotropicalium*, which he and Mr Salvin printed in 1873, making, as did Sundevall, two divisions (according as the hind part of the "tarsus" is plated or scaled), A. *Laminiplantares* and B. *Scutiplantares*—but confining the latter to the *Alaudidae* alone, since the other Families forming Sundevall's *Scutiplantares* are not Oscinian, nor all even *Passerine*. The following table shews the comparative result of the two modes as regards the *Laminiplantares*, and, since the composition of the Swedish author's groups was explained at some length, may be found convenient by the reader:—

<i>Mr Sclater</i> , 1880.	<i>Sundevall</i> , 1872–73.
1. <i>Dentirostres</i> , ⁵ —practically equal to 1. <i>Gichlomorpha</i> .	
2. <i>Latirostres</i> , ² " 2. <i>Chelidomorpha</i> .	
3. <i>Curvirostres</i> , " 3. <i>Certhiomorpha</i> . ⁶	
4. <i>Tenuirostres</i> , " 4. <i>Cinnyrimorpha</i> .	
5. <i>Conirostres</i> , " 5. <i>Conirostres</i> .	
6. <i>Cultrirostres</i> , " 6. <i>Coliomorpha</i> .	

These six groups Mr Sclater thinks may be separated without much difficulty, though on that point the proceedings of some later writers (a notable instance of which he himself cites) shew that doubt may still be entertained; but he rightly remarks that, "when we come to attempt to subdivide them, there is room for endless varieties of opinion as to the nearest allies of many of the forms," and into further details he does not go. It will be perceived that, like so many of his predecessors, he accords the highest rank to the *Dentirostres*, which, as has before been hinted, seems to be a mistaken view that must be considered in the sequel.

Leaving the *Passeres*, the next "Order" is *Picariæ*, of which Mr Sclater proposes to make six Suborders:—(1) *Pici*, the Woodpeckers, with 2 Families; (2) *Cypseli*, with 3 Families,⁷ practically equal to the *Macrochires* of Nitzsch; (3) *Anisodactylæ*, with 12 Families—*Cotuidæ* (MOUSE-BIRD, vol. xvii. p. 6), *Alcedinidæ* (KINGFISHER, vol. xiv. p. 81), *Bucerotidæ* (HORNBILL, vol. xii. p. 169), *Upupidæ* (HOOPOE, vol. xii. p. 154), *Irrisoridæ*, *Meropidæ*, *Monotidæ* (MOTMOT, vol. xvii. p. 3), *Todidæ* (TODY, *q.v.*), *Coraciidæ* (ROLLER, *q.v.*), *Leptosomidæ*, *Podangidæ*, and *Steatornithidæ* (GUACHARO, vol. xi. p. 227); (4) *Heterodactylæ*, consisting only of the TROGONS (*q.v.*); (5) *Zygodactylæ* with 5 Families, *Gallinidæ* (JACAMAR, vol. xiii. p. 531), *Bucconidæ* (PUFF-BIRD, *q.v.*), *Rhamphastidæ* (TOUCAN, *q.v.*), *Capitonidæ*, and *Indicatoridæ* (HONEY-GUIDE, vol. xii. p. 139); and (6) *Coccygæ*, composed of the two Families *Cuculidæ* and *Musophagidæ*. That all these may be most conveniently

⁴ A term unhappily of hybrid origin, and therefore one to which purists may take exception.

⁵ These are not equivalent to Sundevall's groups of the same names.

⁶ Mr Sclater (p. 348) inadvertently states that no species of Sundevall's *Certhiomorpha* is found in the New World, having omitted to notice that in the *Tentamen* (pp. 46, 47) the genera *Mniotilta* (peculiar to America) as well as *Certhia* and *Sitta* are therein placed.

⁷ Or 2 only, the position of the *Caprimulgidæ* being left undecided, but in 1883 (see next note) put here.

¹ An abstract of this was read to the British Association at Swansea in the same year, and may be found in its *Report* (pp. 606–609).

² Not recognized by Garrod.

³ To these Mr Sclater would now doubtless add Forbes's *Xenicidae*.

associated under the name *Picariæ* seems likely enough, and the first two "Suborders" are probably natural groups, though possibly groups of different value. In regard to the rest comment is for the present deferred. The *Psittaci*, *Striges*, and *Accipitres*, containing respectively the PARROTS (*q.v.*), OWLS (*q.v.*), and diurnal Birds-of-Prey, form the next three "Orders"—the last being held to include 3 Families, *Falconide*, *Cathartide*, and *Serpentariide*, which is perhaps the best that can be done with them—the difficult question as to the position of *Cariama* (SERIEMA, *q.v.*) being decided against the admission of that form to the last Family, notwithstanding its remarkable resemblance to *Serpentarioides* (SECRETARY-BIRD, *q.v.*). We have then the *Steganopodes* to make the sixth "Order," consisting of the 5 Families usually grouped together as by Brandt (*supra*, p. 25) and others, and these are followed naturally enough by the HERONS (vol. xi. p. 760) under the name of *Herodiones*, to which the 3 Families *Ardeide*, *Ciconiide* (STORK, *q.v.*), and *Plataleide* (SPONBILL, *q.v.*) are referred; but the FLAMINGOES (vol. ix. p. 286), under Prof. Huxley's title *Odontoglossæ*, form a distinct "Order." The Ninth "Order" is now erected for the *Palamedæ* (SCREAMER, *q.v.*), which precede the *Anseres*—a group that, disemembered from both the last two, is eminently natural, and easily dealt with. A great break then occurs, and the new series is opened by the Eleventh "Order," *Columbæ*, with 3 Families, *Caryopogonide*, *Columbide*, and *Gouride*, "or perhaps a fourth," *Didunculide*,—the DOBOS (vol. vii. p. 321) being "held to belong to quite a separate section of the order." The Twelfth "Order" is formed by the *Pterocletes*, the Sand-Grouse; and then we have the very natural group *Gallinæ* ranking as the Thirteenth. The next two are the *Opisthocornis* and *Henipodii* for the HOACTZIN (vol. xii. p. 28) and the *Turnicide* (often known as Button-Quails) respectively, to which follow as Sixteenth and Seventeenth the *Fulicariæ* and *Alectorides*—the former consisting of the Families *Rallide* (RAIL, *q.v.*) and *Heliornithide*, and the latter of what seems to be a very heterogeneous compound of 6 Families—*Aramide*, *Euryptogide* (SN BITTER, *q.v.*), *Gruvide* (CRANE, vol. vi. p. 546), *Psophide* (TRUMPETEE, *q.v.*), *Cariamide* (SERIEMA, *q.v.*), and *Otidide*² (BUSTARD, vol. iv. p. 578). It is confessedly very puzzling to know how these varied types, or some of them at least, should be classed; but the need for the establishment of this group, and especially the insertion in it of certain forms, is not explained by the author. Then we have "Orders" Eighteen and Nineteen, the *Limicolæ*, with 6 Families, and *Gaviæ*, consisting only of *Laride* (GULL, vol. xi. p. 274), which taken in their simplest condition do not present much difficulty. The last are followed by *Tubinaves*, the PETRELS (*q.v.*), and these by *Pygopodes*, to which only 2 Families *Colymbide* (DIVER, vol. vii. p. 292) and *Alcide* are allowed—the GREEBES (vol. xi. p. 79) being included in the former. The *Impennes* or PENGUINS (*q.v.*) form the Twenty-second, and TINAMOUS (*q.v.*) as *Cryptari* complete the Carinate Subclass. For the *Ratitæ* only three "Orders" are allotted—*Apterygæ*, *Casuarii*, and *Struthionæ*.

