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THE

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EMINENT LITERARY AND SCIENTIFIC MEN.

Natural History.

ON

THE NATURAL HISTORY AND CLASSIFICATION OF BIRDS.

BY

WILLIAM SWAINSON, ESQ. A.C.G.

HONORARY MEMBER OF THE CAMBRIDGE PHILOSOPHICAL SOCIETY;
FELLOW OF THE ROYAL AND LINNÆAN SOCIETIES,
AND OF SEVERAL FOREIGN ACADEMIES.

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1836.

THE STORK IN THE HEAVEN KNOWETH HER APPOINTED TIME, AND THE TURTLE, AND THE CRANE, AND THE SWALLOW OBSERVE THE TIME OF THEIR COMING.

JEREMIAH VIII. 7.

THESE WAIT ALL UPON THEE, THAT THOU MAYEST GIVE THEM THEIR MEAT IN DUE SEASON.

PSALM CIV. 27.

ON THE NATURAL HISTORY and Classification OF BIRDS.

By William Swainson, A.L.S. F.R.S. L. & E. &c.

AND OF SEVERAL FOREIGN ACADEMIES.

VOL. I.

W. Swainson del.t

F. Finden sculp.t

Harpyia destructor, *the Destroying Eagle of S. America.*

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PRELIMINARY REMARKS. — PECULIARITIES OF THE CLASS. — ITS RELATION TO THOSE OF REPTILES AND QUADRUPEDS. — ITS PRIMARY DIVISIONS AND ORDERS.

(1.) If elegance of form, beauty of colouring, or sweetness of voice, were peculiarities which constituted the superiority of one class of beings over another, we should unquestionably assign to Birds the highest station in the scale of the animal creation. No shadow of fear mixes with those pleasurable sensations with which they are viewed; and those feelings, moreover, are heightened by the ethereal nature of the creatures themselves. In a moment they may spread their wings, launch into boundless air, and be seen no more. We almost view them as beings of a happier world, alighting upon this "dim spot called earth," more as a

place of temporary rest, in their voyage through the regions of space, than as their permanent abode. They remind us of those invisible spirits of the unseen world, which, we are taught to believe, traverse the air on the wings of the wind; who alight, but for a moment, among the sons of men, and then depart to breath a purer atmosphere. Of all unintelligent beings, they alone are gifted with a musical voice, possessing both sweetness and varied expression. Their language, in some measure, is thus intelligible even to man, inspiring him with cheerfulness or melancholy. Hence it is, that from among birds the poets have selected their sweetest themes. They are, both poetically and literally, the butterflies of vertebrated animals*; flitting from one plant to another, living less on earth than in the air, and having their wings ornamented with feathers of bright or varied colours. In both we dimly see an indication of that existence which will separate the spirit of man from those cares, anxieties, and allurements which chain him down to earth, as if it was his final and only stage of action. It is highly probable that the "Sweet Psalmist of Israel†" had some such thought, when he longed for the wings of the dove, that he might flee from earth and be at rest.‡

(2.) It is to this interesting and varied class of animals that our present volume will be exclusively dedicated. Our chief object will be to explain those relations which they bear to other animals, and those which they possess among themselves. We shall endeavour to exhibit Ornithology, not as an isolated science, disconnected in its relations from other classes of the animal kingdom, and whose parts are to be classed without any reference to general laws; but we shall view it as a part only of one "stupendous whole,"—as forming an integral portion of that mighty circle over which the same laws of physical science equally

* The feathers of birds, soft and imbricate, are perfectly analogous to the down upon the wings of butterflies, and both are disposed in the same manner.

† Bishop Horne. ‡ Psalm xi. 1. and lv. 6.

and uniformly prevail; and whose parts, whether large or small, are intimately and harmoniously connected with all others in the chain of being. We presume that those who desire to understand and enter into the views here developed, have made themselves already acquainted with the ordinary nomenclature of the science, and with the different denomination of groups which it contains.* The habits and instincts of birds and other animals will form a distinct treatise in this series, while their technical *internal* structure will be left to the physiologist. Their comparative anatomy, as exhibited in their *external* construction, is that part of the science upon which we shall more particularly expatiate: first, because there is no work of this description at all calculated for the present state of science; and, secondly, because every modification of form indicates a corresponding peculiarity of food, habit, or manners. This subject, which will occupy the greater part of our present volume, will render it more particularly an INTRODUCTION TO MODERN ORNITHOLOGY. The Bibliography and Nomenclature of Birds will then follow; after which we shall lay before the naturalist such a systematic arrangement of the different groups as appears to us most in accordance with nature.

(3.) It is easy to perceive that BIRDS form one of the grand divisions of vertebrated animals; that which is most strongly marked, and that which is most isolated. A body covered with feathers, instead of hair or wool, and the two fore feet transformed into wings, is the form under which Nature has now developed one of the most lovely groups in creation. The structure of birds adapts them for inhabiting an element, from which quadrupeds, and even man, is excluded. They seem to wander over the regions of space, with an ease and celerity of which there is no parallel in nature. With few exceptions, they are the most gifted with the power of locomotion; since, as it has

* On the Classification of Animals, p. 265.

been well observed of the wading tribes, they command three elements, and can make way equally well on land, in the air, or in water. They possess the greatest energy of respiration known to exist; and their powers of vision are more highly developed than in any other class of vertebrated animals. Their internal structure is not less peculiar. Their young are produced from eggs, and they have a double system of circulation and respiration: the lungs are fixed to the ribs, undivided, and pierced in such a way as to permit the air not only to pass into the chest and body, but even to penetrate the interior of the bones, so that every part is impregnated with that fluid in which they are destined to move.

(4.) We have already shown* that Birds, in the vertebrated circle, occupy a station between Reptiles and Quadrupeds. Between Birds and the former there seems, in the living world, to be a wide hiatus; a gap, which nothing now known to exist in creation can fill up. But this apparent interruption is not, in fact, so great as may be thought; and even if it were, it must not be confounded with an entanglement, or with a *saltus*, or leap, of Nature: many links are, indeed, wanting, but the circles, at those parts where they may be supposed to touch each other, still preserve such a resemblance, and manifest such a mutual approximation, as to leave us in no doubt on their real and absolute affinity. Were we to rest satisfied with the affinity thought to exist between the tortoises and the penguins, the subject might still be left in doubt; for analysis has satisfied us that this is a resemblance of analogy, and not of affinity. It is here, in short, that we see the absolute necessity of studying the forms of extinct animals, no less than of those now existing. In the extraordinary genus *Pterodactylus*, there is such a singular union of the reptile with the bird, that an ordinary observer, looking at its skeleton, would be quite at a loss to decide to which class it belonged. In these flying

* On the Classification of Quadrupeds, p. 44.

lizards, which belonged to a remote era of our globe, we see the wings and legs of a bat; a long snout, which might be mistaken for a bill, were not the jaws provided with a few teeth; and a neck nearly the length of the body, which immediately reminds us of a wading bird. This peculiar structure, which has no analogy to any existing reptile, is precisely what we should look for in a group of animals connecting reptiles with birds, and offers a far more perfect link of affinity than that between a tortoise and a penguin. There have been discovered no less than three species of these birdlike reptiles in the different limestone slates of Europe; and they obviously belong, with the *Plesiosaurus* and others, to a distinct order of their own class, nearly all of which were swept away by one of those convulsions of the globe which preceded the creation of the last and most perfect of the Almighty's works — MAN.

(5.) The approximation of birds to reptiles being thus established, let us now see in what manner the former are connected to quadrupeds, at the opposite extremity of their circle. For this purpose we may select either the *Ornithorhynchus* in one, or the ostrich in the other class, as equally tending to effect this union. The *Ornithorhynchus*, indeed, is a quadruped; but so totally unlike its congeners, that it stands alone among them as a completely oviparous animal. The similarity of its jaws to those of a bird is so strong, that, upon its first discovery, it was strongly suspected the specimen sent to Europe was a deception, practised by some cunning fellow on the credulity of naturalists, by engrafting the bill of a duck upon the skull of a quadruped. On turning to the ostrich family, we find an equally strong approximation to quadrupeds. The wings, which are the great characteristic of birds, are so small as to become, for the purposes of flight, absolutely useless.—The body of the emu is covered with a sort of hair, rather than with feathers; while its thick feet and tramping gait remind us more of a horse than of a bird. The ostriches, in fact, are without two of the three primary

distinctions of their class. They are birds which cannot fly, and which have no real feathers. They walk, indeed, upon two feet; but so does the kangaroo and the jerboa, which, indeed, are quadrupeds, but whose fore feet are as little developed as the wings of the ostrich. True it is, that we can have no hesitation in referring each of these animals to their proper class; and, therefore, it may be said, there are still gaps in the chain. We freely admit this. But the question is, not whether the series of links are perfect, but whether the last in each does not bear all the marks of having been formerly united by means of some few which are lost. If the *Ornithorhynchus,* of all existing quadrupeds, evinces the nearest approach to birds, and the ostrich, among birds, shows the like tendency towards the structure of quadrupeds, we have all the evidence requisite to prove their relationship.

(6.) We have said that birds are the butterflies of the vertebrated animals, not merely in the figurative imagery of poetry, but in the sober language of science. This analogy will be at once apparent, on comparing the circle of the animal kingdom with that of the vertebrated animals.

	Circle of the Animal Kingdom.	*Typical Characters.*	*Circle of the Vertebrata.*
1. Typical circle.	VERTEBRATA.	Pre-eminently typical.	MAMMALIA.
2. Sub-typical circle.	ANNULOSA.	Body furnished with wings.	AVES.
3. Aberrant circle.	MOLLUSCA.	Crawl upon their bellies.	REPTILIA.
	ACRITA	Changeable in form.	AMPHIBIA.
	RADIATA.	Pre-eminently aquatic.	PISCES.

Notwithstanding what has been said (1.) on the many circumstances which give to birds a greater interest than we in general feel towards quadrupeds, it must be remembered that these latter are a much more highly organised class, and that therefore they exhibit the perfection, or types, not only of the vertebrated circle, but of the entire animal kingdom. Annulose animals, or insects, are the next in rank; and the most perfect of these are the *Ptilota,* or winged class, at the head of which stands the order *Lepidoptera.* Hence, one of the most

typical characters of the *Annulosa* is precisely that of the class of birds; and both are distinguished, in their pre-eminently perfect examples, by having a body furnished with wings. A shellfish is the type of the *Testacea*, just as serpents are of the *Reptilia*; and both these are without feet or fins, yet crawl upon their bellies. The *Acrita* and the *Amphibia* are the least organised of their own circles; while the animals of the *Radiata*, like the fish, are pre-eminently aquatic. In this way has Nature represented the great divisions of the animal kingdom, in the class of *Aves*; and has given us, under the form of a bird, another modification of that which we see in a butterfly.

(7.) We have now sufficiently illustrated the station which the circle of birds occupies in the animal kingdom, and the analogies which belong to it as a class. Before, however, we proceed to explain the primary groups which compose this circle, let us advert to what has already been said on the primary types of nature, and see how far they are exemplified, or how far they can be traced in the objects before us. This investigation will be doubly instructive. It will tend to verify, in detail, those assertions which have been advanced in a general way; it will also awaken the attention of the ornithologist to many peculiarities of structure and of habit; and enable him, even in the investigation of species, to refer many shades of variation to one and the same cause, which would either pass unregarded, or be considered altogether anomalous.

(8.) The primary types to which birds, no less than all other animals, as we conceive, may be referred, have been already expatiated upon.* But we are now to regard them only as they appear in one class; and their definitions will consequently lose much of that vagueness, and be stript of many of those exceptions, which it was impossible to avoid, when attempting to reconcile the innumerable variations they assumed in the different groups of the entire animal kingdom. The names by

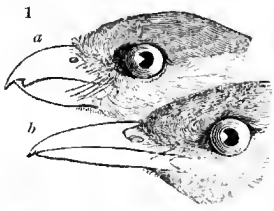
* Classification of Animals, p. 241.

which these types are distinguished in Ornithology, are, 1. The *Raptorial;* 2. The *Insessorial;* 3. The *Natatorial,* or aquatic ; 4. The *Grallatorial,* or *Tenuirostral;* and, 5. The *Rasorial,* or *Scansorial.*

(9.) The first, or pre-eminent type, is termed the *Insessorial,* or typical, because it corresponds to the order *Insessores,* the most perfect in this class. We use the term *perfect,* on this and all other occasions, not as implying that other groups—when compared to such as are thus termed — are imperfectly formed, but as indicative only of a higher or more complicated organisation. Nothing that the UNIVERSAL CREATOR has made, can, by any possibility, be imperfect, in the usual meaning of the word; because, as one of His attributes is *perfection,* it of course follows that all His works are equally so; that is, they are most beautifully and most completely formed for the station in the the scale of nature they are intended to fill, and for performing the functions belonging to their particular organisation. But while this truth is apparent to all who wish to know it, there cannot be a doubt, that some animals have their instincts more developed and their forms more highly organised than others. A bee is a more perfect animal than a butterfly, and this latter than an oyster. Why? Because, although each, "after its kind," is perfection, yet a wonderful degree of instinct has been given to the first, great beauty of form to the second, and both have been denied to the third, — which, moreover, is barely capable of voluntary motion. We have thought it right to enter upon this explanation — not that it is necessary towards men of real science and good feeling — but to take from one or two obscure writers the power of wilfully misinterpreting the sense in which we use the terms *perfect* and *imperfect,* when applied to animals. Regarding circles which are distinguished by these epithets, we have already said sufficient. But to return.

(10). The *Insessorial,* or pre-eminent type, as just intimated, is that which is most highly organised, either with a variety of powers, or with any one power in particular, nearly to the exclusion of many others.

Animals so endowed are called, for the sake of brevity, typical of their own group. Thus the crow is the type of the whole feathered creation, because it unites in itself some part of the properties of all other birds; while, upon the second principle, the woodpecker is the type of the climbing tribe, because it possesses that particular faculty more perfectly than any other. The swallow, again, is the pre-eminent type of the fissirostral birds, because it not only flies with the greatest comparative swiftness, but its feet are more perfectly organised than those of the night-jars (*Caprimulgus*). The insessorial type, in a word, is that which exhibits *all* the characters of the division in which it is placed. It thus becomes pre-eminently typical, and stands in opposition to an aberrant type, which possesses part only of such characters. In regard to the external characters, the bill, in most instances, is more or less conical, and slightly notched (*fig.* 1. *b*), while the feet are well developed: but there are so many variations, that it will be necessary to enter into further particulars when we come to enumerate the orders and tribes.



(11.) The RAPTORIAL, or sub-typical form, has the upper mandible much more hooked; and, in a large proportion of the groups, there is a deep notch near the tip on each side, by which a process, performing the office of a tooth, is produced. (*Fig.* 1. *a.*) Carnivorous habits especially belong to this type, which corresponds to the Feline order among quadrupeds. Its highest development is seen in birds of prey, *Raptores*, where the claws of the toes are also retractile, like those of the cats (*Felinæ*).

(12.) The aberrant types come next. Of the indications of the NATATORIAL, or aquatic structure, the two which are most universal are the shortness and limited power of the feet, and the broad obtuse form of the bill.

The head is always large in proportion to that of other types; and these birds either actually live upon the surface, or habitually frequent the vicinity, of the water. They are well distinguished from those of the next, or grallatorial type, by the excessive width of their mouth, —a formation admirably adapted to the manner in which they feed, which is almost always, like swallows, upon the wing: this peculiarity, indeed, belongs to no other type. The tail is generally very short, and great bulk of body is a frequent accompaniment of the natatorial structure; witness the gigantic albatross, the pelicans, and the penguins, while the ostrich and the cassowaries, although not swimmers, are, nevertheless, the natatorial types of the gallinaceous order. The powers of flight are much diversified, but they are, in general, very great; instances of this swiftness occur in the swallows, petrels, flycatchers, and many other groups belonging to this form. The grallatorial, or tenuirostral type, is shown in birds, as in quadrupeds, by a great slenderness and elongation of the jaws, muzzle, or bill; for all these are merely different terms to express nearly the same thing; the notch in the bill, when it exists, is very slight, and the feathers of the front are considerably advanced upon the base of the upper mandible. The opening of the nostrils is very long, often tumid, but never round. Great swiftness, either of foot or of wing, is a constant indication of this type. Sometimes, as in the snipes, both these characters are united; at other times, as we see in the humming birds, this swiftness is confined only to flight; while in some few, as the flamingo, the wings are short, but the feet very long. The aperture or gape of the mouth is generally very small, as in all suctorial animals; witness the whole of the typical *Grallatores*, or waders, and their representatives, the *Trochilidæ*. The smallest birds, no less than the smallest quadrupeds, are of this type, which is again represented by the little gliriform *Mammalia*. The *Rasorial* type is inferior only to the natatorial in bulk. Birds belonging to it have the tail greatly developed as

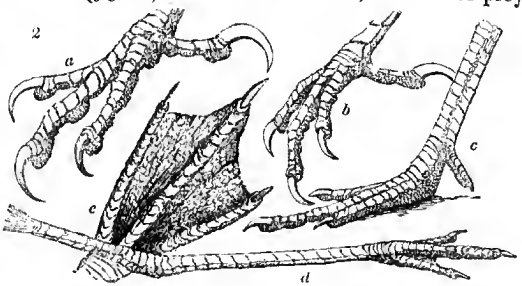
to size, or it is highly ornamented, or it is of some particular or unusual structure. The bill, in the most typical examples, is short and thick, not conic, like the perchers, but having the upper mandible more arched than the under, and the nostrils covered with a hard or horny substance: such, at least, are the characters found in the order which more especially represents this type; but, in other groups, the bill is modified, so as to point out the secondary analogies of the birds. A much more general characteristic is the great size of the foot in all its parts and proportions. Hence we find that the birds in question live merely upon the ground; and that in proportion to the strength of their feet, is the shortness of their wings: their food also is more restricted to the vegetable world than any other birds, and they scratch the ground in search of seeds with their strong feet, and are assisted in the same operation by their robust bills. All the groups which represent this type, in some mode or other, evince either attachment or confidence towards man; and they are peculiarly susceptible of being tamed or domesticated.

(13.) The recapitulation just made of the chief characters of the primary types of the animal kingdom, as they appear in the class before us, will be sufficient to recall the attention of the student to what has been said upon the same subject on a former occasion*; when the definitions of these types were extended to all animals. The further modifications to which they are subject in the different groups, will be noticed as they occur. Bearing in mind, however, the foregoing indications, the student will be prepared to understand more readily those definitions of the primary divisions of the class, which we shall now enter upon.

(14.) All birds belong to one or other of the following orders: — 1. RAPTORES, or rapacious birds; 2. INSESSORES, or Perchers; 3. RASORES, or Fowls; 4. GRALLATORES, or Waders; 5. NATATORES, or Swimmers. We call these divisions *Orders;* but it is more

* Classification of Animals, p. 257.

probable that the three last — which constitute the aberrant group of the class — are only of the rank of *tribes;* equivalent to the *Fissirostres, Scansores,* &c. hereafter noticed. As the circularity of these three groups, taken collectively, has not yet been made out, we shall therefore, for the present, consider them as holding the rank of *orders.* The typical circle is seen in the order INSESSORES, and the subtypical in that of the RAPTORES. Groups, truly natural, may be defined by more than one set of characters; hence it is, that, independent of every other, the primary divisions of this class may be shortly and beautifully discriminated by their feet. In these members we have three striking modifications of structure (*fig.* 2.). In the RAPTORES, or birds of prey

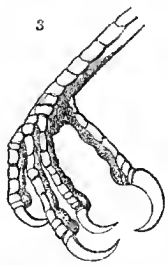


the feet (*a*) are raptorial; that is, adapted for seizing and destroying other animals; the claws are consequently sharp, much hooked, and retractile, and they may be employed both offensively and defensively. In the second, or pre-eminent type — the INSESSORES — the feet are constructed more especially for grasping or perching (*b*); the claws are comparatively small, less curved, and are not retractile; while the hind toe, as in the last, is placed upon the same level as the fore toes. In the third, or aberrant division, composed of the fowls (*c*), the waders (*d*), and the swimmers (*e*), none of the above characters are found. The hind toe, when it exists, is always *elevated above the plane of the others,* and the fore toes are more or less connected by a membrane. The

degree in which this membrane is developed, constitutes the difference between the RASORES, the GRALLATORES, and the NATATORES. A more extended definition of each order will, nevertheless, give a better idea of their contents to the generality of readers.

(15.) I. The rapacious birds, or RAPTORES, are composed only of the vultures, falcons, and owls; of the two other types, which would constitute this a circle, one, which was represented by the Dodo, has been exterminated within the records of modern times, while the other is utterly unknown, and probably was lost in some more remote convulsion of the earth. It is well known that the three families now living, are eminently rapacious, feeding upon other animals, whether living or dead; their bill is armed with a strong, and often sharp, tooth in each jaw, representing the formidable canine teeth of the *Feræ*, and with which they tear and divide their prey. They are the strongest, most cruel, and most sanguinary of all birds; and represent, in their own circle, the carnivorous quadrupeds.

(16.) II. The order INSESSORES is by far the most extensive; for it comprises, with the exception of the fowls, the whole of the remaining tribe which live upon the land. Their chief distinction, as already stated, is in their feet (as seen in that of the common oriole, *fig. 3.*), the toes of which are so disposed that they can grasp the boughs of trees with the greatest facility; and although many of them habitually live upon the ground, yet there is no insessorial bird yet discovered, which has the hind toe raised above the others. The perfection of the feet is accompanied by other peculiarities. It is in this order that we find the greatest powers of song, and, upon the whole, the greatest variety and beauty of plumage. In short, in whatever light we view them, as a whole, they unquestionably exhibit the greatest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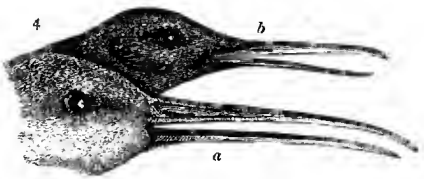
perfection of the class; just as do the *Quadrumana* among quadrupeds.

(17.) III. The order NATATORES indicates the position of the swimming tribes; those whose feet are formed almost exclusively for swimming, and who habitually live in the water. The duck and the goose are familiar examples; but, to see this structure highly developed, we must turn to the cormorant, the pelicans, the grebes, and the puffins. The wings, in general, are very short in such as have the feet greatly developed, as in the two last mentioned families; but sometimes we find this preponderance reversed, for in the pelicans the wings are remarkably long and the feet weak. In the gulls and terns, again, both wings and feet are highly organised, so that it might lead us to suspect those birds were the types of the whole order.

(18.) IV. In the GRALLATORES, or waders, we have a continuation of *aquatic*, but not of perfect *swimming* birds. They are chiefly known by their long legs and half-webbed toes; a structure which enables them to wade sufficiently deep into the water to capture the marine animals upon which they feed: in this they are greatly assisted by their long, slender, and often flexible bill, which they thrust into the mud and sand, and by this means burrow, like pigs, for worms and other small objects (*fig.* 4. *a*). It is clear that their food is sucked up, for the mouth itself is (typically) very small; and in this respect they perfectly resemble the



Trochilidæ (*fig.* 4. *b*), the most suctorial of all birds. In both these groups, the feathers advance very far upon the bill; and in both we find those birds which

have the longest, the straightest, as well as the most curved bills. The sandpipers, the curlews, the ibis, and many other well-known waders, may be cited to illustrate this position; and we see, among the humming birds, representations of all these forms of bills. The eyes are placed far back on the head, just as in the gliriform quadrupeds; witness the woodcock and the hare. The waders, in general, are the swiftest runners, and their flight is equally rapid, yielding only to the swallows. We are now, of course, looking only to those families which are eminently typical of the order; for in others these characters are either much diminished, or do not all exist. Thus, the herons and cranes walk slowly and fly heavily: many of the plovers are seldom found on the sea shore, and have no web to their toes: the rails (*fig.* 5.) have remarkably short wings, large but not high legs, and confine them to fresh water; while the coots have webbed feet, walk badly, but swim dexterously. These deviations, which at first might be thought inconsistent with the alleged distinctions of the order, are, nevertheless, absolutely necessary to make it natural. They indicate analogies, which, did they not exist, would at once show that the group was artificial.

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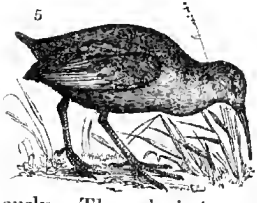


(19.) V. We now come to the last order, that of RASORES, wherein are contained the whole of the *Gallinaceæ*, or fowls; the chief characteristic of which is the great size and strength of their legs, and the proportionate shortness of their wings. We at once perceive how well this structure is adapted for birds which, from living upon the ground, have little occasion for flight. The construction of their feet is somewhat similar to what we see among the *Insessores*, but with this remarkable difference,—that the hind toe, instead of being upon the same level as the others, is situated higher up, and above the heel (*fig.* 2. *c*): the bill, in opposition to that of the

last order, is short, thick, and arched above; and the tail, which in the waders is always more or less short, is here strikingly developed. The peacock, turkey, and our domestic poultry give us examples of one set of rasorial birds; and the partridges, grouse, and quails, of another. Great bulk is found both in this and in the natatorial order, but docility is a moral trait peculiar to this.

(20.) It will be needless, after this exposition, to bring forward further proof that the five types of the animal kingdom, which we have formerly traced in quadrupeds *, are equally conspicuous in birds, nor will the reader be at a loss to perceive in what manner these two classes are represented. Their analogies, indeed, are so beautifully simple and harmonious, that we cannot refrain from throwing them into a tabular form.

Primary Types.	*Orders of Birds.*	*Typical Characters.*	*Orders of Quadrupeds.*
1. Typical.	INSESSORES.	Organs of prehension and general structure highly developed.	QUADRUMANA.
2. Sub-typical.	RAPTORES.	Carnivorous; claws retractile.	FERÆ.
3. Aquatic.	NATATORES.	Live and feed in the water; feet very short or none.	CETACEA.
4. Suctorial.	GRALLATORES.	Jaws much prolonged; burrow for their food.	GLIRES.
5. Rasorial.	RASORES.	Head with crests of horn or feathers; habits domestic; feet long, formed for walking.	UNGULATA.

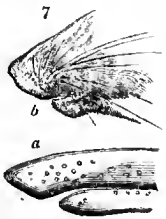
(21.) These analogies are so perfect, and the series so completely in unison with those of all other animals, that we deem it unnecessary to go into any long details. There is one circumstance however, relative to the two first groups; which, as it has never been pointed out, demands our attention, inasmuch as it completely sets aside the speculative idea that the parrots are the types of all birds, *because* the monkeys are so of quadrupeds. The parrots, indeed, are well known to have great powers of grasping, and every one has seen them hold their food in their claws: but this is only the development of *one particular* character, not that union of several, which is the first and greatest distinction of all pre-eminent

* See Classification of Animals, p. 53.

types. It is a structure, moreover, belonging only to one solitary family in a large tribe of others, none of which possess it in the least degree. In the order *Insessores*, on the contrary, this power of grasping is not confined to one group, but is extended to the whole; and it therefore becomes the first and more distinguishing characteristic of the order. The climbing nature of the parrots is at once explained by their forming a prominent type of the scansorial tribe; while the structure

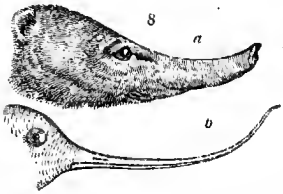
of the bill (*fig.* 6. *a*), almost precisely, in outward form, similar to that of a falcon (6. *b*), and their united powers of grasping, and of climbing, show at once their analogy to the *Raptores*; all the birds of which, like the parrots, hold their prey by their feet while it is devoured. Was this latter property discovered to exist, even in the slightest degree, among eth remaining families of scansorial birds, it would then assume the consequence that it has erroneously been invested with; but seeing that it is altogether *partial*, it sinks to a secondary character, indicating a subordinate and not a primary analogy.

(22.) In further support of the relation between the *Grallatores* and the *Glires*, elsewhere insisted upon *, we shall advert to the elongation of the upper jaw or mandible of these animals, — a peculiarity which is more conspicuous in them and their representatives, than in any other groups. If we examine, for instance, the bill of the woodcock family, we find that its termination (*fig.* 7. *a*), in regard to the contour, gives an almost ludicrous resemblance to the muzzle of a rat (*fig.* 7. *b*), particularly if



* Classification of Animals, p. 304.

we fancy that both were of the same size. Now it is perfectly clear, that as these two animals, when feeding, generally insert their muzzle in the ground, so there can be no doubt that this particular formation is essential to that propensity. The only quadrupeds, again, which have the snout inclining upwards, are of the gliriform type; and the only birds in which the bill takes the same direction, are typical of the *Grallatores*. The genera of *Nasua* (*fig.* 8. *a*), *Sorex*, *Dasypus*, &c. are all types of the gliriform quadrupeds, as those of *Trochilus*, *Avosetta*, *Tringa*, are of the grallatorial structure in birds: so that the resemblance of the snout of *Nasua* and *Avosetta* (*fig.* 8. *b*) are as like as it is possible, considering that one is a quadruped, and the other a bird. To the same type also belongs the *Echidna*, or porcupine anteater, the American genus *Myrmecophaga*, and the Indian *Manis*: all these are pre-eminently characterised by that great prolongation of muzzle, which constitutes, as before mentioned, one of the chief characters of the type we are now illustrating. It is quite unnecessary, in this place, to refute the supposition that the woodpeckers — because they have the feet short, and placed very far back on the body — are analogous to the natatorial birds. In the first place, we do not admit the fact of the feet being so placed: they appear to be so, indeed, in the distorted specimens set "bolt upright" in our museums; but this is a forced and unnatural position. Upon examining a woodpecker, when just dead, it will be found that the bend of the knee is precisely parallel, or on the same line, with the *anus*; and as this formation exists in all other perching families, it follows that, in this respect, there is nothing peculiar in the position of the woodpecker's feet. Furthermore, the analogy cannot be true; inasmuch that a natatorial type never



passes into one that is insessorial. The parrots and the woodpeckers unquestionably follow each other; the one being typical, the other subtypical, of the scansorial tribe. We should much have wished, in this place, to have shown how beautifully the primary orders of birds represent the primary orders of insects; but as our theory on the annulose animals has not yet been laid before the scientific world, and would require to be accompanied with ample details, in support of the novel views it contains, we must reserve this comparison for a subsequent volume.

CHAP. II.

ON THE EXTERNAL ANATOMY OF BIRDS IN REFERENCE TO THEIR HABITS AND ECONOMY. — ON THE PARTS OF A BIRD. — CRESTS, EYES, EARS, TONGUE, MOUTH, BILL.

(23.) BEFORE we enter into further details on Systematic Ornithology, let us for a while contemplate the different modifications of form which belong to birds in general; and trace how far these variations effect corresponding ones in their food, habits, and economy. It might be thought, at first, that this inquiry should have preceded the exposition of the primary orders contained in the last chapter; but, as we shall frequently have to mention the names of those types and divisions which have been just explained, it is clear that our present disquisition would have lost half its interest, had not the reader been first put in possession of the meaning of those terms which it is absolutely necessary for us here to use. The student will therefore do well to peruse the last chapter with attention, before he enters upon this.

(24.) Comparative anatomy regards two distinct portions of the structure of an animal,—its *inward* and its

outward organisation. The study of the first is not so essential to the zoologist as that of the last; and, although both are intimately connected, they may be, and have been, pursued separately. It is, for instance, by no means necessary for the clear understanding of the ruminating quadrupeds, that the naturalist should be informed that they possess more stomachs than any other animal; nor is it essential to his object of defining and classifying them, that he should know which species ruminate their food, and which do not. But were he to neglect the study of the external anatomy of these beasts, and disregard the form, direction, and substance of their horns, the size and situation of their teeth, and other parts of their external anatomy, he would be utterly unable to proceed; nay, more—he would be scarcely able to define what difference there was between an ox and an elephant. As with quadrupeds, so with birds. The form of structure of the body, and all its various members, is comprised under the head of external anatomy; and it is from the various modifications and appearances which these parts assume, that the ornithologist is capable of drawing such discriminating characters as enable him to form clear conceptions of their respective peculiarities. Were he, on the other hand, to make their *internal* anatomy the basis of his system, he might be able to classify those native birds which, from being common, might be procured for dissection; but thousands of others must be left undetermined: and after all, however elaborate might be his system, it would be utterly useless for practical purposes, and unintelligible to all but professed anatomists. It has generally happened, that those who have attached so much fancied importance to the internal anatomy of animals, have been but very imperfectly acquainted with the habits and economy of the animals themselves; and thus, while we have had the most minute details of their internal conformation, we have been left in comparative ignorance of those especial purposes for which each particular structure was intended: just as if we described, with

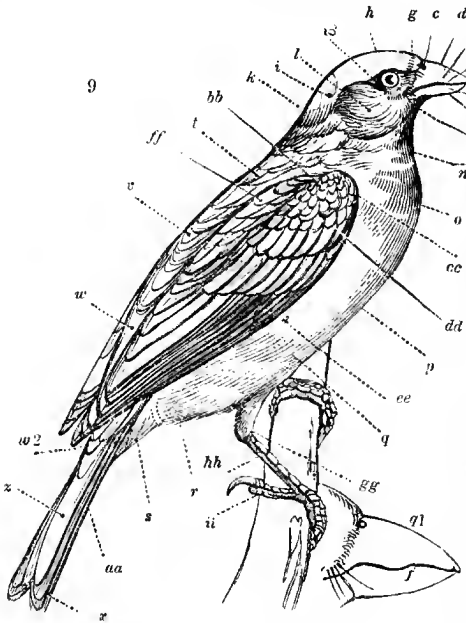
scrupulous accuracy, the several parts of a complicated machine, without giving any intimation of the effects that machine was intended to produce.

(25.) The external anatomy of a bird relates to all those parts which are wholly or partially exposed to sight: under this head, therefore, we comprise its general shape, and the proportion of its parts; the structure of the mouth, bill, tongue, wings, tail, and feet; and the manner in which these are diversified. It will be our first object to give a short explanation of the terms employed to designate the parts of a bird: we shall then point out in what manner they vary in the different types; and trace, as far as possible, the relation between these variations of structure, and the habits of the birds themselves.

(26.) The three primary parts of a bird, as of all vertebrated animals, are its *head*, *body*, and *limbs*, under which all the subordinate parts may be classed. These latter are so numerous, and would require such elaborate definitions if we employed words only, that it becomes desirable to give the annexed sketch (*fig. 9.*), to which the reader can refer when perusing the following short vocabulary of terms, essential to be understood by every student.