As a whole it is impossible not to speak well of the scheme thus sketched out; nevertheless it does seem in some parts to be open to amendment, though the task of attempting to suggest any modifications of it by way of improvement is one that the present writer approaches with reluctance and the utmost diffidence. Yet the task, it appears, must be undertaken. From the preceding

pages, recounting the efforts of many system-makers—good, bad, and indifferent—it will have been seen what a very great number and variety of characters need to be had in remembrance while planning any scheme that will at all adequately represent the results of the knowledge hitherto attained, and the best lesson to be learnt from them is that our present knowledge goes but a very little way in comparison with what we, or our successors, may hope to reach in years to come. Still we may feel pretty confident that we are on the right track, and, moreover, that here and there we can plant our feet on firm ground, however uncertain, not to say treacherous, may be the spaces that intervene. Now that geographical exploration has left so small a portion of the earth's surface unvisited, we cannot reasonably look for the encountering of new forms of ornithic life that, by revealing hitherto unknown stepping stones, will quicken our course or effectively point out our path. Indeed, as a matter of fact, the two most important and singular types of existing Birds—*Balaniceps* and *Rhinocetus*—that in later years have rewarded the exertions of travelling naturalists, have proved rather sources of perplexity than founts of inspiration. Should fortune favour ornithologists in the discovery of fossil remains, they will unquestionably form the surest guide to our faltering steps; but experience forbids us to expect much aid from this quarter, however warmly we may wish for it, and the pleasure of any discovery of the kind would be enhanced equally by its rarity as by its intrinsic worth. However, it is now a well accepted maxim in zoology that the mature forms of the past are repeated in the immature forms of the present, and that, where Paleontology fails to instruct us, Embryology may be trusted to no small extent to supply the deficiency. Unhappily the embryology of Birds has been as yet very insufficiently studied. We have indeed embryological memoirs of a value that can scarcely be rated too highly, but almost all are of a monographic character. They are only oases in a desert of ignorance, and a really connected and continuous series of investigations, such as the many morphological laboratories, now established in various countries, would easily render possible, has yet to be instituted. No methodical attempt at this kind of work seems to have been made for nearly half a century, and, with the advantage of modern appliances, no one can justifiably doubt the success of a renewal of such an attempt any more than he can possibly foresee the precise nature of the revelations that would come of it.

The various schemes for classifying Birds set forth by the authors of general text-books of Zoology do not call for any particular review here, as almost without exception they are so drawn up as to be rather of the nature of a compromise than of a harmony. The best and most notable is perhaps that by Prof. CARUS in 1863 (*Handbuch der Zoologie*, i. pp. 191–368); but it is of course now antiquated. The worst scheme is one of the most recent, that by Prof. CARUS in 1882 (*Grundzüge der Zoologie*, ii. pp. 318–388). Of most other similar text-books that have come under the writer's notice, especially those issued in the United Kingdom, the less said the better. It is unfortunate that neither Prof. Gegenbaur nor the late Prof. F. M. Balfour should have turned their attention to this matter; but an improvement may be expected from Dr Gadov, who is engaged in completing the ornithological portion of Bronn's *Tierreich*, so long left unfinished.

Birds are animals so similar to Reptiles in all the most essential features of their organization that they may be said to be merely an extremely modified and aberrant Reptilian type. These are almost the very words of Prof. Huxley twenty years ago,³ and there are now but few zoologists to dissent from his statement, which by another man of science has been expressed in a phrase even more

Relations of Birds to Reptiles.

¹ In the eighth edition of the *List of Vertebrated Animals* in the Zoological Gardens, which, being published in 1883, may be taken as expressing Mr Slater's latest views, the first two Families only are recognized, the last two being placed under *Columbide*.

² Wrongly spelt *Otidæ*.

³ *Lectures on the Elements of Comparative Anatomy*, p. 69; see also Carus, *Handbuch der Zoologie*, i. p. 192.

pithy—"Birds are only glorified Reptiles." It is not intended here to enter upon their points of resemblance and differences. These may be found summarized with more or less accuracy in any text-book of zoology. We shall content ourselves by remarking that by the naturalist just named Birds and Reptiles have been brigaded together under the name of *Sauropsida* as forming one of the three primary divisions of the *Vertebrata*—the other two being *Ichthyopsida* and *Mammalia*. Yet Birds have a right to be considered a Class, and as a Class they have become so wholly differentiated from every other group of the Animal Kingdom that, among recent and even the few fossil forms known to us, there is not one about the assignation of which any doubt ought now to exist, though it is right to state that some naturalists have even lately refused a place among *Aves* to the singular *Archæopteryx*, of which the remains of two individuals—most probably belonging to as many distinct forms¹—have been discovered in the quarries of Solenhofen in Bavaria. Yet one of them has been referred, without much hesitation, by Prof. Vogt to the Class *Reptilia* on grounds which seem to be mistaken, since it was evidently in great part if not entirely clothed with feathers.² The peculiar structure of *Archæopteryx* has already been briefly mentioned and partly figured in this work (BIRDS, vol. iii. p. 728–9), and, while the present writer cannot doubt that its Bird-like characters predominate over those which are obviously Reptilian, he will not venture to declare more concerning its relations to other Birds, and accordingly thinks it advisable to leave the genus as the sole representative as yet known of the Sub-class *Saururæ*,³ established for its reception by Prof. Hæckel, trusting that time may shew whether this provisional arrangement will be substantiated. The great use of the discovery of *Archæopteryx* to naturalists in general is well known to have been the convincing testimony it afforded as to what is well called "the imperfection of the Geological Record." To ornithologists in particular its chief attraction is the evidence it furnishes in proof of the evolution of Birds from Reptiles; though, as to the group of the latter from which the former may have sprung, it tells us little that is not negative. It throws, for instance, the Pterodactyls—so often imagined to be nearly related to Birds, if not to be their direct ancestors—completely out of the line of descent. Next to this its principal advantage is to reveal the existence at so early an epoch of Birds with some portions of their structure as highly organized as the highest of the present day, a fact witnessed by its foot, which, so far as can be judged by its petrified relics,

might well be that of a modern Crow. The fossil remains of many other Birds, for example Prof. Seeley's *Eualoniornis* (*Quart. Journ. Geol. Society*, 1876, pp. 496–512), Sir R. OWEN'S *Odontopteryx* (BIRDS, vol. iii. p. 729), *Gastornis*, Prof. COPE'S *Diatryma* (*Proc. Acad. N. Sc. Philadelphia*, April 1876), and some more, are too fragmentary to serve the purposes of the systematist; but the grand discoveries of Prof. Marsh, spoken of above, afford plentiful hints as to the taxonomy of the Class, and their bearing deserves the closest consideration. First of all we find that, while Birds still possess the teeth they had inherited from their Reptilian ancestors, two remarkable and very distinct types of the Class had already made their appearance, and we must note that these two types are those which persist at the present day, and even now divide the Class into *Ratite* and *Carinate*, the groups whose essentially distinct characters were recognized by Merrem. Furthermore, while the Ratite type (*Hesperornis*) presents the kind of teeth, arrayed in grooves, which indicate (in Reptiles at least) a low morphological rank, the Carinate type (*Ichthyornis*) is furnished with teeth set in sockets, and shewing a higher development. On the other hand this early Carinate type has vertebræ whose comparatively simple, biconcave form is equally evidence of a rank unquestionably low; but the saddle-shaped vertebræ of the contemporary Ratite type as surely testify to a more exalted position. Reference has been already made to this complicated if not contradictory state of things, the true explanation of which seems to be out of reach at present. It has been for some time a question whether the Ratite is a degraded type descended from the Carinate, or the Carinate a superior development of the Ratite type. Several eminent zoologists have declared themselves in favour of the former probability, and at first sight most people would be inclined to decide with them; for, on this hypothesis, the easiest answer to the question would be found. But the easiest answer is not always the true one; and to the present writer it seems that before this question be answered, a reply should be given to another—Was the first animal which any one could properly call a "Bird," as distinguished from a "Reptile," possessed of a keeled sternum or not? Now Birds would seem to have been differentiated from Reptiles while the latter had biconcave vertebræ, and teeth whose mode of attachment to the jaw was still variable. There is no reason to think that at that period any Reptile (with the exception of Pterodactyls, which, as has already been said, are certainly not in the line of Birds' ancestors) had a keeled sternum. Hence it seems almost impossible that the first Bird should have possessed one; that is to say, it must have been practically of the Ratite type. Prof. Marsh has shewn that there is good reason for believing that the power of flight was gradually acquired by Birds, and with that power would be associated the development of a keel to the sternum, on which the volant faculty so much depends, and with which it is so intimately correlated that in certain forms which have to a greater or less extent given up the use of their fore-limbs the keel though present has become proportionally aborted. Thus the Carinate type would, from all we can see at present, appear to have been evolved from the Ratite. This view receives further support from a consideration of the results of such embryological research as has already been made—the unquestionable ossification of the Ratite sternum from a smaller number of paired centres than the Carinate sternum, in which (with the doubtful exception of the *Anatida*) an additional, unpaired centre makes its appearance. Again the geographical distribution of existing, or comparatively recent, Ratite forms points to the same conclusion. That these forms—Moa, Kiwi, Emeu and Cassowary, Rheu, and finally Ostrich—

Antiquity of the Ratite and Carinate types.

¹ See Prof. Seeley's remarks on the differences between the two specimens, in the *Geological Magazine* for October 1881.

² Prof. Vogt lays much stress on the absence of feathers from certain parts of the body of the second example of *Archæopteryx* now, thanks to Dr Werner Siemens, in the museum of Berlin. But Prof. Vogt himself shews that the parts of the body devoid of feathers are also devoid of skin. Now it is well known that amongst most existing Birds the ordinary "contour-feathers" have their origin no deeper than the skin, and thus if that decayed and were washed away the feathers growing upon it would equally be lost. This has evidently happened (to judge from photographs) to the Berlin specimen just as to that which is in London. In each case, as Sir R. Owen most rightly suggested of the latter, the remains exactly call to mind the very familiar relics of Birds found on a seashore, exposed perhaps for weeks or even months to the wash of the tides so as to lose all but the deeply-seated feathers, and finally to be embedded in the soft soil. Prof. Vogt's paper is in the *Revue Scientifique*, ser. 2, ix. p. 241, and an English translation of it in *The Ibis* for 1880, p. 434.

³ Prof. Hæckel seems first to have spelt this word *Sauriuræ*, in which form it appears in his *Allgemeine Entwicke lungsgeschichte der Organismen*, forming the second volume of his *Generelle Morphologie* (pp. xi. and cxxxix.), published at Berlin in 1866, though on plate vii. of the same volume it appears as *Sauriuri*. Whether the masculine or feminine termination be preferred matters little, though the latter is come into general use, but the interpolation of the *i* in the middle of the word appears to be against all the laws of orthography.

must have had a common ancestor nearer to them than is the ancestor of any Carinate form seems to need no proof. If we add to these the *Æpyornis* of Madagascar, the fossil *Ratitæ* of the Siwalik rocks,¹ and the as yet but partially recognized *Struthiolithus* of Southern Russia,² to say nothing of *Gastornis*, the evidence is stronger still. Scattered as these Birds have been or are throughout the world, it seems justifiable to consider them the survivals of a very ancient type, which has hardly undergone any essential modification since the appearance of Bird-life upon the earth—even though one at least of them has become very highly specialized.

No doubt the difficulty presented by the biconcave vertebrae of the earliest known representative of the Carinate type is a considerable obstacle to the view just taken. But in the *American Journal of Science* (April 1879), and again in his great work (pp. 180, 181), Prof. MARSH has shown that in the third cervical vertebra of *Ichthyornis* "we catch nature in the act as it were" of modifying one form of vertebra into another, for this single vertebra in *Ichthyornis* is in vertical section "moderately convex, while transversely it is strongly concave, thus presenting a near approach to the saddle-like articulation"; and he proceeds to point out that this specialized feature occurs at the first bend of the neck, and, greatly facilitating motion in a vertical plane, is "mainly due originally to its predominance." The form of the vertebra would accordingly seem to be as much correlated with the mobility of the neck as is the form of the sternum with the faculty of flight. If therefore the development of the saddle shape be an indication of development, as well may be the outgrowth of a keel. However, the solution of this perplexing problem, if a solution be ever found, must remain for future paleontological or embryological discoverers. The present writer is far from attempting to decide a question so complicated, though he does not hesitate to say, notwithstanding the weight of authority on the other side, that according to present evidence the probability is in favour of the Carinate having been evolved from a more ancient Ratite type. One thing only is certain, and that is the independent and contemporaneous existence of each of these great divisions at the earliest period when Birds at all like recent forms are known to have lived. The facts that each of these types was provided with teeth, and that the teeth were of a different pattern, are of comparatively secondary importance.

It seems therefore quite justifiable to continue, after the fashion that has been set, to separate the Class *Aves* into three primary groups:—I. *Saururæ*, II. *Ratitæ*, III. *Carinatæ*—the earliest members of the two last, as well as possibly all of the first, being provided with teeth. These three primary groups we may call "Subclasses."³ Thus we shall have:—

SAURURÆ, Hæckel. *Archæopteryx* the only known form.
RATITÆ, Merrem. a. with teeth;

a'. with biconcave vertebrae—as yet unknown;

b'. with saddle-shaped vertebrae—*Hesperornis*.

b. without teeth—recent and existing forms.

¹ For notice of these see the papers by Mr Davies in the *Geological Magazine* (new series, decade ii., vol. vii. p. 18), and Mr Lydekker in the *Records of the Geological Survey of India* (xii. p. 52).

² *Bull. Acad. Sc. St Petersburg*, xviii. p. 158; *Ibid.*, 1874, p. 4.

³ Prof. Huxley has termed them "Orders"; but it is more in accordance with the practice of ornithological writers to raise them to a higher rank, and to call the secondary groups "Orders." There is a good deal to be said in behalf of either view; but, as in most cases of mere terminology, the matter is not worth wasting words over, so long as we bear in mind that what here is meant by an "Order" of *Aves* is a very different thing from an "Order" of *Reptilia*.

CARINATÆ, Merrem. a. with teeth;
a'. with biconcave vertebrae—*Ichthyornis*;
b'. with saddle-shaped vertebrae—as yet unknown.
b. without teeth—recent and existing forms.

We have now to consider the recent and existing forms of toothless *Ratitæ*. These were shown beyond doubt by Prof. Huxley to form five separate groups, which we shall here dignify by the name of Orders,⁴ adding to them a sixth, though little is as yet known of its characteristics. Of this, which contains the great extinct Birds of Madagascar, he did not take cognizance, as it is here necessary to do. In the absence of any certain means of arranging all of these orders according to their affinities, it will be best to place their names alphabetically, thus:—

ÆPYORNITHES. Fam. *Æpyornithidæ*.

APTERYGES. Fam. *Apterygidae* (KIWI, vol. xiv. p. 104).

IMMANES. Fam. i. *Dinornithidæ*; Fam. ii. *Palaapterygidae*.⁵

MEGISTANES. Fam. i. *Casuaridæ*; Fam. ii. *Dromæidæ* (EMEU, vol. viii. p. 171).

RHEÆ. Fam. *Rhæidæ* (RHEA, q.v.).

STRUTHIONES. Fam. *Struthionidæ* (OSTRICH, p. 62 *infra*).

Some systematists think there can be little question of the *Struthiones* being the most specialized and therefore probably the highest type of these Orders, and the present writer is rather inclined to agree with them. Nevertheless the formation of the bill in the *Apteryges* is quite unique in the whole Class, and indicates therefore an extraordinary amount of specialization. Their functionless wings, however, point to their being a degraded form, though in this matter they are not much worse than the *Megistanes*, and are far above the *Immanes*—some of which at least appear to have been absolutely wingless, and were thus the only members of the Class possessing but a single pair of limbs.