(27.) The HEAD is composed of the *skull* and *bill*, and joined to the body by a *neck*. Commencing with the BILL, we see that it is composed of two pieces, corresponding to the jaws of quadrupeds: that which is above is called the *upper mandible* (*a*) (or maxilla); that beneath, the *lower*, or *mandibula* (*b*). The upper mandible contains the nostrils (*nares*, *c*), the form of whose apertures is various: its highest part is the *culmen*, or keel (*d*); the corresponding ridge of the lower mandible is the *gonys* (*e*): both these Latin terms, by common consent, are used in our vernacular descriptions, although *ridge* may be applied to the *culmen*, and *keel* to the *gonyx*. The MARGINS of both mandibles are those lateral edges which meet when the bill is closed (*f*): in some birds, like the todies, flycatchers, and humming birds, the mar-

gins of the upper mandible fold over those of the lower; while in others, as the finches, the two edges meet. The



line thus formed by the meeting of the mandibles is termed the COMMISSURE (*f*): it is either *straight*, as in the woodpeckers; *festooned*, as in the sparrow-hawk; *undulated*, as in some of the tanagers (*fig. q* 1.); *arched*, as in the bullfinch; or *angulated* at its base, as in the starlings. In many birds, the UPPER MANDIBLE is continued far back on the front or forehead, and there dilated, so as to resemble a sort of casque or helmet: this is seen in the shrike-crows (*Barita*, *Vanga*, &c.), in the cassicans, and slightly in the finches. In rapacious birds and parrots, there is a belt of soft naked skin at the base of the upper mandible, in which the nostrils are placed;

this is the *cere*. In others, like the herons, there are few or no feathers between this part and the eye; and the space round the eye itself (*regio ophthalmica, f.* 2.) is often naked.

(28.) The HEAD, in the usual acceptation of the word, is restricted to that part which constitutes the skull, and extends from the base of the beak to the commencement of the neck. The front (*frons, g*) is the region lying close to the nostrils, and consists of those small feathers which join the base of the bill, lying between that and the eye: then follows the crown or summit (*vertex, h*), which occupies the middle or centre of the head, and is that part usually occupied by the crest of such birds as are so ornamented. The hind head (*sinciput, i*) commences at the declivity of the skull, the lower portion of which is termed the *nape* or *nucha* (*k*).

(29.) On the SIDES OF THE HEAD are the ears, and several parts which require distinct names. The feathers which *cover* the EARS, to save repetition, are usually termed *the ears* (*l*): they are generally rather more rigid, and their webs more disconnected, or wider apart, than the surrounding feathers. There are several genera which have STRIPES both above, before, and behind the eye; and others sometimes occur at the base of the lower mandible, particularly among the woodpeckers: to all these distinct names become necessary. A *superciliary stripe* is situated *above* the eye, so as to be analogous to the human eyebrow. An *ordinary eye stripe* is either anterior, posterior, or entire: it is anterior, when it only occupies the space between the eye and bill; posterior, when it commences behind the eye, and advances to, or unites with, the ear feathers; and entire, when it is both posterior and anterior. The *cheek* feathers are between the gape or rictus, and those which cover the ears; while a *maxillary stripe* commences at the base of the under mandible, and descends on the side of the neck. This sort of stripe, as just observed,

is almost universal among the woodpeckers, where its red colour generally indicates the male sex.

(30.) The parts of the NECK (*collum*) are thus designated: the upper part is the *cervix*, and the space between the nape and the back is the *auchenium;* but these parts are more commonly indicated in descriptions by "neck above," or "upper neck." The lower part is divided into three portions: first, there is the chin or *mentum* (*m*), a small space just beneath, and adjoining to, the lower mandible; the *gula* (*n*), or upper throat, next succeeds; and the *jugulum*, or lower throat, occupies the rest of the space between the *gula* and the commencement of the broad part of the body, which is termed the *pectus* (*o*), or breast: this latter being the most convex part of the whole.

(31.) The BODY (*corpus*, *p*) commences with, or joins, the *pectus*, or breast, and extends the whole length of the *sternum*, or real breast-bone: the belly (*abdomen*, *q*) succeeds to this, which is terminated by the vent (*venter*, *r*); immediately behind the vent, is what authors term the *crissum*, but which is more properly the *under tail covers* (*s*); these are frequently of a different colour from the surrounding feathers, especially in the toucan family, and in certain groups which represent them, as the short-legged thrushes (*Brachypus*), linnets (*Linaria*), &c. Proceeding to the upper part of the body (*dorsum*), we have the interscapular region (*interscapulum*, *t*), situated between the base of the wings; which part is usually denominated, par excellence, the *back;* as the *tergum* (*v*) is called the lower back: the *uropygium*, or rump, is that part where the upper tail feathers (*w* 2.) are inserted, and these latter are immediately above the *crissum*. Last of all is the tail (*cauda*), composed of long stiff feathers termed *tectrices* (*x*). As the various forms of these will be subsequently described, it is only necessary in this place to observe, that the two middle feathers are the *intermedial* (*z*), as more immediately interposed between those on the side, or *lateral* feathers (*aa*). We may now

pass on to the members, which are composed of the wings and feet.

(32.) The WING of a bird, and its parts, will be more particularly described hereafter: our only object at present is to give a very short explanation of the terms, and to designate the different parts in relation to the figure delineated at p. 22. The *humerus* (*bb*), is generally termed the shoulder; the *flexum* (*cc*), is the shoulder joint; and the *axilla* (*dd*), which corresponds to the *cubitus*, is commonly called the shoulder margin. These terms are sufficiently precise to characterise the contour of the bony parts of the wings, which is all that is necessary when the mere colouring of the plumage of these parts is concerned. The wings are clothed with three sorts of feathers: the first, which are the smallest, are the *tectrices*, or wing covers; the second are the scapulars (*scapulares*); and the third are the quills (*remiges*). The wing covers, again, from being of various sizes, and covering different parts, are divided into the shoulder covers (*tectrices humerales*), the lesser covers (*tectrices minores*), and the greater covers (*tectrices majores*). Adjoining these latter, and protecting the base of the quills themselves, are certain small feathers, placed in a series, of which the largest is always outermost, called the spurious wings (*alæ spuriæ, ee*). The scapulars are a series of feathers which spring from the base of the *humerus*, or shoulder (*ff*), and are continued in a longitudinal stripe so as to cover the last series of the quill feathers, with which, in fact, they often become confounded. This brief explanation will sufficiently explain the universal nomenclature of the wings of all birds: but so important a subject will again be adverted to.

(33.) The LEG, as in quadrupeds, is composed, 1. Of the thigh (*tibia, gg*); 2. The *tarsus*, or shank (*hh*); and, 3. The *digiti*, or toes (*ii*). Of these last, one, which is almost always placed backwards, or in opposition to the others, is distinguished as the *hallux*, or hind toe; and they are all terminated by *ungues*, or claws. The fore

part of all these divisions of the foot are more or less defended by scales. Some ornithologists term the anterior or fore part of the tarsus, *acrotarsum*, and the hind part, *planta;* and hence we find, in generic characters, *acrotarsum scutulatum*. But this character is altogether superfluous, since it is one of the most universal in the class of AVES! Out of thousands of birds which we have seen, not one has been met with, whose *tarsi*, if naked, were not protected in front by scales; and even the very few that are *booted*, or clothed with feathers in this part, have scales upon the front of their toes. This is sufficiently apparent among many of the owls, the buzzards, and the ptarmigans. Thus far for the nomenclature of birds, which, however dry, must be learned by every student. We shall now trace in what manner these several parts are found to vary.

(34.) We have already remarked that a bird, like most other animals, is composed of three parts: 1. Head; 2. Body; and, 3. Members, or Limbs. Life is soon extinguished if the first or second is in any degree mutilated; but a slight injury to the limbs is not attended with such fatal consequences. Nature herself repairs the wound, if it is not too severe to prevent the bird from procuring its food. We have seen a toucan, whose bill bore evident marks of having been shot through, and even fractured, long before the bird met its ultimate fate; while the wings and legs of other birds have been found injured and healed in a similar manner.

(35.) The parts of the HEAD comprise the eyes, ears, nostrils, and mouth; to the last of which belong the bill and tongue. The head itself is sometimes remarkably large, as in the owls, for the purpose of containing certain chambers, or cavities, connected with an unusual development of the sense of hearing: this additional faculty given to the birds in question, is highly advantageous to their nocturnal search after food; and it is very probable that the superior size of the head which so often distinguishes other fissirostral types, as the

goatsuckers, &c., is in some measure attributable to the same cause, although in a far less degree.

(*36.*) The NECK attaches the head to the body: sometimes this part is very long, not only in birds, but in certain quadrupeds. The use, however, of this unusual prolongation is various. In the *Camelopardalis* it enables the animal to reach the branches of the tall mimosas, whose leaves constitute its chief nourishment. In the perching order of birds, *Insessores*, the only examples of this sort are found among the woodpeckers*, whose peculiar method of picking holes in trees, by the force of repeated strokes of the bill, obliges them to throw the head very backward without elevating the body: this they are enabled to do by their long neck; an additional force, or impetus, is thus given to every blow, just as a person who wishes to strike hard with a hammer, elevates his hand in proportion to the blow he wishes to produce. Nearly all other insessorial birds have short necks, for no such exertion as we have just described is requisite to procure their food; and their constant habit of perching on the branches of trees, renders it unnecessary that they should be more elevated for the purpose of discerning the approach of danger. Among birds, however, which have feeble wings and live habitually upon the ground, like the rasorial order, the neck is much more developed. This may be intended to effect two purposes: first, to give a greater scope of vision, as a security against danger; and, secondly, to facilitate the act of feeding. It is evident that birds attach the feeling of security to elevation; for nearly all those which habitually live only upon the ground, roost in branches, where they can see much farther, and discern the approach of an enemy. On the other hand, as the gallinaceous order, like the turkey and the peacock, have generally high legs, a long neck is essential to avoid any difficulty in feeding and picking their food from the ground, close to which the head must reach

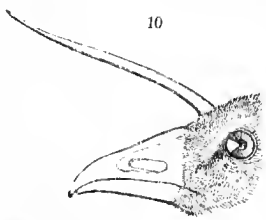
* This is doubtless one of the analogies between the herons and the *Picidæ*.

without any great alteration of the walking attitude. This, in fact, is the reason why the long-legged waders have necks and bills proportionate to the elevation of their bodies; for as the habit of wading and of running requires this great development of foot, so, had they short necks and bills, they could not possibly feed but in a constrained and unnatural position. According to the habits of the bird, so do we find the same structure applied to different uses. Hence, in the swans, and the whole of the duck family (*Anatidæ*), there is great elongation of neck, accompanied by very short feet. Now, were these terrestrial birds, it is obvious that such disproportion of parts would be anomalous; but they are all aquatic, and without their long necks they would be quite unable to reach the bottom of the waters upon which they swim, and where they are taught to look for their food. A swan or a duck swims along the edge of a reedy stream, and thrusts its long neck into every break, dives to the muddy bottom, and ferrets out among the roots of plants its appropriate food. The length and thinness of the neck makes all these habits perfectly easy, which, but for such an adaptation of structure to its mode of life, would be difficult, if not impossible. Again, all birds which seize their prey from a fixed station, without using their wings in its capture, have also the neck greatly lengthened. The whole family of herons, among the waders, and the aquatic genera of *Carbo* and *Plotus*, are examples of this structure. Whereas, when the wings are also used in the capture of the prey, the neck is very short. This opposite extreme is very conspicuous in the whole tribe of *Fissirostres*, as the swallows, swifts, goatsuckers, &c.; and in their representatives, the flycatchers, todies, tyrants, &c. It may be taken as an invariable rule, that out of the insessorial and natatorial order, all birds have their neck and legs of proportionate length.

(37.) The head is generally clothed with feathers; but in very many birds it is more or less naked. What

particular purpose this latter structure is intended to answer, it is impossible to form a correct idea. Were it confined to those groups which live upon putrid animal substances, like the vultures, where the nakedness of the head is almost universal, it might be conjectured that, as the feathers of the head would become clotted with gore and putrid particles of the disgusting food of these birds, which were not within reach of the cleansing operation of the bill, this covering was desired: but then we find that other birds, feeding only upon seeds and vegetables, like the turkey and the chatterers, have their heads also naked; not to mention the jabiru, some of the cranes, and the great herons of India. These latter, however, and nearly all the bare-necked *Grallatores*, feed upon all sorts of things, living or dead, and may be almost considered as the vultures of their own order.

(38.) The head is frequently ornamented with appendages, either in the shape of horns, wattles, or crests: the first two are composed of fleshy or horny substances; but the latter, which are the most common, consist of lengthened feathers, which the bird can generally erect or depress at pleasure. Although several birds have horn-like appendages, there is only one which has a real horn: this is the *Palamedea* (*fig.* 10.), from the front of whose head issues a long spear-shaped horn, moveable, as we believe, at its root, but perfectly hard and compact in its substance, and which is used as a means of defence against its enemies. The *Buceridæ*, or hornbills, are remarkable for elevated processes, very much resembling horns, but which are no other than enlargements of the bill: the cassowary and the Guinea-fowl, however, may be said, perhaps, to have true horns, although not of the shape usually understood by the term; yet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they are, nevertheless, solid, and proceed from the front of the head. This process in the cassowary, is represented in a most remarkable way in the rhinoceros; and if the circles of the groups which contain these animals are compared, it will be found that they mutually represent each other. The other naked appendages found on the heads of birds, are always fleshy, and are attached either to the front of the head, as in the turkey, or on the sides of the mouth, as in the cock. Rasorial types, more than any other, furnish us with these unusual deviations from the ordinary appearance of birds: several examples, however, occur in the grallatorial form, as in the genus *Casmorhynchus* among the chatterers or fruit-eaters, the *Psarianæ*, the *Cebleppyrus lobatus*, the aberrant forms of the *Charadriadæ*, and the different grallatorial sub-genera of the *Muscicupidæ*; none of which, by the most minute analysis, can be reduced to rasorial types. There is a peculiarity, nevertheless, among these, which deserves notice; for the greater part possess only a naked skin round the eye, similar to that in the genus *Perspicilla* (*fig.* 11.) among the waterchats. The only natatorial birds we can recollect as having naked appendages, are the lobed duck of New Holland and the common Muscovy duck: there is one example in the tenuirostral tribe, and none in the fissirostral.

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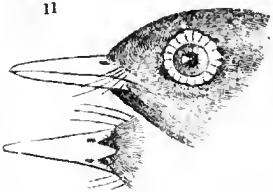


(39.) Crests are the most beautiful appendages to the heads of birds; and give to those, which are even of the plainest colours, an imposing and attractive appearance. The use of the crest is twofold: in most birds so distinguished, it is chiefly an ornament, given as a mark of distinction, almost exclusively, to the male; in others, it not only is ornamental, but useful as a sort of defence. To explain this novel assertion, we can safely say that many are the beautiful crested woodpeckers of the

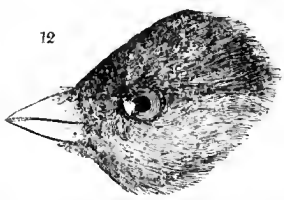
Brazilian forests, which have scared us from a steady aim of our gun, by the sudden manner in which they threw up their crests the moment they discovered their danger, uttering at the same time a loud and discordant scream. The sensation, it is true, lasts but for a moment; but the whole is so sudden and unexpected, that the sportsman is involuntarily startled; and this momentary feeling gives time for the bird to dart among the thick foliage of the forest, and thus effect its escape. The crest of a bird is always erected under a sense of danger or of anger, as every body knows who has seen a cockatoo; so that it has obviously been intended by nature to perform the office of intimidating, however momentarily, the foes of its possessor. We have elsewhere shown* that crests are one of the most certain indications of rasorial types; because this appendage is intended to be analogous to the horns of ruminating quadrupeds, which the rasorial birds represent: and we shall now explain the various forms they assume.

(40.) All the crests of birds, however diversified, may be referred to three primary forms, or types. The first is mobile, and reposes in a flat or horizontal position on the back of the head, and is elevated and expanded when displayed. The second is almost mobile, but the feathers are not lengthened; it opens, as it were, from the midst of the crown, and radiates from a common centre: this we shall call a *concealed* crest; for in a state of repose, from the feathers not being elongated, it can only be discovered by raising them up. The third sort of crest is fixed—the feathers being, as it were, compressed on the sides of the head, so that their ends form an elevated keel, like the ridge of a helmet; and this always remains, more or less, in the same position.

(41.) *Mobile Crests* are the most common, and are consequently the most varied; hence we can trace among them five different modifications. The first in-

* Introductory Discourse, p. 253. Classification of Animals, p. 264.

dication of this ornament is seen in those birds where the head is very full of feathers, which are somewhat longer than those of the nape and surrounding parts, without assuming any particular shape: the apparently large head of very many birds is caused by this superabundance of feathers, rather than from the size of the skull. The head of the *Tamatias*, or puff-birds of Brazil, when they are quietly seated upon a branch, appears to be nearly double the natural size, from its thick clothing of feathers, which are then somewhat raised*; but if the bird is suddenly disturbed, instead of erecting these feathers still more, as the woodpeckers do, the puff-bird immediately brings them flat upon the skull; and its head, although at all times large, seems suddenly reduced to half its size.† The thick-heads of New Holland (*Pachycephala* Sw.), which represent the last mentioned group in their own circle, have the feathers equally thick, but we know nothing of their manners. We can hardly call this formation a crest, seeing that it assumes no form independent of that common to the head, and it is certainly no ornament. There can be no doubt, however, that it is connected, in some way, with the economy of the birds possessing it, otherwise we may feel assured it would not be possessed only by certain races. Incipient crests, in the same manner, are possessed by many birds, which are generally described, even by systematic writers, as having none. We are not aware that any of the describers of British birds have mentioned the crest of the male chaffinch‡ (*fig.* 12.), which is always erected when the bird is disturbed, and retained in that position even after



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* As in *Tamatia melanotis*, Sw. Birds of Brazil, pl. 10.
† As in *Tamatia maculata*, ibid. pl. 11.
‡ The head of the male yellow hammer is also decidedly crested.

it has again perched. During spring, indeed, when in company with the other sex, the male always carries it erect, although, when the bird is killed, it seems to disappear: many of the tyrant flycatchers of America exhibit, in the same manner, what may be called the rudiments of a simply pointed crest, which is the first and most simple of all those that are moveable: examples of this form are very numerous, and exhibit a progressive development of the feathers, the longest of which are either placed on the vertex or highest part of the crown of the head, or immediately behind, towards the nape. These feathers are always more or less pointed, and rise gradually, one above the other, somewhat in the shape of a cone. The two extremes of this structure may be seen, among our native birds, in the common *Muscicapa grisola* and the lapwing plover. Some of the most beautiful examples, in foreign ornithology, of this sort of crest, developed to its utmost extent, will be found among the cockatoos, in the splendid *Trochilus Lalandii*, the crested boat-bill, and the Agami heron, wherein the two or three longest feathers very much exceed the others, and assume, towards their ends, a gentle and graceful curve upwards. Sometimes, however, as in the latter bird, the European chatterer (*Bombycilla*), and the African coly (*Colius*), the ends are pendant: but this is most conspicuous in the genus *Dendronessa*, or summer ducks.*

(42.) *Radiated, or fan-shaped* crests are not so frequent as the last, but they are much more beautiful. The first or incipient development of this form is seen in those elegant longtailed flycatchers, belonging to the subgenus *Muscipeta* Cuv., where the top of the head is somewhat flattened, and the feathers unusually broad and round: those in front are not perceptibly lengthened, but they are slightly so towards the declivity of the crown; so that when the feathers are a little elevated, they assume the form of a flat, semicircular little

* *Dendronessa sponsa — galericulata* Sw. North. Zool. ii. p. 497.

crest, which can barely be discerned in the preserved skin. Very many of those humming birds, whose crown is particularly brilliant, have this slight indication of a fan-shaped crest, particularly the ruby-topaz*; and it may even be detected in the violet-eared species.† When fully developed, the feathers are so disposed that they radiate from the hinder part of the head, and assume the appearance of a fan, the last series being considerably lengthened: the feathers are thus spread out horizontally, and not, as in the last, perpendicularly; and they are always broad and rounded, instead of narrow and pointed. The *Harpyia destructor*‡, or destroying eagle of Brazil, the *Bacha* of Le Vaillant§ (another eagle of Africa), and the secretary vulture of the Cape, all possess the sort of crest we are now describing; but in no bird is it so fully or so beautifully developed as in the royal tody of Brazil‖ (*fig.* 13.), the size of the crest being really enormous in proportion to that of the bird, and assuming an appearance, when fully expanded, very analogous to that of the tail of the peacock. Sometimes, although the feathers are scarcely longer than the others, they are of a different colour, so as to produce a conspicuous semicircular band: in the six-shafted Paradise bird this band has a striking effect, from the splendid metallic gloss of the feathers composing it; while in the *Myïagra cærulea*, or azure flycatcher of India¶, it resembles a crescent of black velvet.

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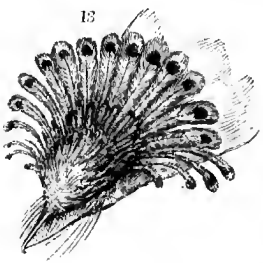

(43.) Of *lanceolate* or pedunculated crests, there are

* *Trochilus moschitus*, Braz. Birds, vol. i. pl. 30.
† *Trochilus auritus*, ibid. pl. 29.
‡ Represented in the vignette to this volume.
§ Ois. d'Afrique, vol. i. pl. 15.
‖ *Megalophus regius*, Braz. Birds, vol. ii. pl. 51, 52.
¶ Le Vaill. Ois. d'Afrique, pl. 153.

very few examples: they differ from both of the foregoing, by consisting of long feathers perfectly naked except at their tips, where the webs assume the shape of a lance's head, or the thick extremity of a club or hatchet. This imposing ornament seems to be confined entirely to the gallinaceous order, and is familiarly exemplified in the common peacock: no less beautiful is the splendid crest of the *Lophophorus refulgens*, (*fig.* 14.) glittering like mimic spears of refulgent gold. There

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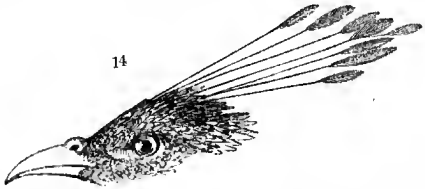

is a modification of this crest in some of the small quails, where the shafts are not altogether destitute of rays, and are recurved towards the head.

(44.) The last modification of those crests which are moveable, is seen in the owls and a few other birds; where, in fact, the crest, from being divided into two tufts, may be called double; and as these tufts are placed one on each side, close to the ears (*fig.* 15.),

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they are usually termed *egrets*. It is highly probable that they are given to the owls for some specific purpose connected with a very refined sense of hearing, more than for a mere ornament, because the females possess these egrets no less than the males; and even when these birds are at rest, these egrets are more or less erect, as if to assist the ear in catching the slightest noise. In their shape, no less than in their position, the egrets of the owls are

analogous to the external ears of quadrupeds; the outer surface being convex, and the inner concave. These egrets, strictly speaking, are confined to one of the most typical genera of the owls; but more than one species of lark, and the double-crested cormorant of Hudson's Bay*, have tufts of feathers analogous to the egrets of the owls; but they are obviously no more than simple ornamental crests, much more slender, and without any breadth or concavity behind. It is no argument against the supposition just mentioned to say, that if the egrets possessed by some of the owls were essential to their sense of hearing, nature would have bestowed these appendages upon the whole of the family, and not have restricted them to only one genus. This, in fact, is the rock upon which shallow naturalists, and partial reasoners, are continually splitting. They seem to forget that Nature, throughout her works, produces the same effect by different means, as if she delighted in every mode of variety. It will subsequently appear, that of the whole family of *Strigidæ*, *Strix* and *Otus* are the most typical genera; that is to say, they possess the sense of hearing far more perfect than any of the other owls; and yet this sense, which is probably equal in both, is produced by very different structures. In *Strix* the ear is enormously large, and protected by a lid or operculum, but there are no egrets. In *Otus*, on the other hand, the egrets are very large, but the size of the ear is reduced nearly one half, and has no operculum: thus, by a balance of powers, the faculty in both is probably equalised. The rest of the owls are more or less diurnal; their eyesight does away with the necessity of acute hearing, and they have consequently small ears and no egrets. This equalisation of faculties, in short, is one of the most beautiful laws of the creation.

(45.) We now come to the second class of crests, or those which we have termed *concealed*. Like the first, they are moveable, and can be shut or expanded at

* Carbo Dilophus, Sw. North. Zool. vol. ii. p. 473.

pleasure; but the principle of their construction is totally different, and is altogether peculiar. These crests are generally either of a bright yellow, red, or golden colour; sometimes, though very rarely, white.* If the feathers of the crown, which are not conspicuously elongated, are laid perfectly smooth, the crest does not appear, although its presence is sometimes indicated by a slight streak of the same colour. When the bird, however, is excited, the central feathers of the crown suddenly expand, radiate almost in a circle, and display what is often a most beautiful and striking ornament. The bright colours of the crest, in fact, are only at the roots of the feather, which are all tipt with the ordinary colour of the plumage; so that when these are expanded, they are no inapt representation of the opening petals of a marigold or some beautiful little syngenesious flower; the predominant colour of that class, no less than of the crests which represent them, being different shades of yellow. Now, it is a circumstance no less singular than remarkable, in conjunction with what we shall presently state, that of between fifty and sixty birds possessing this sort of crest, every one is purely insectivorous, that is, living entirely upon insects, which are caught, not by hunting, but are seized only on their near approach. We have frequently had occasion to advert to the fact, that all the tyrant flycatchers of Brazil never pursue their prey, or go out in search of it, by wandering about from tree to tree like other birds. They take their station on a particular branch, and there patiently wait, like a spider on its web, for such insects as come within range of a sudden dart. It is to this family of birds that the crests we have been describing are almost entirely restricted. We have frequently seen the *Bentevi* of Brazil (*Saurophagus sulphuratus* Sw., *fig.* 16.) — the most familiar, as well as common species, in that country —

* As in two or three of the American tyrant flycatchers, and in the subgenus *Dumicola* Sw. North. Zool. ii. p. 439.

open and shut his fine yellow crest, when merely occupied in watching for insects. This fact, joined with the considerations already mentioned, has more than once

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suggested to us the idea that these flower-like ornaments are occasionally used as snares, to attract the attention of insects, so as to bring them within reach of being captured by a sudden dart. This, at least, we know,— that insects are attracted by the bright colours of flowers, and turn out of their course to visit them. It is, therefore, not too much to suppose that, seeing what, at a little distance, appears to them a bright yellow flower, they should fly towards it, discovering their mistake only when they are within the range of the sudden swoop of their treacherous enemy. It by no means follows that this is the habit of all flycatchers; for in proportion to the variety in the different races of insects, so are the birds which feed upon them endowed with different instincts, and pursue different modes in their capture. Be this hypothesis, however, true or false, the facts upon which it is founded are beyond cavil, and we must leave those who are not disposed to admit the inferences we draw from them, to discover some more plausible mode of accounting for the facts we have stated.

(46.) The only native birds which possess a crest in any way analogous to those of the tyrants, are the gold crests, the pre-eminent types of the whole family of *Sylviadæ*, or warblers. The crests, however, of these little creatures cannot be strictly termed conccaled, for this ornament is conspicuous, even when the feathers lie flat upon the head; it is, in fact, a union of this form and of the first we noticed. Several of the North American warblers, forming the genus *Sylvicola*, have what may be called incipient crests of this sort, indicated by a stripe of bright yellow down the middle. If

to these we add the *Phibalura cristata**, one of the swallow chatterers; the *Oxyrhynchus cristatus*†, among the climbing creepers; and two species of *Tiaris*, among the tanagers — we are not aware of any other birds, independent of the American flycatchers, whereon this peculiar sort of crest is developed.

(47.) The third class of crests differ from the two former in not being mobile; that is to say, they are of such a structure as always to remain, more or less, fixed and elevated in the same position. They are formed by the feathers on each side of the head being disposed as if they had been raised up, and then compressed together, so as to leave a ridge or keel rising up along the centre of the skull, precisely similar to the elevated ridge of a helmet; or, to express this structure more technically, these crests are vertically compressed, and carinated. There are, comparatively, so few examples of this structure, that we should not expect to find it much diversified; and yet it appears under many curious modifications. The first, or incipient indication of this form, is seen in those birds which, like the satin grakles (*Ptilonorynchus, fig.* 17.): many of the true grakles (*Lamprotorninæ*), have the small frontal feathers closely pressed round the base of the nostrils and upper mandible, and very slightly raised just above the front: this, however, cannot be called a crest, but is rather the commencement of one. In several of the swallow shrikes (*Edolinæ*), nature advances another step; for here we see some of the frontal feathers not only more elevated than the others, but even slightly elongated; next we find them curled backwards, so that the *drongup* of Le Vaillant‡,

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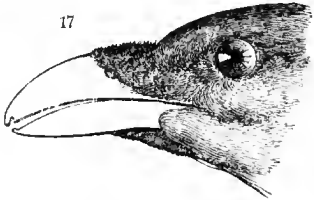
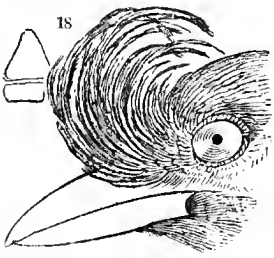


* Zool. Illust. i. pl. 13.
† Crested sharpbill, Zool. Illust. i. pl. 49.
‡ Ois. d'Afrique, pl. 170.

has a little crest just above the nostrils, while in the *Cyanurus cristatellus* (*fig.* 18.) this form is at its maximum of development. Now, it is quite obvious that this is not a crest which admits of being raised and depressed at pleasure; for the feathers are so much curled that they *could not* repose flat upon the others, as in ordinary crests; and this result will be much more apparent on looking to the last-named bird. The next modification is when the frontal feathers are much longer than those on the crown, and form a sharp elevated ridge immediately before the eye, without being continued further: this, in fact, is but a half crest, and is possessed by very few birds, among which *Metopia galeata* Sw.*, a beautiful manakin of Brazil, is the most remarkable. Some approach is also made to this structure in two other splendid little species of the same group — *Pipra parcola* and *Pipra caudata* †; but their crests are rather rudimentary. In the third form we see the compressed crest in its full development: not only the frontal feathers, but the whole of those on the crown are compressed together so as to be quite compact, and an elevated curve overarches the entire head. Those beautiful birds, the *Rupicola Cayana* of South America, and the *Calyptomina viridis* of India, afford us striking examples of this structure; where the frontal feathers are so long, and so much pointed forward, as to exceed, and in part conceal, the bill of the bird. The great crowned pigeon of India, gives us likewise a notable and magnificent illustration of this description of crest, except that the peculiar loose texture of the feathers takes from it that compactness, and carinated edge, which are so remarkable in the birds just before mentioned. This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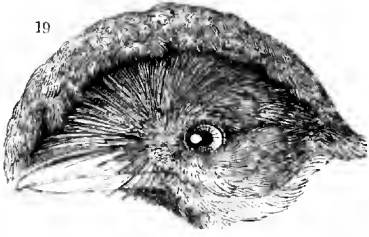
* Brazilian Birds, vol. i. pl. 23.

† Ibid. pl. 45, 46.

deviation, however, leads us to another, of which at present we know but of one example, the *Cephalopterus ornatus* of Geoffroy St. Hillaire. The crest of this extraordinary bird is immensely large, advancing so far in front as to touch the end of the bill, and it is compressed in the same manner as that of *Rupicola;* but the ends of the feathers, instead of meeting so as to form a sharp ridge, suddenly recede from each other, curve outwards, and form a most elegant drooping line of plumes, hanging over on the sides, so as to shade the face like an umbrella. The figures that have hitherto been given of this rare bird are all taken from the specimen in the Paris Museum, and which has been sadly distorted in the setting up ; a minute examination of this specimen has convinced us that the frontal feathers, instead of being raised over the bill, as Temminck represents them, partly repose and overshadow it, at least as much as do those of *Calyptomina* and *Rupicola*. Having now reached the highest development of this form, Nature evinces her usual propensity to return to the more simple form of crest, and she therefore unites the fixed with the mobile structure. The crests of the ordinary species of *Corythaix* is precisely of this description : that part which occupies the front of the head advances forward, and this being the natural position of the feathers, gives us the character of a fixed crest; but the hinder part, which is the longest, is not altogether compressed, although it cannot be said to lie flat on the crown, like those of ordinary birds. We have recently had the opportunity of seeing some living examples of this genus in which the crest appears to be always carried erect; although, judging even from the



position of the feathers in preserved specimens, it is obvious that the hinder part of the crest is not so procumbent as those last mentioned: we suspect also, that the crest of the *Corythaix erythrolophus* is differently formed to that of a species now before us (which is possibly the *C. Buffoni* of Wagler), where the hinder part appears adapted for reposing upon the occiput. It is somewhat surprising that, on a subject so interesting as that we have now discussed, every author we have consulted should be is altogether silent. The crests of birds are their most beautiful ornaments, and no student would have imagined they were so much diversified. By following up this inquiry, it will be found, that particular sorts of crests belong to particular types, all those, for instance, which radiate from the crown, and which we have termed *concealed*, belong to those incessorial groups which represent the tyrant flycatchers. Those with helmet-like or compressed crests, on the contrary, are chiefly representations of the typical *Rasores;* at least *Rupicola, Metopia,* and probably *Calyptomina,* are of that type; although the latter has indications also of the fissirostral structure in its wings.

(48.) In some few birds there are certain appendages to the head, which, although not strictly coming under the denomination of crests, are, in some degree, analogous thereto: the ornaments we allude to are certain bare shafted feathers, very greatly elongated, which spring out on each side, close to the ear, and of the use of which we are altogether ignorant. Incipient indications of these singular plumes may be detected in the violet-eared humming bird*; but they are more lengthened in *Tr. rufus* and *ornatus*, although in these latter birds they proceed more from the sides of the neck than from the head; but in that most resplendent creature, the six-shafted Paradise bird, these feathers are at their maximum, measuring near five inches; they are completely spear-shaped; and although perfectly naked, except at their tips, are there ornamented with a spatulate web of resplendent

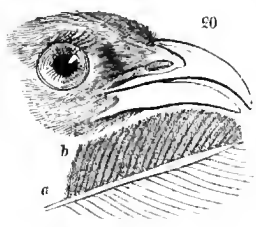
* *Trochilus auratus*, Braz. Birds, vol. i. pl. 29.

colours. In the *Sifelet* of Le Vaillant, the shafts appear equally long, but are altogether destitute of any web.