Turning then to the third Subclass, the *Carinatæ*, their subdivision into Orders is attended with a considerable amount of difficulty; and still greater difficulty is presented if we make any attempt to arrange these Orders so as in some way or other to shew their respective relations—in other words, their genealogy. In regard to the first of these tasks, a few groups can no doubt be at once separated without fear of going wrong. For instance, the *Crypturi* or Tinamous, the *Impennes* or Penguins, the *Striges* or Owls, the *Psaltria* or Parrots, and the *Passeres*, or at least the *Oscines*, seem to stand as groups each quite by itself, and, since none of them contains any hangers-on about the character of which there can any longer be room to hesitate, there can be little risk in setting them apart. Next comes a category of groups in which differentiation appears not to have been carried so far, and, though there may be as little doubt as to the association in one Order of the greater number of forms commonly assigned to each, yet there are in every case more or fewer outliers that do not well harmonize with the rest. Here we have such groups as those called *Pygopodes*, *Gaviæ*, *Limicolæ*, *Gallinæ*, *Columbæ*, *Anseres*, *Herodiones*, *Steganopodes*, and *Accipitres*. Finally there are two groups of types presenting characteristics so diverse as to defy almost any definition, and, if it were not almost nonsense to say so, agreeing in little more than in the differences. These two groups are those known as *Picariæ* and *Alectorides*; but, while the majority

⁴ See *Ann. Nat. History*, ser. 4, xx. pp. 499, 500.

⁵ On the supposition that the opinions of Dr Von Haast (*Trans. and Proc. N. Zeal. Institute*, vi. pp. 426, 427) can be substantiated; but they have since been disputed by Prof. Hutton (*op. cit.*, ix. pp. 363–365), and for the present it is advisable to suspend our judgment.

of Families or genera usually referred to the former plainly have some features in common, the few Families or genera that have been clubbed together in the latter make an assemblage that is quite artificial, though it may be freely owned that with our present knowledge it is impossible to determine the natural alliances of all of them.¹

A phylogenetic scheme as yet impracticable. That our knowledge is also too imperfect to enable systematists to compose a phylogeny of Birds, even of the Carinate Subclass, and draw out their pedigree, ought to be sufficiently evident. The uncertainty which still prevails among the best-informed ornithologists as to the respective origin of the *Ratitæ* and *Carinatae* is in itself a proof of that fact, and in regard to some groups much less widely differentiated the same thing occurs. We can point to some forms which seem to be collaterally ancestral (if such a phrase may be allowed), and among them perhaps some of those which have been referred to the group "*Alectorides*" just mentioned, and from a consideration of their Geographical Distribution and especially Isolation it will be obvious that they are the remnants of a very ancient and more generalized stock which in various parts of the world have become more or less specialized. The very case of the New-Caledonian Kagu (*Rhinocetus*), combining features which occasionally recall the Sun-Bittern (*Eurypyga*), and again present an unmistakable likeness to the *Limicola* or the *Rallida*, shews that it is without any very near relation on the earth, and, if convenience permitted, would almost justify us in placing it in a group apart from any other, though possessing some characteristics in common with several.

It is anything but the desire of the present writer to invent a new arrangement of Birds. Such acquaintance as he possesses with the plans which have been already propounded warns him that until a great deal more labour has been expended, and its results made clearly known, no general scheme of Classification will deserve to be regarded as final. Nevertheless in the best of modern systems there are some points which, as already hinted, seem to be well established, while in them there are also some dispositions and assignments which he is as yet unable to accept, while he knows that he is not alone in his mistrust of them, and he thinks it his duty here to mention them in the hope that thereby attention may be further directed to them, and his doubts either dispelled or established—it matters not which. The most convenient way of bringing them to the notice of the reader will perhaps be by considering in succession the different groups set forth by the latest systematist of any authority—Mr Selater—a sketch of whose method has been above given.

Crypturi. If we trust to the results at which Prof. Huxley arrived, there can be little doubt as to the propriety of beginning the Carinate Subclass with his *Dromæognathæ*, the *Crypturi* of Illiger and others, or Tinamous, for their resemblance to the *Ratitæ* is not to be disputed; but it must be borne in mind that nothing whatever is known of their mode of development, and that this may, when made out, seriously modify their position relatively to another group, the normal *Anseres*, in which the investigations of Cuvier and L'Herminier have already shewn that there is some resemblance to the *Ratitæ* as regards the ossification of the sternum. It will be for embryologists to determine whether this asserted resemblance has any real meaning; but of the sufficient standing of the *Crypturi* as an Order there can hardly be a question.

¹ Heterogeneous as is the group as left by the latest systematist, it is nothing to its state when first founded by Illiger in 1811; for it then contained in addition the genera *Glareola* and *Ceropepis*, but the last was restored to its true place among the *Anseres* by Temminck. The *Alectorides* of Duméril have nothing in common with the *Alectorides* of Illiger, and the latter is a name most unfortunately chosen, since the group so called does not include any Cock-like Bird.

We have seen that Prof. Huxley would derive all other existing Carinate Birds from the *Dromæognathæ*; but of course it must be understood in this, as in every other similar case, that it is not thereby implied that the modern representatives of the *Dromæognathous* type (namely, the Tinamous) stand in the line of ancestry.

Under the name *Impennes* we have a group of Birds, the *Impennes*. Penguins, smaller even than the last, and one over which until lately systematists have been sadly at fault; for, though we as yet know little if anything definite as to their embryology, no one, free from bias, can examine any member of the group, either externally or internally, without perceiving how completely different it is from any others of the Carinate division. There is perhaps scarcely a feather or a bone which is not diagnostic, and nearly every character hitherto observed points to a low morphological rank. It may even be that the clothing of *Mesperornis* was not very dissimilar to the "plumage" which now covers the *Impennes*, and the title of an Order can hardly be refused to them.

The group known as *Pygopodes* has been often asserted *Gavia* to be closely akin to the *Impennes*, and we have seen that Brandt combined the two under the name of *Urinatores*, while Mr Selater thinks the *Pygopodes* "seem to form a natural transition between" the Gulls and the Penguins. The affinity of the *Alcidæ* or Auks (and through them the Divers or *Colymbidæ*) to the Gulls may be a matter beyond doubt, and there appears to be ground for considering them to be the degraded offspring of the former; but to the present writer it appears questionable whether the Grebes, *Podicipedidæ*, have any real affinity to the two Families with which they are usually associated, and this is a point deserving of more attention on the part of morphologists than it has hitherto received. Under the name of *Gaviæ* the Gulls and their close allies form a very natural section, but it probably hardly merits the rank of an Order more than the *Pygopodes*, for its relations to the large and somewhat multimorph though very natural group *Limicolæ* have to be taken into consideration. Prof. PARKER long ago observed (*Trans. Zool. Society*, v. p. 150) that characters exhibited by Gulls when young, but lost by them when adult, are found in certain Plovers at all ages, and hence it would appear that the *Gaviæ* are but more advanced *Limicolæ*. The Limicoline genera *Dromas* and *Chionis* have many points of resemblance to the *Laridæ*; and on the whole the proper inference would seem to be that the *Limicolæ*, or something very like them, form the parent-stock whence have descended the *Gaviæ*, from which or from their ancestral forms the *Alcidæ* have proceeded as a degenerate branch. If this hypothesis be correct, the association of these three groups would constitute an Order, of which the highest Family would perhaps be *Otididæ*, the Bustards; but until further research shews whether the view can be maintained it is not worth while to encumber nomenclature by inventing a new name for the combination. On the other hand the Petrels, which form the group *Tubinarcæ*, would seem for several reasons to be perfectly distinct from the *Gaviæ* and their allies, and possibly will have to rank as an Order. *Tubinarcæ*.

Considerable doubt has already been expressed as to the existence of an Order *Alectorides*, which no one can regard as a natural group, and it has just been proposed to retransfer to the *Limicolæ* one of the Families, *Otididæ*, kept in it by Mr Selater. Another Family included in it by its founder is *Cariamidæ*, the true place of which has long been a puzzle to systematizers. The present writer is inclined to think that those who have urged its affinity to the *Accipitres*, and among them taxonomers starting from bases so opposite as Sundevall and Prof. Parker, have more nearly hit the mark, and accordingly would

now relegate it to that Order. It is doubtless an extremely generalized form,¹ the survival of a very ancient type, whence several groups may have sprung; and, whenever the secret it has to tell shall be revealed, a considerable step in the phylogeny of Birds can scarcely fail to follow.²

Gallinæ.