(49.) We may now pass unto the Eyes of birds; organs, indeed, which, from being external, come within the range of our projected inquiry, but which more strictly belong to the province of the comparative anatomist. We shall, therefore, merely endeavour to generalise a few facts which may come within the observation of the majority of students. And, first, in regard to the size of the eyes, in which respect there is a considerable difference in particular groups. We find that the largest eyes are possessed, both among quadrupeds and birds, by such species as feed during the night, of which the lemurs in one class, and the owls in the other, are notable examples: those of the falcons are not very much smaller; but, among the goatsuckers, they are enormous. Next to these, as a family, we may mention the plovers, particularly the genus *Œdicnemus*; while the corresponding group among quadrupeds, the hare and the jerboas, partake of the same peculiarity. It is a fact worth mentioning, but which we must leave the oculist to explain, that no birds, strictly nocturnal, have a coloured iris: exceptions occur, indeed, among the horned owls; but we believe that no *Caprimulgus* has hitherto been found, having other than entirely black eyes; these organs again, are equally large among the woodcocks and snipes, which are, in a great degree, nocturnal feeders. In passing on to the other extreme, we find that the humming birds, independent of their diminutive size, have the smallest eyes in the whole class: perhaps this peculiarity may receive some explanation from the fact, that these birds are only in full activity during the most sultry hours of the day, — a time when nearly all others have retired to the shade, as if to avoid the dazzling reflection of a vertical sun. It will be remembered also, that, in harmony with the small eyes of the tenuirostral tribe, we find the quadrupeds which represent them are equally remarkable in this respect; these organs are disproportionately small in the majority of the

Glires, as also in pigs, anteaters, armadillos, moles, and shrews, all which groups are of the gliriform type, corresponding to the tenuirostral among the perchers. The eyes are defended and protected by two sorts of eyelids; the first being those which are common to quadrupeds, and which are external: these, in the generality of birds, are clothed with small feathers, but are destitute of lashes: sometimes they are surrounded with a fleshy, naked skin, which is frequently so delicate as scarcely to be discerned, as in some of the American trogons, but this sort of ring in the turaeeos (*Corythaix* Ill.) is much broader, and begins to form a prominent dentated rim, the full development of which is seen in the genera *Perspicilla* (*fig.* 11.) and *Prionops*. What function this very singular appendage is intended to perform, is altogether unknown; but it is more prevalent in tenuirostral types than in any other; and in the genus *Zosterops* it is represented by a circle of thick, glossy, dense feathers, of a snowy whiteness, which is more or less conspicuous in every species. It is chiefly in the family of cuckows (*Cuculidæ*), that we meet with eyebrows; they consist of a fringe, on the upper eyelid, of rigid, stiff bristles, placed singly, and sometimes much developed; but at all times they are sufficiently long to overreach the ball of the eye. The genus *Centropus*, more especially, is thus distinguished; the same structure, less developed, may be seen in nearly all the *Coccyzinæ;* but in the European cuckoo, and its immediate allies, these eyelashes are entirely wanting. There can be no doubt that this additional protection to the eyes is given to birds whose habits lead them into close thickets, and who explore dense foliage for their subsistence. We know, at least, from personal observation, that such are the haunts of all the South American *Coccyzinæ;* and there is additional reason to believe in this conjecture, from the peculiar hardness and rigidity of the feathers in *Centropus* (*fig.* 20.), the shafts of which (*a*) are hard, glossy, and rigid, each ending in a point, so that, but for their webs (*b*), they would become

miniature representations of the quills of the porcupine. On the second, or under eyelid, these lashes do not appear. The third, or internal eyelid, is called the nictitatory membrane. It is thin and semitransparent, and is drawn over the ball of the eye at pleasure, as we should draw the curtain of a window on a sunny day, and for the same purpose; namely, to diminish the light when the rays are too powerful: it is often seen when a bird has been just wounded, and in the agonies of death; but at other times, excepting in the owls, it is not externally apparent.



(50). The power of *sight*, in all birds, is well known to be very great, and far exceeds what is possessed by *man*, and perhaps by any class of animals. The high development of this faculty will appear absolutely necessary to birds, when we consider, for a moment, the various purposes it is intended to accomplish, as the speedy and ready discernment of their food, the determination of their route when upon long journeys, or in migrating, and to aid the celerity of their movements. It is well known, even to a proverb, that eagles and falcons possess this faculty to an astonishing degree; but the necessity of the gift does not appear to have been touched upon. If the powers of vision in these rapacious birds had merely been equal to those of other tribes, it is very questionable whether they could long have existed; they would have been compelled to have hunted out their prey, so near, as to scare it away; for it is well known that all the small birds, immediately upon discovering a hawk, set up a note of alarm, heard and understood by their companions, both as a signal of danger and for immediate concealment. It is essential, therefore, to the very existence of rapacious birds, that they should have the power of reconnoitring at a distance, beyond the ken of their quarry, and even of fixing and

darting with incredible rapidity upon it, before their presence has been discerned, the alarm note given, and a retreat effected. A great deal has been written, and now rendered familiar to every one by our cheap compilations, on the powers of sight in the falconine tribes; but those of the swallows seem to have been quite overlooked. It is, nevertheless, difficult to say which is the most astounding, the far-sightedness of the former, or the instantaneous and complicated discernment of the latter. The swallow is proverbially the swiftest flyer in the feathered creation; and yet, in the full career of its course, it is entirely intent upon quite another object than that of flight. While darting through the air at the rate of three miles a minute, it is looking on the right hand and on the left, sideways, upwards, and downwards, for its food. The insects it preys upon are often exceedingly minute — sometimes flying above or below the level of the swallow's flight; and yet they are seen, captured, and swallowed, without any diminution of the prodigious rate at which the bird is flying: nay, more, any one who attentively watches the swallow skimming over a meadow in summer, will perceive that it will capture two or even three insects in such quick succession as to convince us the bird must have had them in his eye, to use a colloquial expression, all at once, and that the whole are caught and swallowed in as many moments. The faculty of vision, in short, in these birds, is fully as much developed as in the falcons, although in a very different way; the one being *long*, and the other *quick* sighted, and both, to a degree, perfectly unexampled in the animal creation. Buffon has used his eloquence very happily in expatiating on the immense distance at which the hawk can distinguish his prey. He affirms, apparently with truth, that a hawk can distinguish a lark, coloured like the clod of earth upon which it is sitting, at twenty times the distance at which it would be perceived either by a dog or a man; but when he asserts that a kite, soaring beyond the reach of our sight, can see the lizards and mice on the fields

below, we must be allowed to question the accuracy of the statement: it wears every appearance of exaggeration, and obviously cannot be proved. That most of the rapacious tribes, on the other hand, possess a *length* of sight, if we may use the term, far superior to all other birds, is proved by the additional means given to them for that purpose, in the structure of the eyebrows, or superciliary ridge, which, in these birds, projects over the eyes, to which they act as a screen from the vertical rays of light, and concentrates their powers in viewing objects placed before or beneath them. This structure is also apparent in the horned owls and eagle owls (*Otus*, *Nyctea*), but is not found in those of the restricted genus *Strix*.

(51.) The EARS of birds, excepting those of the owls, exhibit to outward appearance very little variation. M. Cuvier remarks, that nocturnal birds alone have a large external ear, which nevertheless is not so prominent as that of quadrupeds. This statement is so vague as to require some explanation. The ears of a sparrow or a hawk are just as external as those of an owl, seeing that in neither of these birds can they be discovered unless the feathers are carefully removed; whereas, when we speak of an external ear, we annex the idea of its being prominent, like that of the majority of quadrupeds. Now, there is only one bird yet discovered, whose ear, in this sense, can be called external; and this is the *L'Oricou* of Le Vaillant* (*fig.* 21.), a large species of vulture, discovered by him in Southern Africa, and subsequently named by methodists *Vultur auricularis;* the ear, in this singular bird, appears truly external,

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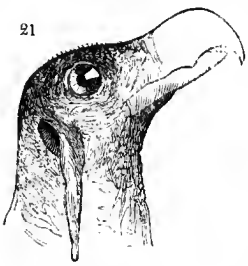


* Ois. d'Afrique, vol. i. pl. 9. Some ornithologists are of opinion that this prolongation is the mere effect of leanness, or of old age, as wrinkles are on the human face; but this theory wants confirmation.

because it is not only bare of feathers, but the orifice appears to have a prominent rim, lengthened into a wattle, which hangs down on each side of the neck. The conch of the ears in the common barn owl, and a few others, have a small lid or operculum, which partially closes the aperture; but this appendage lies perfectly flat, and is entirely hid by the surrounding feathers. In describing the parts or colours of a bird, the term "ear" must be considered as not strictly applying to that organ, but to the ear feathers, or those which cover the orifice of the ear itself.

(52.) We know, either from facts, or from certain indications, that the sense of *smell* is very highly developed in some tribes, and but very slightly in others. It has generally been supposed that vultures were attracted to their food by their sense of smell, and not by their sight; and this error has given rise to some ingenious arguments and unjustifiable personalities against Mr. Audubon,— the first, we believe, who called this supposed truth in question. The results, however, have been such as to enable that gentleman to silence his opponents, and to establish, in the most complete manner, the accuracy of his first assertion. We must, therefore, consider that the toucans, above all other birds, are the most highly gifted in this respect,—a fact which is not only established by their economy, but also by their structure; the latter evidence being wholly wanting in the case of the vultures, whose nostrils have nothing in them to sanction a belief of their being more highly sensitive than those of ordinary birds. This great development of the olfactory nerves in the toucan is concentrated in the bill, which is entirely filled with a cellular tissue of nerves, somewhat resembling the webs of those spiders which are found in dark corners, being crossed and interlaced in different directions by thread-like nerves, all of which communicate to the two lateral openings of the nostrils, placed, not in the substance, but on the sides of the bill, close to the front of the head. This extraordinary gift of smell enables these birds to discover the nests of others,

upon the eggs and young of which they feed during one part of the year, while they live on fruits the rest.

(53.) The *tongue*, in the generality of birds, is small, thin, and cartilaginous; the extremity flat and jagged, and incapable of being protruded beyond the bill. To this however, there are several remarkable exceptions. That of the ordinary parrots is shaped very much like ours, although its substance is not always so fleshy; and it is probable that this is one of the causes which enables these birds to imitate so clearly the human voice. In the toucan family and motmots (*Ramphastidæ, Prionites*), this member, without being extensible, is fully as long as the bill, very slender, and the sides divided into filaments, so as to resemble, in its general shape, a miniature quill feather. There can be no doubt that unusual sensibility belongs to this form, or it would not have been so elaborated by the hand of nature. The duck family, however, have the largest tongues of all other birds; and by its thick fleshy substance, it more resembles that of the human subject than even the parrots. When we consider the particular use which the duck makes of its tongue, we shall immediately perceive that it is endowed with great and unusual sensibility. The duck, unlike all other birds, discriminates its food, not by sight or by smell, but by the touch of its tongue. It thrusts its bill in the mud, just as a fisherman throws his net into the sea, and brings up whatever it contains: from this mouthful of stuff it selects, by the tongue alone, what is good for food, and every thing else is rejected. As the curious reader may peruse our former observations on this subject in another work*, we shall not in this place enlarge upon it. The smallest tongues are found among the night-jars and swallows, — two groups which are at the same time distinguished by the largest mouths; but here, again, as in a thousand other instances, we may perceive that beautiful principle of *design* which pervades all nature. The habits of the ducks render it essential that the tongue

* On the Typical Perfection of the Family of Anatidæ, printed in the Journal of the Royal Institution, No. 4.

should be the chief instrument of procuring food; it is therefore large and fleshy. But in birds which gulp their food the instant it is captured, the tongue apparently is of no sort of use; it is therefore reduced to a mere rudiment: such is the case with the swallows and night-jars. There must be something very analogous to the same mode of feeding in the genus *Casmorhynchus;* for on dissecting more than one specimen of *C. nudicollis*, we found the tongue fully as small, and the mouth as wide, as in the ordinary *Caprimulgidæ*. The food of the duck is discriminated solely by the tongue, while that of the swallow is selected by the eye; and hence this remarkable difference in their respective tongues. Hitherto we have noticed those forms only in which the length of this member is regulated by that of the bill; but there is another structure which is not uncommon, and by which the bird is able to protrude it to twice its usual length; hence such tongues are called *extensible:* of these there are two distinct modifications, — one possessed by the woodpeckers, the other by the honeysuckers. On opening the bill of a woodpecker, immediately after it is killed, the tongue seems to be of the ordinary length, rather short, and shaped vey much like the heads of those spears used by the Caffers of Southern Africa, and called *assagais*, being pointed at the end, with numerous little barbs on the sides: this, however, is only the head or point of the tongue; draw it out of the mouth, and a person unacquainted with its formation would fancy he had got hold of a very long earth-worm, which the bird had incautiously devoured, and which had stuck in its throat. This description, unscientific though it be, will give the reader a much better idea of the tongue of the woodpecker, than the most elaborate anatomical character we could draw up. A tongue so formed, in allusion to the appearance it assumes, is called *vermiform:* the point reposes, in the ordinary manner, between the mandibles of the bill; the rest is concealed, and from being elastic is capable of being thrown out, at the pleasure of the bird, to four or five times the length of the bill itself. This

action is much assisted by the formation of the root of the tongue, as it is usually called, or more properly the *os hyoides*, or forked bones by which it is attached to the mouth. These bones are greatly lengthened, and are compactly curved round the skull, having on each side a little sac or reservoir of a particular secretion which serves to lubricate the muscles; just as we apply grease to the wheels of a carriage. Now, the use of this complicated structure, — which does not, however, as in the duck, imply any unusual sensibility of touch, — is intimately and vitally connected with the habits of the bird. Its bill, indeed, is remarkably powerful, and capable of breaking into the strongest wood; but there its powers cease: its tip is made for splitting, not for piercing; and it has no teeth or notch by which it could firmly grasp a struggling insect. No sooner, therefore, has the woodpecker, by breaking away the external bark with powerful strokes of the bill, laid open the retreat of the insect beneath, than it suddenly darts out its tongue, spears its prey, and instantly brings the luckless insect to its mouth. Tongues of this structure are not entirely confined to the family of woodpeckers, under which we include the wryneck, but we detected an example among the Brazilian creepers, forming the genus *Dendrocolaptes*, whose tongues have been supposed by all ornithologists to be similar to that of the common European creeper; that is, thin, simply pointed, and not extensible. We shall now describe two other modifications of this member, very different from the last, but which are also capable of being considerably elongated. The first of these is seen in the humming birds (*Trochilidæ*); the second in the honeysuckers (*Meliphagidæ*.) It has generally been supposed that the two long filaments into which the tongue of the humming bird is divided were tubular, by which construction they were enabled to suck up from the nectary of flowers the natural honey therein contained. But this is altogether erroneous. So far back as the year 1817, we detected this error in dissecting the humming birds of Brazil; and we have often announced the fact, that the food of these

birds consisted both of honey and of minute insects. Since then some modern writers have flown to the other extreme, and, wholly unsupported by facts, have declared their belief that these birds live entirely upon insects. In this they are as much mistaken as in their former assertion; the fact being, that they feed indiscriminately upon both. The two filaments, which were supposed to be tubular, are perfectly flat, and very thin,—a structure obviously adapted for licking up the food. We have reason, also, to believe that these processes are covered with a mucilaginous substance, sufficiently adhesive to act upon the pollen of flowers, and the wings of the small dipterous insects, which the humming birds chiefly select for their animal diet. The tongue of the African sunbirds (*Cinnyridæ*) we have never had the opportunity of examining; but by a fortunate chance we have discovered that the type among the Australian honeysuckers (*Meliphagidæ*), which represents the *Trochilidæ*, has the tongue constructed precisely the same as those birds. This brings us to the second description of extensible, or rather of suctorial tongues, and which is of a form almost peculiar to the honeysuckers of Australia, and its islands. In these birds the tongue is not nearly so extensible as in the *Trochilidæ*, being seldom more than half as long again as the bill; nor are the bones of the os hyoides carried back upon the skull, as in the woodpeckers and humming birds. Nevertheless, the structure appears especially adapted for suction: the form of the lower part is the same as in ordinary birds; but the end is composed of a great number of delicate fibres or filaments, exactly resembling a painter's brush. Lewin, who drew and described these birds in their native region, has figured the tongue of the warty-faced honeysucker * (*Meliphaga phrygia*), and describes the bird as sometimes to be seen "in great numbers, constantly flying from tree to tree (particularly the blue gum), feeding among the blossoms, by extracting the honey with their long tongues

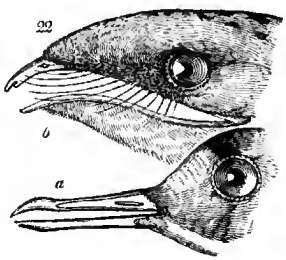
* Birds of New Holland, pl. 4.

from every flower as they passed." What will appear still more extraordinary to the scientific naturalist, is the fact, that some birds of this meliphagous group, are actually woodpeckers, and yet retain the typical structure of the tongue of their own natural family. The same observer, speaking of the blue-faced honeysucker, describes it as being "fond of picking transverse holes in the bark, between which and the wood it inserts its long tongue in search of small insects, which it draws out with great dexterity."* Now, as Lewin describes this bird as a honeysucker, we must conclude, until facts prove otherwise, that it has the filamentous tongue of the honeysuckers, but that it is used for the purpose, not of spearing insects, but of catching them by means of the glutinous matter on the filaments,—a mode of capturing its prey by no means improbable, provided the insects are of a small size. It must not be supposed, however, that the food of the *Meliphagidæ*—several of which are as large as a thrush, and three or four much larger—is restricted, any more than that of the humming birds, simply to the nectar of flowers. They, indeed, feed upon the honey; but, as Lewin declares, combined with the numerous small insects lodged in most of the flowers, which they extract in a dexterous manner with their tongues, peculiarly formed for that purpose. It is clear, moreover, when we come to reflect upon the matter, that birds which are attached to the secretions of particular trees—as are many of the *Meliphagidæ*—can only enjoy their favourite food for a comparatively short season; that is, while the tree or plant is in blossom: they must, therefore, either feed at other times upon small insects or upon fruit. The two first habits we have shown them to possess; and the last—that of devouring fruits also—is exemplified in the yellow-eared honeysucker of Lewin; who remarks, that "in the *winter* season these birds have been seen feeding on the sweet berry of the white cedar in great numbers."† There are several other modifications of the

* Birds of New Holland, pl. 5. † Ibid.

tongue, of less importance than those leading forms we have now described; but as our space will not allow of extending our remarks upon this organ, we shall at once proceed to notice others.