Allusion has also been made to the peculiarities of two other forms placed with the last among the *Alectorides*—*Eurypyga* and *Rhinocetus*—being each the sole type of a separate Family. It seems that they might be brought with the *Gruidæ*, *Psophiidae*, and *Aramidae* into a group or Suborder *Grues*,—which, with the *Fulicariæ*³ of Nitzsch and Mr Sclater as another Suborder, would constitute an Order that may continue to bear the old Linnæan name *Gallinæ*. It must be borne in mind, however, that some members of both these Suborders exhibit many points of resemblance to certain other forms that it is at present necessary to place in different groups—thus some *Rallidæ* to the *Gallinæ*, *Grus* to *Otis*, and so forth; and it is as yet doubtful whether further investigation may not shew the resemblance to be one of affinity, and therefore of taxonomic value, instead of mere analogy, and therefore of no worth in that respect.

Gallinæ.

We have next to deal with a group nearly as complicated. The true *Gallinæ* are indeed as well marked a section as any to be found; but round and near them cluster some forms very troublesome to allocate. The strange Hoactzin (*Opisthocomus*) is one of these, and what seems to be in some degree its arrested development makes its position almost unique,⁴—but enough has already been said of it before (see vol. xii. p. 28, and *supra* p. 36). It must for the present at least stand alone, the sole occupant of a single Order. Then there are the Hemipodes or Button-Quails, which have been raised to equal rank by Prof. Huxley as *Tarnicomorphæ*; but, though no doubt the osteological differences between them and the normal *Gallinæ*, pointed out by him as well as by Prof. Parker, are great, they do not seem to be more essential than are found in different members of some other Orders, nor to offer an insuperable objection to their being classed under the designation *Gallinæ*. If this be so there will be no necessity for removing them from that Order, which may then be partitioned into three Suborders—*Hemipoditæ* standing somewhat apart, and *Alectoropodes* and *Peristeropodes*, which are more nearly allied—the latter comprehending the *Megapodiidæ* and *Cracidæ*, and the former consisting of the normal *Gallinæ*, of which it is difficult to justify the recognition of more than a single Family, though in that two types of structure are discernible.

Pteroclitidæ.

The Family of Sand-Grouse, *Pteroclitidæ*, is perhaps one of the most instructive in the whole range of Ornithology. In Prof. HUXLEY'S words (*Proceedings*, 1868, p. 303), they are "completely intermediate between the *Alectoromorphæ* [i.e., *Gallinæ*] and the *Peristeromorphæ* [the Pigeons]. They cannot be included within either of these groups without destroying its definition, while they are perfectly definable themselves." Hence he would make them an independent group of equal value with the other two. Almost the same result has been reached by Dr GADW

(*op. cit.*, 1882, pp. 331, 332). No doubt there are strong and tempting reasons for taking this step; but peradventure the real lesson taught by this aggregation of common characters is rather the retention of the union of the *Gallinæ* and *Columbæ* into a single group, after the fashion of by-gone years, under the name, however meaningless, of *Rasores*. Failing that, the general resemblance of most parts of the osteology of the Sand-Grouse to that of the Pigeons, so well shewn by M. Milne-Edwards, combined with their Pigeon-like pterylosis, inclines the present writer to group them as a Suborder of *Columbæ*; but the many important points in which they differ from the more normal Pigeons, especially in the matter of their young being clothed with down, and their coloured and speckled eggs,⁵ must be freely admitted. Young Sand-Grouse are described as being not only "Dasypedes" but even "Præcoces" at birth, while of course every one knows the helpless condition of "Pipers"—that is, Pigeons newly hatched from their white eggs. Thus the opposite condition of the young of these two admittedly very near groups inflicts a severe blow on the so-called "physiological" method of dividing Birds before mentioned, and renders the *Pteroclitidæ* so instructive a form. The *Columbæ*, considered in the wide sense just suggested, would seem to have possessed another and degenerate Suborder in the Dodo and its kindred, though the extirpation of those strange and monstrous forms will most likely leave their precise relations a matter of some doubt; while the third and last Suborder, the true *Columbæ*, is much more homogeneous, and can hardly be said to contain more than two Families, *Columbidæ* and *Diduaculidæ*—the latter consisting of a single species peculiar to the Samoa Islands, and having no direct connexion with the *Dididæ* or *Dodos*,⁶ though possibly it may be found that the Papuan genus *Otidiphaps* presents a form linking it with the *Columbidæ*.

The *Gallinæ* would seem to hold a somewhat central position among existing members of the Carinate division,⁷ whence many groups diverge, and one of them, the *Opisthocomiæ* or *Heteromorphæ* of Prof. Huxley, indicates, as he has hinted, the existence of an old line of descent, now almost obliterated, in the direction of the *Musophagidæ*, and thence, we may not unreasonably infer, to the *Coccygomorphæ* of the same authority. But these "Coccygomorphs" would also appear to reach a higher rank than some other groups that we have to notice, and therefore, leaving the former, we must attempt to trace the fortunes of a more remote and less exalted line. It has already been stated that the *Gaviæ* are a group closely allied to though somewhat higher than the *Limicolæ*, and that at least two forms of what have here been called *Grallæ* present an affinity to the latter. One of them, *Rhinocetus*, has been several times thought to be connected through its presumed relative *Eurypyga* (from which, however, it is a good way removed both as regards distribution and structure) with the *Heriodiones*, Herons. On the other hand the *Gaviæ* would seem to be in like manner related through *Phaethon* (the TROPIC-BIRD, *q.v.*) with the *Steganopodes* or *Dysporomorphæ* of Prof. Huxley, among which it is usually placed, though according to Prof. MIVART (*Trans. Zool. Society*, x. pp. 364, 365) wrongly. These supposed affinities lead us to two other groups of Birds that have, it has been proved, some common characters; and from one or the other (no one yet can say which) the *Accipitres* would seem to branch off—

⁵ This fact tells in favour of the views of Dr Gadow and those who hold the Sand-Grouse to be allied to the Plovers; but then he places the Pigeons between these groups, and their eggs tell as strongly the other way.

⁶ Cf. *Phil. Transactions*, 1867, p. 349.

⁷ Cf. Prof. Parker's remarks in the *Philosophical Transactions* for 1869, p. 755.

¹ *Cariacina* is the oldest name for the genus, but being a word of "barbarous" origin it was set aside by Illiger and the purists in favour of *Dicholophus*, under which name it has been several times mentioned in the foregoing pages.

² A brief description of the egg and young of *Cariacina cristata* produced in the Jardin des Plantes at Paris is given in the Zoological Society's *Proceedings* for 1881, p. 2.

³ This group would contain three families—*Rallidæ*, *Heliornithidæ* (the Finfoots of Africa and South America), and the *Mesitidæ* of Madagascar—whose at least approximate place has been at last found for them by M. A. Milne-Edwards (*Ann. Sc. Naturelles*, ser. 6. vii. No. 6).

⁴ *Mesites*, just mentioned, presents a case which may, however, be very similar.

possibly from some ancestral type akin to and now most directly represented by the enigmatical *Cariama*—possibly in some other way which we can only dimly foreshadow. The *Herodiones* are commonly partitioned into three groups—*Ardeæ*, *Ciconiæ*, and *Platyleæ*, the last including the Ibises—which may certainly be considered to be as many Suborders. The second of them, the Storks, may perhaps be regarded as the point of departure for the *Accipitres* in the manner indicated,¹ as well as, according to Prof. Huxley, for the *Famingoes*, of which he would make a distinct group, *Amphimorphæ*, equivalent to the *Odontoglossæ* of Nitzsch, intermediate between the *Pelargomorphæ* and the *Chenomorphæ*, that is, between the Storks and the Geese. When the embryology of the *Phenicopteridæ* is investigated their supposed relationship may perhaps be made out. At present it is, like so much that needs to be here advanced, very hypothetical; but there is so much in the osteology of the *Famingoes*, besides other things, that resembles the *Anseres* that it would seem better to regard them as forming a Subclass that group to rank equally with the true *Anseres* and with the *Pulamedææ* (SCREAMER, *q.v.*), which last, notwithstanding the opinion of Garrod, can hardly from their osteological similarity to the true *Anseres* be removed from their neighbourhood.

Herodiones.

Accipitres.

Whatever be the alliances of the genealogy of the *Accipitres*, the Diurnal Birds-of-Prey, their main body must stand alone, hardly divisible into more than two principal groups—(1) containing the *Cathartidæ* or the Vultures of the New World, and (2) all the rest, though no doubt the latter may be easily subdivided into at least two Families, *Vulturidæ* and *Falconidæ*, and the last into many smaller sections, as has commonly been done; but then we have the outliers left. The African *Serpentariidæ*, though represented only by a single species,² are fully allowed to form a type equivalent to the true *Accipitres* composing the main body; but whether to the Secretary-bird should be added the often-named *Cariama*, with its two species, must still remain an open question.

Striges.

It has so long been the custom to place the Owls next to the Diurnal Birds-of-Prey that any attempt to remove them from that position cannot fail to incur criticism. Yet when we disregard their carnivorous habits, and certain modifications which may possibly be thereby induced, we find almost nothing of value to indicate relationship between them. That the *Striges* stand quite independently of the *Accipitres* as above limited can hardly be doubted, and, while the *Psittaci* or Parrots would on some grounds appear to be the nearest allies of the *Accipitres*, the nearest relations of the Owls must be looked for in the multifarious group *Picariæ*. Here we have the singular *Steatornis* (GUACHARO, vol. ix. p. 227), which, long confounded with the *Caprimulgidæ* (GOATSUCKER, vol. ix. p. 711), has at last been recognized as an independent form, and one cannot but think that it has branched off from a common ancestor with the Owls. The Goatsuckers may have done the like,³ for there is really not much to ally them to the Swifts and Humming-birds, the *Macrochires* proper, as has often been recommended. However, the present writer would not have it supposed that he would place the *Striges* under the *Picariæ*, for the

Picariæ.

last are already a sufficiently heterogeneous assemblage, and one with which he would not meddle. Whether the Woodpeckers should be separated from the rest is a matter of deeper consideration after the deliberate opinion of Prof. Parker, who would lift them as *Scurognathæ* to a higher rank than that in which Prof. Huxley left them as *Celeomorphæ*, indeed to be the peers of *Schizognathæ*, *Desmognathæ*, and so forth; but this advancement is based solely on the characters of their palatal structure, and is unsupported by any others. That the *Pici* constitute a very natural and easily defined group is indisputable; more than that, they are perhaps the most differentiated group of all those that are retained in the "Order" *Picariæ*; but it does not seem advisable at present to deliver them from that chaos when so many other groups have to be left in it.

Passeres.

Lastly we arrive at the *Passeres*, and here, as already mentioned, the researches of Garrod and Forbes prove to be of immense service. It is of course not to be supposed that they have exhausted the subject even as regards their *Mesomyodi*, while their *Acromyodi* were left almost untouched so far as concerns details of arrangement; but the present writer has no wish to disturb by other than very slight modifications the scheme they put forth. He would agree with Mr Sclater in disregarding the distinctions of *Desmodactyli* and *Elcetherodactyli*, grouping the former (*Euryglamidæ*) with the *Heteromeri* and *Haploophonæ*, which all together then might be termed the Suborder *Oligomyodi*. To this would follow as a second Suborder the *Tracheophonæ* as left by Garrod, and then as a third Suborder the abnormal *Acromyodi*, whether they are to be called *Pseudoscines* or not, that small group containing, so far as is known at present, only the two Families *Atrichidæ* and *Menuridæ*. Finally we have the normal *Acromyodi* or true *Oscines*.

their Sub-
orders.

Oscines,
their homo-
geneous-
ness.

This last and highest group of Birds is one which, as before hinted, it is very hard to subdivide. Some two or three natural, because well-differentiated, Families are to be found in it—such, for instance, as the *Hirundinidæ* or Swallows, which have no near relations; the *Alaudidæ* or Larks, that can be unfaillingly distinguished at a glance by their scutellated *planta*, as has been before mentioned; or the *Meliphagidæ* with their curiously constructed tongue. But the great mass, comprehending incomparably the greatest number of genera and species of Birds, defies any sure means of separation. Here and there, of course, a good many individual genera may be picked out capable of the most accurate definition; but genera like these are in the minority, and most of the remainder present several apparent alliances, from which we are at a loss to choose that which is nearest. Four of the six groups of Mr Sclater's "Laminiplantar" *Oscines* seem to pass almost imperceptibly into one another. We may take examples in which what we may call the Thrush-form, the Tree-creeper-form, the Finch-form, or the Crow-form is pushed to the most extreme point of differentiation, but we shall find that between the outposts thus established there exists a regular chain of intermediate stations so intimately connected that no precise lines of demarcation can be drawn cutting off one from the other.

Still one thing is possible. Hard though it be to find definitions for the several groups of *Oscines*, whether we make them more or fewer, it is by no means so hard, if we go the right way to work, to determine which of them is the highest, and, possibly, which of them is the lowest. It has already been shewn (page 30) how, by a woful want of the logical apprehension of facts, the *Turdidæ* came to be accounted the highest, and the position accorded to them has been generally acquiesced in by those who have followed in the footsteps of Keyserling and

Supposed
highrank of
Turdidæ

¹ Garrod and Forbes suggest a "Ciconiiform" origin for the *Tubinæes* (Zool. Voy. "Challenger," pt. xi. pp. 62, 63).

² It was long suspected that the genus *Polyporoides* of South Africa and Madagascar, from its general resemblance in plumage and outward form, might come into this group, but that idea has now been fully dispelled by M. A. Milner-Edwards in his and M. Grandidier's magnificent *Oiseaux de Madagascar* (vol. i. pp. 50-60).

³ The great resemblance in coloration between Goatsuckers and Owls is of course obvious, so obvious indeed as to make one suspicious of their being akin; but in reality the existence of the likeness is no bar to the affinity of the groups; it merely has to be wholly disregarded.

not borne
out by
alliances,

Blasius, of Prof. Cabanis and of Sundevall. To the present writer the order thus prescribed seems to be almost the very reverse of that which the doctrine of Evolution requires, and, so far from the *Turdidae* being at the head of the *Oscines*, they are among its lower members. There is no doubt whatever as to the intimate relationship of the Thrushes (*Turdidae*) to the Chats (*Saxicolinae*), for that is admitted by nearly every systematizer. Now most authorities on classification are agreed in associating with the latter group the Birds of the Australian genus *Petroica* and its allies—the so-called “Robins” of the English-speaking part of the great southern communities. But it so happens that, from the inferior type of the osteological characters of this very group of Birds, Prof. PARKER has called them (*Trans. Zool. Society*, v. p. 152) “Struthious Warblers.” Now if the *Petroica*-group be, as most allow, allied to the *Saxicolinae*, they must also be allied, only rather more remotely, to the *Turdidae*—for Thrushes and Chats are inseparable, and therefore this connexion must drag down the Thrushes in the scale. Let it be granted that the more highly-developed Thrushes have got rid of the low “Struthious” features which characterize their Australian relatives, the unbroken series of connecting forms chains them to the inferior position, and of itself disqualifies them from the rank so fallaciously assigned to them. Nor does this consideration stand alone. By submitting the Thrushes and allied groups of Chats and Warblers to other tests we may try still more completely their claim to the position to which they have been advanced.