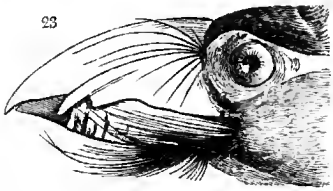
(54.) The Mouth, or rictus, is of greater or less expansion, according to the description of food upon which the bird subsists, or the method of taking it, although in the generality of species the mouth is not of great extent; its angles or sides, when the jaws or mandibles are closed, do not reach so far back as to pass the base of the eye, supposing a perpendicular line to be drawn from one end to the other. But in birds having a very wide mouth, the basal angle of the jaws passes far behind this imaginary line, and the mouth is said to open *beneath* the eye. The smallest mouths are seen in the grallatorial order, where we have the plovers (*fig.* 22. *a*), and in the types by which it is represented in other circles. This is strictly conformable to that law of variation in structure before explained, by which this primary type is so distinguished; because, in fact, it represents the class of *Aerita*, in the great circle of the animal world, where the mouth is for the most part altogether wanting. It is in conformity with this law that the humming birds, being suctorial, have the smallest mouths in the insessorial order; for as they swallow those insects only which are very minute, a greater extension is not necessary. Birds, on the contrary, which capture their prey upon the wing, and gulp it down immediately, have mouths of enormous width. The whole tribe of the *Fissirostres*, at the head of which are the swallows, may be instanced as possessing this structure, carried, perhaps, to a greater extent in the night-jars (*Caprimulgidæ*, *fig.* 22. *b*) than in any



other race. A similar structure is also apparent in some of the typical chatterers, as the genus *Casmorhynchus*; but it is intended for a very different purpose. The wide mouth of the swallow tribe is not for the passage of large insects — because it is well known that these birds feed only upon such as are very small — but to give them a greater chance of securing their prey. The chatterers, on the contrary, feed after the manner of ordinary birds, that is, with closed wings; but a very wide mouth is essential to them, for they frequently swallow, in a whole state, wild fruits bigger than our sloes; and in dissecting these birds, we have often been astonished at the size of the fruit discovered, in an entire state, in their crops. There must be something very peculiar in the economy of those little-known birds, the *Eurylaminæ*, or broadbills of India, whose mouths far exceed in width those of the most typical flycatchers (*Muscicapinæ*). Their prey is probably of a larger description than that captured by their congeners; or, as one species is known to feed both upon insects and vegetables, it is probable that the others also partake of berries not much inferior in size to those devoured by the chatterers of Brazil. It would appear, at first, preposterous to say that *lips* are to be found among birds; and yet there are instances where parts, at least analogous thereto, might be so termed. In the *Ceblepyris labiata*, — a very rare species, of the size of our blackbird, found in Southern Africa, — the basal half of each mandible is margined by a skin, which is destitute of feathers, and of a bright red colour; and the same development of the part is observable in most young birds, or nestlings, before they have acquired their first feathers.

(55.) The mouth is often defended by rictal BRISTLES, more or less stiff, which are from five to six in number, and are situated at the base of the upper mandible, immediately above the angle of the mouth. Sometimes, as in the genus *Pogonias* (*fig.* 23.) composed of the Barbut woodpeckers of Africa, these bristles extend

themselves round the base of the lower mandible, as if to defend the mouth in all directions; but we do not at this moment remember any other birds with a similar formation. These appendages being found only in such birds as feed upon insects, and chiefly in those which catch their prey on the wing, leaves us in no doubt as to their specific use. Among the swallows, indeed, these bristles cannot be found, because the insects they live upon, being very small, are swallowed without any difficulty, and are incapable of making any struggles; but the case is far different with those captured by the night-jars, whose chief sustenance is derived from coleopterous insects which fly in the evening, and whose hard legs and bifurcated claws might inflict much injury in their struggles to escape. Now, the bristles we are describing, are more developed in this tribe of birds than in any of those which feed upon the wing; and they obviously answer two purposes, — they protect the angles of the mouth from any injury, while at the same time they confine the struggles of the captive insect. In the genuine flycatchers, these bristles are rather less developed; although in some few, as in the genus *Megalophus**, they are very long: but then, on the other hand, the *Muscicapinæ* never, or very rarely, feed upon coleopterous insects, but seem to confine themselves to those whose bodies are soft; yet, as the wings of these latter are often large, the bristles are necessary to confine their fluttering. It is rather singular that the woodpeckers, which feed upon coleopterous insects, as well as soft larva, are destitute of these bristles; but we may observe that the feathers round the mouth are remarkably thick and compact, and that the nostrils are

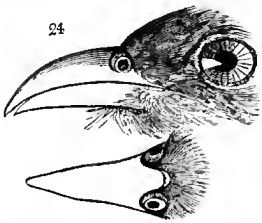


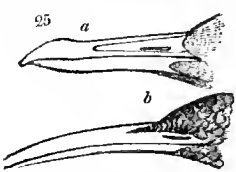
* *Megalophus regius*, Brazilian Birds, pl. 51, 52.

completely concealed by a dense tuft of stiff setaceous feathers: both these peculiarities may have something of the same effect, though produced in a different manner to what we have just stated; while the care with which nature has defended the nostrils of these birds is for the double purpose of preventing their being injured by the claws of insects, and to exclude every particle of wood, which the bird scatters about while perforating and breaking into the tree where he knows his food lies concealed. In proportion as birds partake both of a vegetable and an insect diet, so are these bristles more or less developed. In the robin, for instance, they are short and feeble, intimating that its diet is only partially insectivorous, or rather, that it seldom captures *flying* insects: and such we know to be the fact. Proceeding a step further, we find the bristles of the thrush and blackbird altogether rudimentary, leading us to suppose that, although they may occasionally eat insects, they never capture them when upon the wing. Experience confirms this theoretical inference, for every field naturalist is fully aware that such is truly the fact.

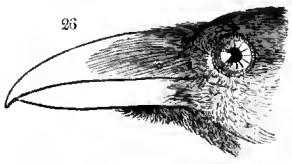
(56.) The different forms of the NOSTRILS, no less than their situation, deserve attention; for in both these particulars they assume many different appearances. In all the birds of prey, they are situated nearly in the middle of a naked and soft skin, called the *cere*, which covers the base of both mandibles, and is probably connected with the sense of smell. The cere, however, is not confined to the rapacious tribes; for we find it, although much smaller, in almost the whole of the parrot family, whose food is entirely vegetable. No other land birds possess this appendage; nor can it be said to exist, under the same form, in any other birds excepting some of the rasorial orders: most of the cranes, herons, &c. have the space between the eye and the bill naked and soft; but this is merely from the ordinary skin being destitute of feathers. The nostrils are either placed, 1. at the base of the lateral surface of the bill, as in the generality

of birds; or 2. behind its basal margin, as in the toucans; or, 3. towards the very centre of the bill — intermediate between the front of the head and the tip of the under mandible, — as in the genus *Musophaga* (*fig.* 33.). The first of these forms is common to most birds, but there is yet great variation in the shape of the aperture; sometimes it is round, sometimes oval, and sometimes linear (*fig.* 25. *a*). Round apertures are most prevalent among the falcons, the owls, the cuckoos, and the parrots, where the margins are generally tumid or swelled. In the fern-owls (*Caprimulgidæ*), and in the cuckoo (*fig.* 24.), the aperture is not only round, but slightly tubular, something analogous to many of the bats. In the other fissirostral birds, the opening is more oval, and is placed either at the extreme termination of a membranaceous skin, which fills up the depression of the part where the nostrils are situated, or a little on one side: between these, and such as are of a lengthened oval, there are innumerable grades of variation. Linear nostrils have also their own peculiar modifications. The grallatorial birds show us this structure in its highest state of development. On looking to the bill of the common plover, we observe that there is a groove running in the middle of the upper mandible of the bill for nearly two thirds its length; and that the aperture of the nostrils assumes the form of a mere slit at the base (*fig.* 25. *a*). A similar structure is seen in the different snipes, curlews, and sandpipers. In the herons, this slit is without the groove; while in the humming birds (*fig.* 25. *b*) it is often so completely hid





by the narrow membranaceous skin which conceals the linear aperture, that the nostrils would never be discovered by a student unacquainted with this curious formation: upon raising this lappet, the aperture appears as an elongated slit; but which, in the sunbirds (*Cinnyridæ*) is of a semicircular form. The most tumid nostrils are those of the pigeons; but in what respect this structure is connected with their economy, we know not. There is an obvious analogy, however, even between this shape and that which is seen in the plovers. In rasorial types the aperture is almost lateral — that is, placed on that side of the membrane which is nearest to the margin of the bill; the membrane itself being unusually thick and strong, almost corneous, and often very convex. It is obvious that all these are different modes for protecting an organ so delicate: but Nature is ever inexhaustible in her variations; and thus we find that in numberless instances she accomplishes the same object by the means of bristles, or feathers, variously disposed, according to the particular habits of the birds. The great majority of insectivorous birds have setaceous feathers or bristles incurved over the nostrils, sufficient to ward off injury, yet leaving the orifice, in other respects, exposed to the free action of the air. In birds, however, whose habits lead them to plunge their bill into substances which might enter the apertures, the nostrils are completely covered by thick-set feathers, or rigid bristles, reposing flat upon the bill. We have already adverted to this structure in the whole of the woodpeckers; and it is almost as general among the crows (*fig.* 26.), which have not only their nostrils, but a great part of the base of the bill, protected and even covered by stiff bristles. Hence they are enabled, with impunity, to perforate the earth and pick holes in the ground, during their search for insects, without the least particle of dirt getting into their nostrils. The genus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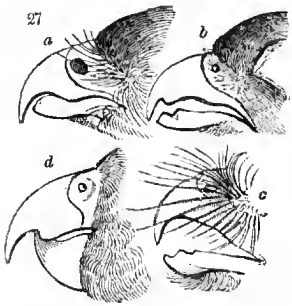
Ptilonorhynchus (*fig.* 17.), as its name implies, has the base of the bill entirely covered with small close-set feathers instead of bristles; but unfortunately we know nothing of the economy which renders this structure necessary. The second mode in which the nostrils are developed, is almost peculiar to the toucans, and has already been adverted to. The third structure is equally rare, and most developed in that magnificent bird the *Musophaga violacea* (*fig.* 33.), or violet plantain-eater: we know not, however, the manner in which this peculiar structure harmonises with the functions of life.

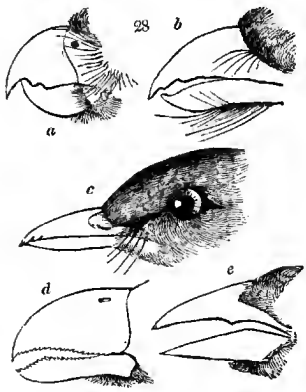
(57.) We now come to the BILL, or rather to the jaws of birds, the two mandibles of which are merely the jaws of a vertebrated animal lengthened out into a *rostrum* or beak, analogous to that form which is seen in crocodiles, garfish, and even in long-snouted quadrupeds. In birds, however, these parts are altogether naked, of a horny substance outside, and are unprovided with teeth, properly so called. The upper of these pieces forms the superior, and the under the inferior, mandible; while both collectively constitute the bill. It is by this organ that the food is seized, or laid hold of, by ordinary birds, or torn in pieces by the rapacious tribes. The absence of teeth, in such birds as seize their food by the bill, or in which this member has superior powers of prehension, is supplied by a notch, which forms a tooth-like projection close to the point of one or both mandibles: but in some of the rapacious birds, as the sparrow hawk, this process is placed rather more towards the middle of the bill, and is rather in the shape of a festoon (*fig.* 27. *a*); whereas, in the typical falcons (*b*), the notch is so deep as to produce a sharp tooth-like angle. The owls, on the other hand, have neither the one nor the other of these projections on the upper mandible (*c*); but still the tip is as much curved as in the two former, and the under mandible is toothed. It is almost unnecessary to say how greatly this structure facilitates the operation of tearing and dividing the

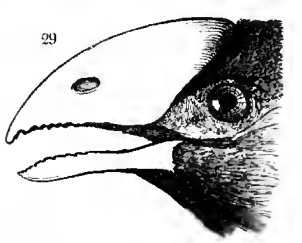
flesh of those animals which are caught, and which could not be accomplished by a bill of the ordinary shape. A modification of this structure is also seen



in the parrots (*d*), where the point of the bill, especially of the macaws (*Macrocercus*), is even more pointed. Personal observation, however, enables us to account for this apparent anomaly. Many of the parrots of South America stick their sharp-pointed and hooked bill into the fruit they feed upon, before it is brought between both mandibles; so that, in fact, it serves to secure their food before they begin to devour it. The notch, again, in the upper mandible, so analogous to that of a rapacious bird, is not used to tear the food, but acts as a rest for those hard nuts which are to be cracked and broken by the great muscular force of the under mandible. The favourite food of most of the splendid macaws of Brazil consists in the seeds or nuts of the different species of palms; and these are so deeply seated in their husks or receptacles, that they could not be extracted but by a bill which could perform the office of a pick-axe; and such a bill has accordingly been given to the macaws. But we must now pass on to other shapes. The lateral tooth, so conspicuous in the genera last mentioned, becomes very much smaller in the birds composing the tribe of *Dentirostres*, where it only assumes (except in the *Laniadæ*, or shrikes, and their representatives) the appearance of a distinct notch, such as may be observed in any of our thrushes and warblers. Finally, in the conirostral tribe, where we have the crows and starlings, this notch becomes almost obsolete; being always faint, and frequently wanting. This substitute for real teeth is

thus to be found only in the two typical orders of birds, the *Raptores* and the *Incessores;* in all others it is entirely wanting. There is yet a third mode by which nature supplies the deficiency of real teeth to the bill of birds; and that is, by dividing the edges into a number of saw-like notches, of greater or less size as the peculiar habits of the birds require. The first developement of this structure is seen in the double-toothed falcons, as in the genus *Harpagus* (*fig.* 28. *a*); the next is in the typical trogons (*b*), and in the sub-genus *Andropadus** (*c*): a further advance is seen in the toucans and hornbills, where the serratures, although coarse and wide apart, extend the whole length of the bill: but the highest development is exhibited in the *Chizærhis variegata* (*d*), where the teeth are small, sharp, regular, and of equal size. In the *Musaphaga violacea* (*fig.* 29.), on the other hand, they are somewhat unequal, and nearly obsolete towards the base of the cutting margins. We cannot, unfortunately, illustrate any one of these structures by detailing corresponding traits in the economy of the birds. There is one, however — the plant-cutter of Chili — whose bill is described as much

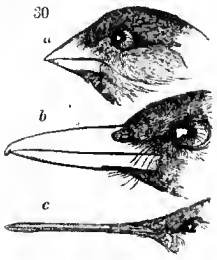




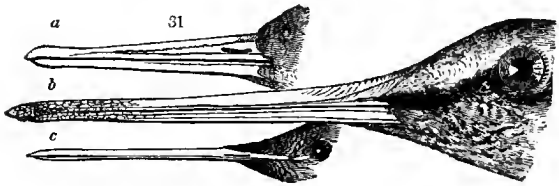
* North. Zool. vol. ii. p. 485. The *Importan* of Le Vaillant (Ois. d'Af. pl. 106. f. 2.), but recently described as a new bird by Jardin and Selby under the name of *Trichophorus brachypodioides*. Ill. of Orn. pl. 128.

serrated, for the purpose of cutting away the outer leaves of the heads of plants, in order to get at those which are the youngest and most tender. Mollini, who vouches for this fact, goes on to assure us that these birds are consequently very destructive to the farmer; and we can readily suppose that a few of them would very soon destroy a field of Indian corn before the heads had burst or come to perfection. It is probable that the teeth of the toucan is of essential service in crunching and breaking the bodies of the small birds which it captures, and which are reduced to a shapeless mass before it is tossed up in the air and swallowed. The only example we are acquainted with of an incessorial bird having a central or raptorial tooth to its bill, is the *Lanio* of Vieillot (*fig.* 28. *e*), a bird which obviously belongs to the tanagers, notwithstanding this anomalous formation.

(58.) We may now consider the bill in regard to its figure; that is, its length, breadth, and direction. A bill is called *short*, when its length does not equal the space between the nostrils and the nape of the neck (*fig.* 30. *a*); it is then said to be shorter than the head: when these two parts are equal, the bill is termed *moderate* (*b*); but when it exceeds the length of the head, it is designated as *long* (*c*). Its circumference assumes three principal forms; for it is either compressed, depressed, or round. The length of a bill is usually estimated from that part which protrudes beyond the front of the head; and not, unless so expressed, from the angle of the mouth to the tip of the upper mandible. We shall adopt this plan, because it is in general use, although the latter mode of measurement is certainly more strictly correct than the former. According to these views, the shortest billed birds become those which have the widest

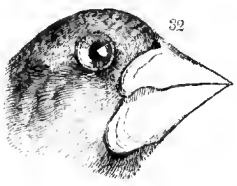


mouths, both which characters belong to the goatsuckers and the swallows: in both these the mandibles are so weak as to be only capable of clasping small insects; and it is very questionable whether those of the ordinary *Caprimulgidæ* are ever employed for this purpose, the remarkable smallness of both mandibles rendering them little more than rudimentary. The great majority of birds which catch their food in the air have short bills,



but of great breadth, as we see in the flycatchers: while those birds which *peck* their food, like crows and thrushes, have them generally of a moderate length; or, at least, they are never depressed, as this latter form always implies weakness, and an incapacity for striking the bill against any substance. The longest bills are found among the waders (*Grallatores, fig.* 31. *a b*), and such birds as plunge this member into substances which contain their food. The snipes, woodcocks, and many of the godwits, are familiar examples of this structure; and they are well known to insert their bills to a considerable depth in soft mud, for the purpose of finding worms and aquatic insects. This great elongation of the bill, or mouth, as we have had frequent occasion to remark before, is one of the leading characters of the grallatorial type in its different modifications throughout the animal kingdom. We consequently find that the tenuirostral tribes, represented by the humming birds, have the longest bills (*fig.* 31 *c*) among the perchers; and the pigeons are so characterised by this very circumstance in the order of *Rasores,* although their bills, in comparison with those of the generality of birds, are only moderately long.