Without attaching too much importance to the systematic value which the characters of the nervous system afford, there can be little doubt that, throughout the Animal Kingdom, where the nervous system is sufficiently developed to produce a brain, the creatures possessing one are considerably superior to those which have none. Consequently we may reasonably infer that those which are the best furnished with a brain are superior to those which are less well endowed in that respect, and that this inference is reasonable in accordance with the experience of every Physiologist, Comparative Anatomist, and Palaeontologist, who are agreed that, within limits, the proportion which the brain bears to the spinal marrow in a vertebrate is a measure of that animal's morphological condition. These preliminaries being beyond contradiction, it is clear that, if we had a series of accurate weights and measurements of Birds' brains, it would go far to help us in deciding many cases of disputed precedence, and especially such a case as we now have under discussion. To the dispraise of Ornithotomists this subject has never been properly investigated, and of late years seems to have been wholly neglected. The present writer can only refer to the meagre lists given by TIEDEMANN (*Anat. und Naturgesch. der Vögel*, i. pp. 18–22), based for the most part on very ancient observations; but, so far as those observations go, their result is conclusive, for we find that in the Blackbird, *Turdus merula*, the proportion which the brain bears to the body is lower than in any of the eight species of *Oscines* there named, being as 1 is to 67. In the Redbreast, *Erithacus rubecula*, certainly an ally of the *Turdidae*, it is as 1 to 32; while it is highest in two of the Finches—the Goldfinch, *Carduelis elegans*, and the Canary-bird, *Serinus canarius*, being in each as 1 to 14. The signification of these numbers needs no comment to be understood.

Evidence of another kind may also be adduced in proof that the high place hitherto commonly accorded to the *Turdidae* is undeserved. Throughout the Class *Aves* it is observable that the young when first fledged generally assume a spotted plumage of a peculiar character—nearly each of the body-feathers having a light-coloured spot at

its tip—and this is particularly to be remarked in most groups of *Oscines*, so much so indeed, that a bird thus marked may, in the majority of cases, be set down without fear of mistake as being immature. All the teachings of morphology go to establish the fact that any characters which are peculiar to the immature condition of an animal, and are lost in its progress to maturity, are those which its less advanced progenitors bore while adult, and that in proportion as it gets rid of them it shews its superiority over its ancestry. This being the case, it would follow that an animal which at no time in its life exhibits such marks of immaturity or inferiority must be of a rank, compared with its allies, superior to those which do exhibit these marks. The same may be said of external and secondary sexual characters. Those of the female are almost invariably to be deemed the survival of ancestral characters, while those peculiar to the male are in advance of the older fashion, generally and perhaps always the result of sexual selection.¹ When both sexes agree in appearance it may mean one of two things—either that the male has not lifted himself much above the condition of his mate, or that, he having raised himself, the female has successfully followed his example. In the former alternative, as regards Birds, we shall find that neither sex departs very much from the coloration of its fellow-species; in the latter the departure may be very considerable. Now, applying these principles to the Thrushes, we shall find that without exception, so far as is known, the young have their first plumage more or less spotted; and, except in some three or four species at most,² both sexes, if they agree in plumage, do not differ greatly from their fellow-species.

nor by
char-
acter of
plumage.

Therefore as regards capacity of brain and coloration of plumage priority ought not to be given to the *Turdidae*. It remains for us to see if we can find the group which is entitled to that eminence. Among Ornithologists of the highest rank there have been few whose opinion is more worthy of attention than Macgillivray, a trained anatomist and a man of thoroughly independent mind. Through the insufficiency of his opportunities, his views on general classification were confessedly imperfect, but on certain special points, where the materials were present for him to form a judgment, one may generally depend upon it. Such is the case here, for his work shews him to have diligently exercised his genius in regard to the Birds which we now call *Oscines*. He belonged to a period anterior to that in which questions that have been brought uppermost by the doctrine of Evolution existed, and yet he seems not to have been without perception that such questions might arise. In treating of what he termed the Order *Vagatores*,³ Rank of *Corvidae* including among others the Family *Corvidae*—the Crows, he tells us (*Brit. Birds*, i. pp. 485, 486) that they “are to be accounted among the most perfectly organized birds,” justifying the opinion by stating the reasons, which are of a very varied kind, that led him to it. In one of the earlier treatises of Prof. PARKER, he has expressed (*Trans. Zool. Society*, v. p. 150) his approval of Macgillivray's views, adding that, “as that speaking, singing, mocking animal, Man, is the culmination of the Mammalian series, so that bird in which the gifts of speech, song, and mockery are combined must be considered as the top and crown of the bird-class.” Any doubt as to which Bird is here intended is dispelled by another passage, written ten

¹ See Darwin, *Descent of Man*, chaps. xv., xvi.

² According to Mr Seebohm (*Cat. Birds Brit. Museum*, v. p. 232) these are in his nomenclature *Melurus nigrescens*, *M. fasciata*, *M. glogas*, and *M. giganteus*.

³ In this Order he included several groups of Birds which we now know to be but slightly if at all allied; but his intimate acquaintance was derived from the *Corvidae* and the allied Family we now call *Strutidae*.

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established
by size
of brain,

years later, wherein (*Monthly Microsc. Journal*, 1872, p. 217) he says, "The Crow is the great sub-rational chief of the whole Kingdom of the Birds; he has the largest brain; the most wit and wisdom;" and again, in the Zoological Society's *Transactions* (ix. p. 300), "In all respects, physiological, morphological, and ornithological, the Crow may be placed at the head, not only of its own great series (birds of the *Crow-form*), but also as the unchallenged chief of the whole of the 'Carninatae.'"

and by
character
of plumage.

It is to be supposed that the opinion so strongly expressed in the passage last cited has escaped the observation of recent systematizers; for he would be a bold man who would venture to gainsay it. Still Prof. Parker has left untouched or only obscurely alluded to one other consideration that has been here brought forward in opposing the claim of the *Turdidae*, and therefore a few words may not be out of place on that point—the evidence afforded by the coloration of plumage in young and old. Now the *Corvidae* fulfil as completely as is possible for any group of Birds to do the obligations required by exalted rank. To the magnitude of their brain beyond that of all other Birds Prof. Parker has already testified, and it is the rule for their young at once to be clothed in a plumage which is essentially that of the adult. This plumage may lack the lustrous reflexions that are only assumed when it is necessary for the welfare of the race that the wearer should don the best apparel, but then they are speedily acquired, and the original difference between old and young is of the slightest. Moreover, this obtains even in what we may fairly consider to be the weaker forms of the *Corvidae*—the Pies and Jays. In one species of *Corvus*, and that (as might be expected) the most abundant, namely, the Rook, *C. frugilegus*, very interesting cases of what would seem to be explicable on the theory of Reversion occasionally though rarely occur. In them the young are more or less spotted with a lighter shade, and these exceptional cases, if rightly understood, do but confirm the rule.¹ It may be conceded that even among *Oscines*² there are some other groups or sections of

groups in which the transformation in appearance from youth to full age is as slight. This is so among the *Paridae*; and there are a few groups in which the young, prior to the first moult, may be more brightly tinted than afterwards, as in the genera *Phylloscopus* and *Anthus*. These anomalies cannot be explained as yet, but we see that they do not extend to more than a portion, and generally a small portion, of the groups in which they occur; whereas in the Crows the likeness between young and old is, so far as is known, common to every member of the Family. It is therefore confidently that the present writer asserts, as Prof. Parker, with far more right to speak on the subject, has already done, that at the head of the Class *Aves* must stand the Family *Corvidae*, of which Family no one will dispute the superiority of the genus *Corvus*, nor in that genus the pre-eminence of *Corvus corax*—the widely-ranging Raven of the Northern Hemisphere, the Bird perhaps best known from the most ancient times, and, as it happens, that to which belongs the earliest historical association with man. There are of course innumerable points in regard to the Classification of Birds which are, and for a long time will continue to be, hypothetical as matters of opinion, but this one seems to stand a fact on the firm ground of proof.

During the compilation of much of the present article the writer flattered himself with the hope that he might at its conclusion have been able to give a graphic illustration of the way in which the various groups of Birds may be conceived to be related to one another in the form of a map, such as has been so usefully furnished by several of his more gifted brethren in regard to other Classes or portions of Classes of the Animal Kingdom. This hope he has been reluctantly constrained to abandon,—whether from the inherent difficulty, perhaps impossibility, of at present executing the task, or from his own want of cartographical skill, it is not for him to say. He may, however, be allowed to express the belief that there is no group in Animated Nature that more assuredly deserves the further attention of the highest zoological intellects than Birds; and, looking to the perplexities which on all sides beset their scientific study, there is no department of Zoology that will better repay the application of those intellects than Ornithology.