That the humming birds, and all those which suck the contents of flowers, should have a bill so much lengthened, is owing to the nature of their food, which requires the faculty of probing the bottom of those long tubular flowers of the natural order of *Bignoniaceæ*, with which the forests of tropical regions abound; this structure, in fact, is as necessary to them as an elongated mouth is to bees, which feed upon, and have to reach, the very same substance. It may here be observed, and laid down as a general rule, that as a depressed bill always indicates weakness, so one that is compressed on its sides, (that is, whose length is always greater than its breadth), indicates strength. No better proof of this position can be adduced than the genera *Platyrhynchus* and *Megalophus*, as examples of the first of these forms; and that of the crows or the parrots, as examples of the second. When, however, the bill is not only short, but so thick as to become almost round or cylindrical, we have examples of the greatest strength with which Nature has endowed the mouth of birds. No group in the ornithological circle exhibits this powerful structure so much as that of the *Fringillidæ*, where the bill is short, and nearly conic; both mandibles are equally thick, and when closed, their height and breadth are nearly the same. In many of the finches (as in the sub-genera *Amadina*, *Coccothraustes*, &c.), the thickness of the bill at its base, in comparison to the size of the head, is enormous: but in the *Loxia Ostrina* of Vieillot (*fig.* 32.), a rare and most extraordinary bird from Western Africa, the bill is not much inferior to the size of the head. It is well known that all these "hard-billed" birds, as the old writers aptly called them, feed entirely upon seeds and nuts; and the harder these are, the stronger are the bills of such species as are appointed to derive nourishment from the different sorts. Whenever an insectivorous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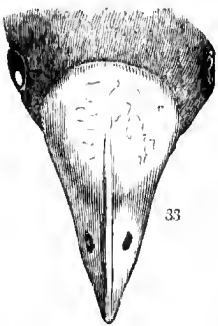
and frugivorous diet is united, as is the case with most of the Tanager finches, the upper mandible is notched, for the obvious purpose of more firmly securing that part of their food, which, like insects, can escape.

(59.) The degree of *strength* possessed by the bill is in a great degree influenced by the proportion which the upper and the under mandible bear in their relative size or thickness. The under mandible of the strong bill in the falcons, it is true, is much smaller and thinner than that of the upper; but then it is armed with a toothed process, and the strong-hooked point of the other renders it sufficiently powerful to *tear* flesh without requiring much aid from the lower mandible. But in the parrots, where the food is prepared in quite a different manner,—that is, by *breaking*, both mandibles are equally strong, in order to produce an equal degree of pressure, without which it would be impossible for these birds, any more than the great-billed finches just mentioned, to crack, with facility, the hardest nuts: hence the macaws and the grosbeaks have the strongest bills of all known birds, because the two mandibles are more equal in size and strength than in any others. The weakest bills, on the contrary, are those where the under mandible is remarkably thin; instances of this we see in the flycatchers and the whole of the humming-birds. In the latter family this part is so slender as to be almost hid, at its base, by the folding over of the upper mandible; so that when these birds are just killed, their bills are almost flexible. It is much to be regretted that our total ignorance of the economy of the plantain-eaters leaves us unable to account in any way for the great development of the upper mandible (*fig. 33.*), which spreads over the front of the head like a casque: nevertheless this frontlet, although



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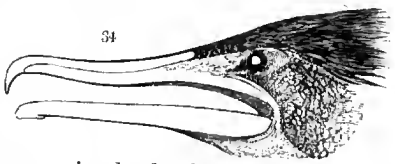
thick, does not appear to be very solid or compact; it is not improbable that its inside is of a cellular texture, something analogous to that of the toucans, and connected with the very extraordinary situation of the nostrils.

(60.) The enormous *size* of the bill, as seen in the toucans and hornbills (*Buceridæ*), shows that this quality is not necessarily accompanied by *strength*, for the internal structure, in both families, being cellular, the bill is not only very light, but may be broken with ease. That of the awks (*Alcadæ*), when viewed in profile, seems to be very large, but it is, in fact, so thin, or in other words so compressed, that it must possess very little strength. The pelican's bill seems disproportionably large, but it possesses little or no strength: the under mandible is so thin that the bones are pliable; and it is one of the vulgar tricks of the keepers in travelling menageries, to show the spectators how it may be turned into a cap or bonnet.

(61.) There are some other modifications in the form of the bill, which will not strictly come under the foregoing definitions; but which, although comparatively rare, deserve our attention. The chief of these may be distinguished by the following names: — 1. Semi-raptorial; 2. Cuneated, or wedge-shaped; 3. Falcate, or sword-shaped; 4. Spatulate, or spoon-shaped; 5. Recurved; and, 6. Truncated. Each of these forms will now be separately considered.

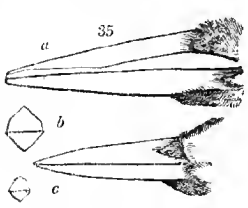
(62.) I. A *Semi-raptorial bill* is where the upper mandible terminates in a strong, sharp, abrupt, and formidable hook, obviously intended for rapine, but yet unassisted by those tooth-like processes, or notches,



which we see in the hawks, shrikes, and fissirostral birds. It is obvious that this powerful hook acts as a

strong claw, and is somewhat analogous to the talons of an eagle, by being struck into the prey. It certainly is not used, like that of the true rapacious order, for tearing the food in pieces, for it is well known that pelicans, in a state of confinement, preserve their natural habit of swallowing their food entire, and we have evidence to prove that the whole of the cormorant family do the same. Indeed, the great expansive power of the throat of both these genera, manifestly constructed for receiving food in such a state, places the fact beyond dispute. The owls, which represent the Natatorial order (wherein this structure is only found), show it in its incipient state; for, although their upper mandible is greatly hooked, there is no appearance of the notch so universal among the falcons.

(63.) II. A *cuneated*, or *wedge-shaped* bill, is altogether confined to the woodpeckers and the nuthatches: we can only look for its full development, however, in the genus *Picus* as now restricted. A glance at the bill of the *Picus robustus* (*fig. 35. a*) will convey, much better than by words, a just idea of its general shape: both mandibles are of such an equal size and thickness, that when closed the commissure (or line made by the joining of the two together,) is precisely in the middle; the bill gradually becomes smaller from the base; and its circumference would be cylindrical were it not for certain ridges, which form little projecting angles, so that its section (*b*) appears nearly hexagonal: the end has not a sharp point, but a perpendicular edge, like that of a wedge or hatchet. By this most beautiful mechanism, aided by uncommon strength in the muscles of the neck, these birds can break through and demolish the hardest wood; so that in their native regions, the base of the trees where some of the larger species have been at



work, are covered with as many splinters and chips as would be found in a carpenter's shop.* The student must not look for the full development of this structure in our common green woodpecker (*Chrysopterus viridis* Sw.), which belongs to a different genus; but he will find them in the greater and lesser spotted species. The nuthatches (*c*), which connect the woodpeckers with the creepers, show the only near approach to this form which we yet know of. We have said that the maccaws have the strongest bills of any birds; but it is, in truth, exceedingly difficult to award that distinction justly, seeing that strength is distributed under so many shapes and ways, suited to the habits of the birds, and to the particular functions which the bill is to perform. Equally difficult is it to apply, with strict propriety, the epithets of small and great; for, although the goatsucker's bill, in point of real size, is by far the smallest, yet that of the ostrich, in proportion to the dimensions of the bird, is very considerably smaller.

(64.) III. *Falcate*, or *sword-shaped* bills, are those which have both mandibles more or less curved, so as to assume the figure of a sword with the point turned downwards. These bills are almost always greatly lengthened, and from their peculiar shape, no less than from their great compression, are generally weak. The first indication of this form may be seen in the outline of the toucan's bill, the under piece of which curves downwards in the same direction as the upper. The hornbills make another advance, and the bills of many of the species would come under this denomination but for the additional protuberances which rise from them. Some of the long-legged thrushes (*Crateropodinæ*) show an obvious tendency the same way, as do also many of the honey-suckers in the families of *Trochilidæ* and *Cinnyridæ*. The ibis and the curlew, among the waders, have their bills decidedly falcate, and the same may be said of many of the promerops, and of that

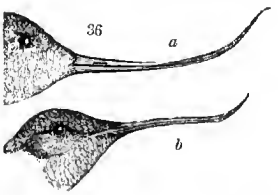
* See Wilson's Ornithology, article *Ivory-billed Woodpecker*.

truly magnificent bird the *Ptiloris paradisea* of New Holland; but it is only among the scansorial creepers that we find this structure in its highest stage of development. The common creeper, *Certhia familiaris*, and the hoopoe, are the only native examples we have; but the forests of Brazil are the peculiar regions of the genus *Dendrocolaptes*, one of which, the *D. procurvis*, has the bill so long and so much curved, that it can only be compared to the blade of a sickle. We never were fortunate enough to meet with this bird, which is particularly rare, and confined to certain localities; so that its peculiar habits have never been investigated: it would be also interesting to know the structure of its tongue. In several other tree-creepers of South America, closely allied to the last, the tongue is quite as long as the bill, and even longer, while its tip, being horny and sharp, leads us to infer that it is used to transfix such small insects as are passed over by the more powerfully constructed woodpeckers.

(65.) IV. *Spatulate* bills are confined to one genus only, that of *Platalea*, known by the common name of spoonbills. However anomalous this form may appear, it is but a singular modification of the depressed shape belonging to all the *fissirostral* types of birds, engrafted, as it were, on the elongated bill of the herons, and analogous to the ducks, the boatbills, and other modifications of the same type. Little or nothing appears to be known of the habits of these birds, or what peculiar functions this singular-shaped bill is intended to perform; we cannot therefore illustrate its history.

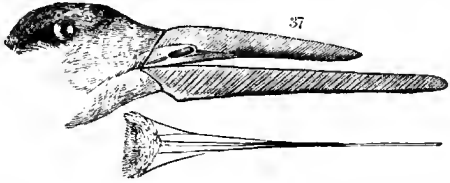
(66.) V. A *Recurved* bill is one of the most remarkable deviations from the ordinary form of this member, all other bills being either straight or curved downward; but in this the point is bent upwards. There is an inclination to assume this form in some of the tree-creepers, as in the genus *Sitella*, among the nuthatches, and still more in *Zenops*, a genus of the Brazilian creepers; nevertheless, although the ridge or *gonys* of the under mandible, in these examples, is inclined upwards, the

culmen, or ridge of the upper, is perfectly straight. The same also may be said of several of the long-billed waders, which at present form part of the genus *Totanus*, so that it is in the *Avocets* alone (*fig.* 36. *a.*) we have this form at its maximum: here both the mandibles towards their extremity make a sudden curve upwards, and although very thin and delicate at this part, they are considerably compressed. The recurved-bill humming birds, of which there now appears more than one species, possess the same structure, with this exception only, that the *gonys* is somewhat thickened. For several years after we had published a figure and description of the *Trochilus recurvirostris* (*fig.* 36. *b.*), the French ornithologists, with their usual hastiness of decision, maintained that the upward direction of the bill merely originated in that part having been artificially distorted in the only specimen then existing of the species. We did not think it worth while to combat this assertion, fully persuaded that, as soon as these gentlemen could receive ocular demonstration by an inspection of a second example, they would change their opinion; and they have accordingly done so. Several specimens within the last few years have reached Paris, and it now appears that more than one species has the bill decidedly recurved. Nothing is positively known of those peculiar habits which require a bill shaped so differently from all other birds. Wilson, in speaking of the American Avocet (*Recurvirostra Americana*), merely observes, that it "frequents the shallow pools of water in the salt marshes, wading about, often to the belly, in search of food; viz. marine worms, snails (?), and various insects (crabs?) that abound among the soft muddy bottoms of the pools."



(67.) VI. *Truncated* bills are, perhaps, the most singular of all the forms which nature has given to this

member among birds. Both mandibles are straight, and so much compressed as to resemble the blade of a knife—placed edgewise—more than any thing else: the upper mandible, indeed, is slightly thickened at its base, where the nostrils are situated; but one quarter of its length appears broken off, so that the under mandible protrudes beyond the upper nearly an inch (*fig.* 37.).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There are three, if not four, species of this most singular genus, which in every other point of structure shows an intimate affinity to the ordinary Terns. Notwithstanding the length, even of the upper mandible, the mouth of the bird itself is remarkably small: for it does not extend beyond the nostrils. Beyond that part, both the edges on the under mandible are quite sharp, but that which is uppermost is received into a very narrow groove on the corresponding piece, as if to protect and preserve its sharpness. Not having had the opportunity of watching these birds alive, we can state nothing from personal observation; but this is not to be regretted after the following account of their manners by Wilson. "The sheerwater (*Rhynchops niger* L.), is formed for skimming, while on the wing, the surface of the sea for its food, which consists of small fish, shrimps, young fry, &c., whose natural haunts are near the shore and towards the surface. That the lower mandible, when dipt into and cleaving the water, might not retard the bird's way, it is thinned and sharpened like the blade of a knife; the upper mandible, being at such times elevated above water, is curtailed in its length, as being less necessary, but tapering gradually to a point, that, on shutting, it may suffer no oppo-

sition. To prevent inconvenience from the rushing of the water, the mouth is confined to the mere opening of the gullet, which, indeed, prevents mastication taking place there; but the stomach, or gizzard, to which this business is solely allotted, is of uncommon hardness, strength, and muscularity, far surpassing in these respects any other water-bird with which I am acquainted. To all these is added a vast expansion of wing, to enable the bird to sail with sufficient celerity while dipping in the water. The general proportion of the wing of our swiftest hawks and swallows to their breadth, is as one to two; but in the present case, as there is not only the resistance of the air, but also that of the water, to overcome, a still greater volume of wing is given, the sheerwater measuring nineteen inches in length and upwards of forty-four in extent. In short, whoever has attentively examined this curious apparatus, and observed the possessor, with his ample wings, long, bending neck, and lower mandible, occasionally dipt into and ploughing the surface, and the facility with which he procures his food, cannot but consider it a mere playful amusement, when compared with the dashing immersions of the tern, the gull, or the fish-hawk, who, to the superficial observer, appear so superiorly accommodated. The sheerwater is most frequently seen skimming close along shore, about the first of the flood. — I have observed eight or ten in company, passing and repassing at high water, dipping, with extended neck, their open bills into the water, with as much apparent ease as swallows glean up flies." We have now enumerated the most remarkable of those forms with which nature has diversified the bill of birds: but these forms, again, are varied and combined in such a multitude of ways, that it would be useless, if not impossible, to attempt further definitions. Some systematists, however, have chosen to make these variations the ground-work of their systems, to the utter confusion of all natural arrangement, and the no small perplexity of the student. Upon this principle the falcons must come next the parrots; the fly-

catchers and warblers must be widely separated; the crows and the tom-tits be classed together, and the avosets joined to the recurved-bill humming-birds. These are only a few of the ridiculous combinations which would result from such a principle of classification, which, however simple and inviting it may appear in theory, becomes utterly impracticable when we attempt to work out its details.

(68.) The *nuchal bristles* of birds are certain setaceous hairs, more or less developed, but always simple, which arise from the nape, or back part of the neck of several birds, and are concealed among the feathers. They are

most developed in the bristle-necked thrushes, forming the genus *Trichophorus* (*fig.* 38.), where they are so much prolonged as to be three times the length of the surrounding feathers; and it is generally supposed that they are altogether peculiar to this group. We believe, however, that a great many of the perching genera are furnished with these appendages, for we have detected them in our common thrushes, and even in the robin redbreast. It is only, however, in the circle of the short-legged thrushes, or the *Brachypodinæ**, that these bristles are lengthened; in all other birds that we have yet seen, they are merely the length of the ordinary feathers of the nape, from which they are to be distinguished by being destitute of any webs, excepting a few at their extreme point. Their use is not accurately known, but they are probably connected with the sexual intercourse.

* First defined and characterised in North. Zool. vol. ii. Appendix i.

CHAP. III.

THE SAME SUBJECT CONTINUED. — THE FEATHERS, WINGS, TAIL, AND FEET OF BIRDS.

(69.) We now come to the FEATHERS, which are analogous to the hair of quadrupeds, — not only covering and protecting the body in a similar way, but enabling that body to be raised from the earth and carried through the air. Buffon and others have given such long and elaborate accounts of the structure of this extraordinary clothing, and these accounts have been so often transcribed into modern compilations, that we deem it unnecessary to dwell upon such minute details. It must be remembered, also, that it is the object of the treatises composing this series to give the result of personal study and observation, and merely to draw upon our predecessors for that information (of which we shall always acknowledge the source) which local or accidental causes have prevented us from personally verifying. It has been one of the consequences that have resulted from the sudden favour into which natural history has lately risen, that the task of giving elementary works to the public has, in nearly all instances, fallen into the hands of persons who were the least capable of performing the task; and who, to use the bitter but deserved sarcasm of a truly eminent naturalist, are giving the public "stale systems, miserably travestied." — "Natural history," as the same writer justly observes, "is the very last thing that a mere compiler should meddle with;" and yet it is from compilers and tyros that we have new systems of classification, and of nomenclature, mixed up with the indiscriminate censure of authors, whom it is evident they have never read, far less understood. Our readers, therefore, must not expect, in the limited compass to which these treatises are restricted, that they will find all that has

been copied and recopied in the volumes of others; but, on the other hand, they may hope to see many of those subjects placed in a new light, accompanied by some original information, which peculiar circumstances have placed us in the way of acquiring. But to proceed: — We shall only take a hasty glance at the construction of feathers in general, and then proceed to notice those particular modifications of their form which influence their natural habits, and indicate their natural affinities.