(A. N.)

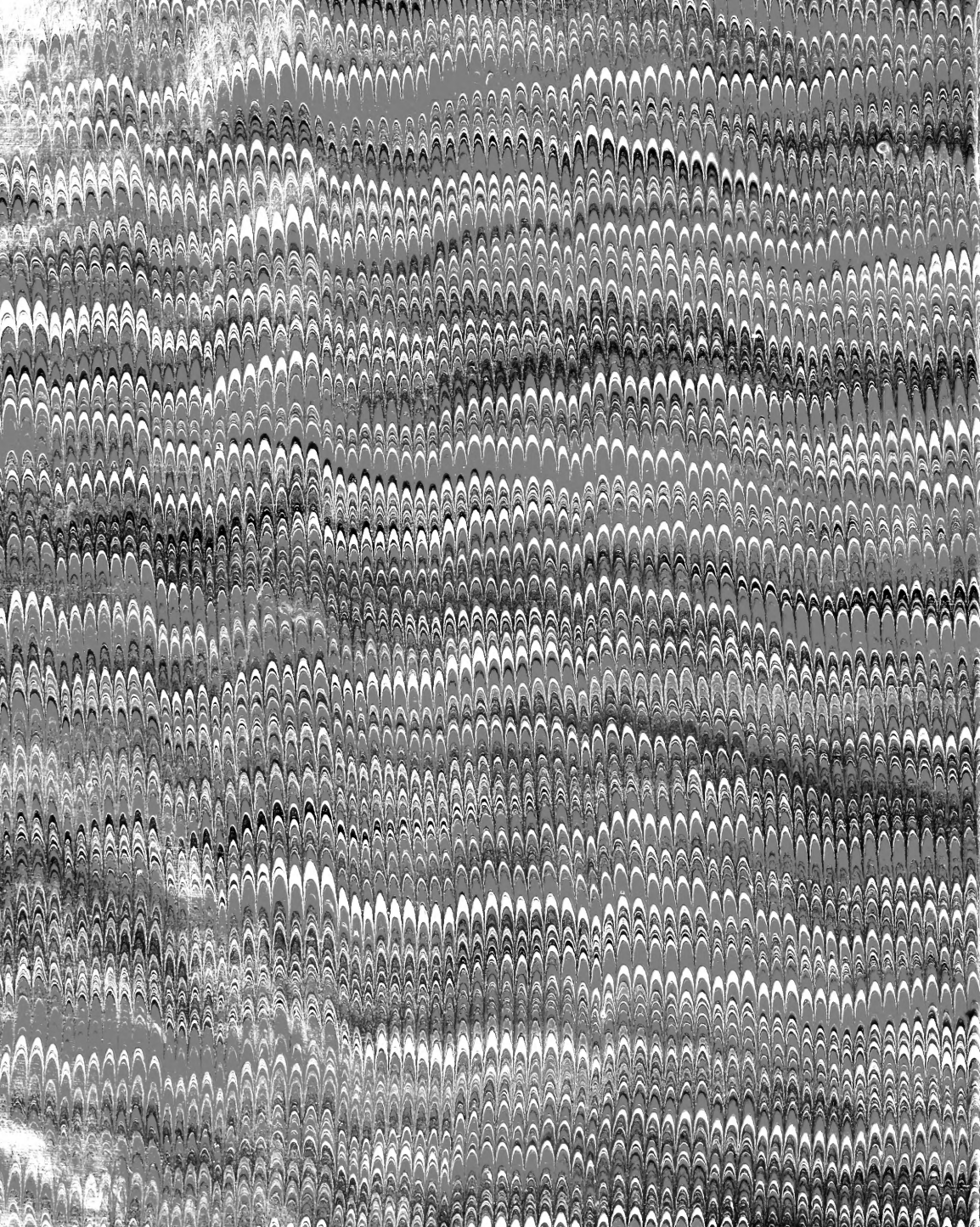
¹ One of these specimens has been figured by Mr Hancock (*N. H. Trans. Northumb. and Durham*, vi. pl. 3); see also Yarrell's *British Birds*, ed. 4, ii. pp. 302, 303.

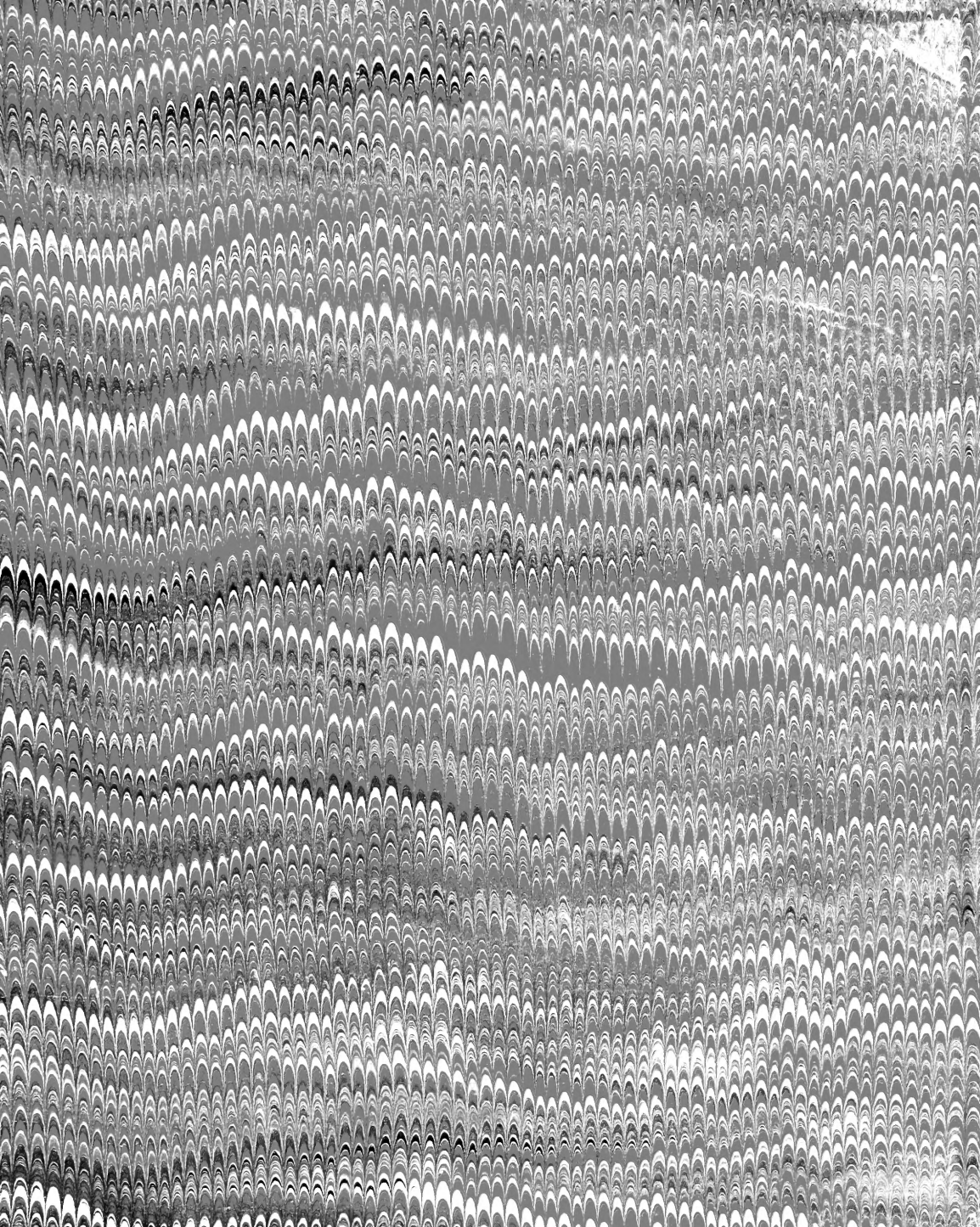
² In other Orders there are many, for instance some Hummingbirds and Kingfishers; but this only seems to shew the excellence in those Orders attained by the forms which enjoy the privilege.


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