(70.) The FEATHERS which are upon a bird are of three different kinds: 1. Those which are next to the body, and are altogether concealed from the sight; 2. Those which are external, but are used in flight; 3. Those by which the body is sustained in the air. The substance which composes the first is known by the name of *down*. It is more analogous to the soft fur of quadrupeds than to the feathers, properly so called, of birds, inasmuch as it does not possess that distinctness of parts which is observable in a perfect feather. Some of its obvious uses are to keep the body in an equal degree of temperature, and to resist cold or wet, so that it performs the same office as an under-vestment of flannel does to the human skin. This inner covering, however, is not to be found in all birds; or, at least, it is so slight in some that its presence is only indicated by soft hairs thinly scattered over the body, as we see in domestic fowls and other poultry. It may be observed, however, that in such birds which have not, like the ducks, a distinct layer of down, the lower part of the external feathers supplies the deficiency, so that it may be said the down is only removed to another situation, and instead of being detached, it is placed at the base of the true feathers, where it equally covers and protects the skin. *Down*, when existing as a separate substance, is mostly confined to the bodies of aquatic birds, for the manifest intention of additional warmth, and to render the skin still more inaccessible to the watery element; this delicate sort of feathers, as is well known, is most developed in the duck family, particularly on the eiders and swans. It is

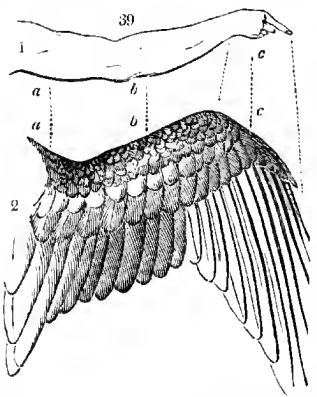
also remarkably conspicuous upon the breast of the herons, where it exists unmixed with any other feathers, and contains, moreover, a white powdery substance, the use of which is unknown. It is curious that the breast of the herons should have a protection of this kind, when the back of their neck, which is equally destitute of true feathers, has none. But it is obvious, from the wading habits of these birds, that their breasts are much more likely to come into contact with the water than the back of their necks, seeing that the latter part is only thrown out and extended for a moment when the bird suddenly seizes its prey, whereas the breast, if the bird is wading, may be exposed for some time to the action of the water. Birds, whose bodies are supplied with a great quantity of down, instinctively employ it to line their nests, as the eider is well known to do.

(71.) The regular *external feathers* of the body, like those of the wings and tail, are very differently constructed from such as are called the down; they are externally composed of three parts or substances: 1. The down; 2. The laminæ, or webs; and, 3. The shaft, or quill, on the sides of which the two former are arranged. The downy laminæ, or webs of these feathers, are very different from the substance we have just described, since they not only have a distinct shaft of their own, but the laminæ which spring from both sides of it are perceptibly and regularly arranged, although, from being devoid of all elasticity, like true down, they do not unite and repose parallel to each other. The soft downy laminæ are always situated close to the insertion of the quill into the skin; and although, for obvious reasons, they are more developed on those feathers which cover the body, they likewise exist on such as are employed in flight, as shown in the quill of a goose; and as they are always concealed from sight when the plumage is uninjured, and are not exposed to the action of the air, so they are always colourless. The third part of a feather consists in the true external laminæ, which are arranged in two series, one on each side the shaft; and these sides

are called the *external* and the *internal* webs. To outward appearance the form of the laminæ which compose these webs, appears to be much the same as that of down, which has been just described, with this difference only, that the laminæ are stronger and elastic, and seem to stick together, and form a parallel series, which the downy laminæ do not. Now, this singular adhesiveness is seen by the microscope to be occasioned by the filaments on each side of these laminæ being hooked into those of the next lamina, so that one supports the other in the same position; while their elasticity makes them return to their proper place in the series, if by any accident they are discomposed. This will be sufficient to give the reader a correct idea of the general construction of a feather, without going into further details on the microscopic appearance of the parts. In all such feathers that part only is coloured which is exposed to the air. It is usual to state that the feathers on the body of a bird are disposed or set in a quincunx form, thus ⁘ — This, however, does not appear to us a correct statement of the fact, the points of their insertion forming, in reality, only a series of triangles over the whole body, thus ⁙; in other words, they are imbricated, the termination of one forming the basis, as it were, of the sides of two others. It is only in those birds whose feathers are remarkably rigid (like those of the shining crests and throats of the humming-birds, or *Trochilidæ*), that this disposition can be distinguished externally; but it may be readily detected in a recent bird, by examining the feathers where they are inserted in the skin. It is an error also to assert that these feathers are equally spread over the whole body, because there are few or none on the sides of the neck, or upon the front of the belly — in the latter case they would obviously be in the way of imparting the full animal warmth of the parent to the eggs in the process of incubation; and they are accordingly deficient.

(72.) The WING FEATHERS, and those of the tail, are those which we have placed in the third class of the last

paragraph. Although similarly constructed, they are eminently distinguished from the last by their great development, and by that peculiar office they perform in enabling the bird to mount in the air, and to direct its voluntary course. They are much more diversified in their size, form, and even structure, than the ordinary feathers of the body, because they regulate all those variations which we see in the flight of birds; and they consequently form the basis, which the others do not, of numerous and important systematic distinctions. We shall first consider the wing feathers; and, after explaining the different series, and the names by which they are distinguished, illustrate our remarks by instances of the various forms they assume, and the influence which they have on the manners and habits of the birds respectively possessing them. It is necessary, however, to the clear elucidation of these remarks, that the reader should understand something, in the first instance, of the bony structure of the wing of a bird, that he may be able more readily to know the situations occupied by the different series of feathers with which it is covered.



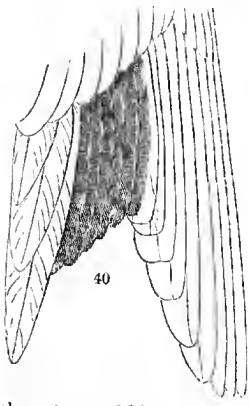
(73.) The *joints of the wing* correspond with, and are analogous to, those of man and of quadrupeds; yet they are so singularly modified, that an ordinary observer would not perceive their mutual relation. In the annexed cut (*fig.* 39.), which represents the outlines of both, *a a* is the *humerus*, or *brachium*, *b b* the fore-arm, or *cubitus*, and *c c* the *carpus*, or hand. This latter, in man and in quadrupeds, is divided into fingers, or claws; but in birds, according to M. Cuvier, there

is only one small bone representing a finger, with the vestige of two others. If, therefore, the human arm was also an instrument of flight, it would present the appearance of the two figures in the last cut blended together. The absence of digits or fingers to the *carpus*, or hand, is supplied by the longest and most powerful of all the wing feathers, which, by thus representing the enormous fingers of the bat, bring the wings of both, however differently constructed, nearly to the same shape.

(74.) The wings bear two sorts of feathers, besides a third series which lie over the base of the *humerus*, and cover that and the tertial quills. The first are those by which the broad part of the wing is covered, and which serve to protect and strengthen the base of the second series, or the quills, which more especially are the instruments of flight. We must consider each of these separately. The first, which of course are the smallest, are called the *wing covers*, and they are of three sorts, — the *shoulder*, the *lesser*, and the *greater*. They are disposed not so much in an imbricate form as in rows; so that the outer web of one lies on the inner web of the next, and so on. Those on the shoulder are the smallest: at the edge or margin, adjoining the bones of the wing, they are very small, each series gradually increasing in size, and assuming more and more a parallel direction; but this disposition is not perfectly observable until we come to the *lesser covers*, which consist of a single row of feathers larger than any of the preceding, and which are disposed in the manner just mentioned. The *greater covers* immediately follow; being, as their name denotes, larger than the last, but forming a single row, and disposed in the same manner. Their use is obviously to protect and strengthen the base of the most important feathers belonging to the bird, which we shall now notice.

(75.) The QUILLS constitute the greatest proportion of the length of the wing, the longest being generally four or five times more developed than the greater covers; their length, however, is entirely regulated by the situation they occupy with reference to the joints of the

wing. They consequently form three divisions, distinguished as the *primaries*, the *secondaries*, and the *tertials*. The primaries are the outermost; they are almost always longest, and in swift flying birds, like the swallow, are double the length of any of the other quills. The primaries are ten in number, and are attached to the *carpus*, or those bones which represent the hand; they gradually diminish in length until they reach the secondaries, which are inserted on the *cubitus*, or first joint of the arm, and are usually only half the length of the primaries. Lastly come the *tertials*, which have their origin from the *humerus*. M. Cuvier has wrongly applied the term *scapular* to these feathers, which are unquestionably a portion of the quills; neither do they cover the scapulars, for their peculiar office is to fill up the interval between the body and the wing, which would otherwise arise when the latter was expanded, and, by confining the air, to oppose a broader surface of resistance to it. The true scapulars consist of a longitudinal series of feathers very thickly crowded at their insertion, commencing at the axillæ, or armpit of the wing, and intended to unite more perfectly the shoulder covers with the feathers of the body. The scapulars, therefore, are the most convex feathers of the bird; they are also much longer than those which they join, and they gradually unite with the tertials, which are equally convex, and they serve, when the wing is folded, to protect the lesser quills. The annexed figure (*fig.* 40.) will explain all these parts at once to the eye; and we may now proceed to notice the different modifications which the wings of birds (that is, the quills) present.



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(76.) The *spurious quills* are constructed precisely the same as the others. Their number coincides exactly with those of the primaries, that is, ten; but they are of so many different lengths, that no author has yet determined either their number or their office. Taken collectively, they assume the shape of a somewhat irregular fan, the two first being very small, the third and fourth longest, and the rest diminishing in length until they become equal to, and join with, the greater covers; they are remarkably stiff, considering their shortness, and they are unquestionably intended to strengthen and cover the base of the ten primary quills, as being those which are the most important to the power of flight, and require the most effective support. The greater wing covers, in fact, do not cover the greater quills, but merely the lesser; for, as they approach the greater, they take a curved direction, and merely reach sufficiently far to lay over the base of the spurious quills.

(77.) The formation of the wing, in reference to its office, depends almost entirely upon the arrangement, the proportion, and the shape of the quills; and these again determine the powers of flight. The three subjects are thus so intimately connected that they will lose their chief interest unless they are treated of together. Between a swallow and a turkey, the most familiar instances that can be adduced of the rapidity and the difficulty of flight, there are innumerable modifications of the same power, the most striking of which will alone be noticed. The greatest powers of flying are enjoyed by the different groups which belong to, or represent, the natatorial order, to which alone those birds are confined which catch their food in the air. The albatrosses, frigate-birds, and petrels, are consequently the most expert flyers in the feathered creation. In the fissirostral tribe, which is the natatorial type of the perchers, we see the same faculty given in a pre-eminent degree to the swallows, swifts, night-jars, and bee-eaters; and in this manner we may trace the same

quality through almost every one of the minor groups of the perching birds. Taking the other extreme of slowness, we find that all birds belonging to or representing the rasorial order, have the shortest wings, and consequently the most imperfect flight. Not to mention our domestic poultry, including the fowl, Guinea hen, turkey, and peacock, there is the whole of the ostrich family, to whom the power of lifting their heavy bodies from the earth is altogether denied. Between these two orders, or primary types, stands the grallatorial, which, in this respect, is not greatly inferior to the aquatic, but yet vastly superior to the rasorial. We accordingly find that its prototype among the perchers, which is the tenuirostral tribe, is only inferior to the swallows. A humming-bird, indeed, appears to fly with greater swiftness than it really does, because, from its very diminutive size, the eye no sooner discerns it than it disappears; but this, in some measure, may be the effect of size, more than of pre-eminent rapidity in flight. Admitting, however, that a humming-bird passes through the air even with greater celerity than a swallow, they differ materially in the power of *sustaining flight*. The one can remain on the wing for hours, while the other, after probing the tubes of a flowering shrub, generally perches upon one of its naked twigs, for the obvious purpose of rest. In the two remaining orders of birds, the powers of flight are very unequal. In the *raptores*, which immediately follow the *natatores*, we accordingly find this faculty considerably developed; for of all land birds, excepting, perhaps, the swallows, none are so swift or vigorous on the wing as the eagles and falcons. Lastly, we have the insessorial or perching order, where the flight is only moderate: it is less rapid, indeed, than that of the *raptores;* but more perfect than in the *rasores*. These facts lead to a very curious result; for they establish a circular series in the development of that faculty most characteristic of the whole class. The *maximum* of flight is found in the natatorial order, from which it branches off, as it were,

into two series : on one side it gradually diminishes, through the *raptores* and the *insessores ;* and, on the other, through the *grallatores,* until both these meet in the order *rasores,* where the flight is reduced to its *minimum.* We shall now describe such modifications of the wing as influence these different degrees of motion ; considering these members as, 1. acuminated ; 2. falcate ; 3. pointed, 4. rounded, 5. ample, 6. abbreviated or obsolete. In regard to their comparative extent, a wing, however it may be otherwise constructed, is termed *long,* when it extends beyond the middle of the tail ; *moderate* when it reaches nearly, or to, that member ; and *short* when it just extends to the base, and the primary quills are not much longer than the secondaries.

(78.) 1. Acuminated wings are those adapted for the most rapid and long-continued flight. The most perfect examples of this form are seen in the oceanic genera ; and the frigate pelicans may be instanced as the most powerful flyers in the creation. But as few of our readers are likely to see these birds, we may instance the swallow as exhibiting a perfect example of an acuminated wing (*fig.* 41.). The first quill is generally the

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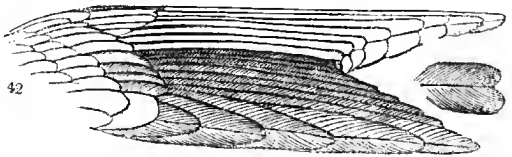
longest, although it sometimes happens that there is scarcely a perceptible difference between that and the second : the rest, however, gradually, but regularly, diminish at almost equal intervals, until they reach the lesser quills, which are little more than one third the length of the exterior primaries, the whole of which are very broad, but gradually taper at their extremities. The lesser quills, on the contrary, are not only unusually short, but terminate so abruptly that they appear to have their ends cut off at that part ; however,

there exists in the middle a distinct notch, or sinuosity, to break the passage of the air — a structure which is only carried to its *maximum* in the bee-eaters. The tertials are very little longer than the secondaries, and hardly exceed the shortest of the primaries. It is thus obvious that nearly the whole power of the wing is thrown into the ten principal quills, which are those principally employed in all birds to cut the air, but which, in the present family, are most particularly adapted for that purpose. There is nothing materially different from this structure in the wings of the sea-swallows, as they are aptly termed, or the terns, except that the lesser quills are even shorter, and instead of being notched, are pointed in the middle, while the tertials are longer, and gradually become attenuated at the end, like the primaries. Such is the formation of an acuminated wing, when seen in its full development. To note all the modifications that this form undergoes in its declension would be tedious, if not impossible. In the bee-eaters (*Merops*) the shorter primaries, the whole of the secondaries, and a part of the tertials, are deeply notched (*fig.* 42.); but the greater elongation



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of the two latter ranges of quills clearly shows a diminished strength in the primaries, and indicates that these feathers are not so much called into action as they are in the swallows. Accordingly we observed, while in the south of Europe, that the flight of the *Merops apiaster*, although swift, was effected by very little motion of the wings, and that a swallow would beat the air three times when they would only do so once. Their flight, indeed, is more like that which is called *sailing*, and they are enabled to do this by the greater

length of their secondary and tertial quills. In another fissirostral genus, *Collaris*, which includes the short-billed rollers, there is an evident falling off of the typical perfection; some of the primaries and secondaries are indeed notched, yet the first quill feather is shorter than the second and third; but in the genuine rollers these notches disappear, the primaries are much shorter, and the second, third, and forth quills are nearly of equal length. We have not been an eye-witness to the manner of flight of either of the two last-named genera, nor does any author appear to have noticed them. There can be no question, however, that the rollers not only are fissirostral birds, that is to say, taking their food on the wing, but that they immediately and naturally follow the short-billed rollers; the structure of their mouth and feet completely disproving the assertion of some authors, that they live, like magpies, by searching for insects upon the ground. It will be unnecessary to notice the different representations of the fissirostral type of wing, seeing that it is generally combined in such types with other characters, too intricate to be well understood by the student.

(79.) II. The FALCATED, or sword-shaped form of wing, is only possessed by the numerous family of humming-birds (*fig.* 43.). It differs from that last described

by the two or three first primaries being curved towards their ends, which are rather suddenly rounded off, while all the others which succeed them are pointed. The primaries are certainly developed even more than in the swallows; a circumstance which is decidedly favourable to the idea that these bird are the swiftest. The whole strength of the wing, it may almost be said, is thrown into these feathers, for the shortest, which is of course

the tenth, is longer than any of the secondaries, and in the giant humming-bird the secondary and tertiary quills consist altogether of only six feathers; the tertials, in fact, may be termed as altogether obsolete. Perhaps the most correct definition of the different powers of flight in these two groups would be this, that the swallows have the strongest, and the humming-birds, while their flight lasts, the most rapid. The wing of the giant humming-bird seems to be composed entirely of primary quills, gradually, but regularly, diminishing in size from the tip to the very end of the scapulars. The exterior quill, although very strong, and much more curved than the others, is, nevertheless, not very typical of a falcated wing. The white-tailed black species* is much more so, but the sickle-winged humming-birds (*fig.* 43.) are in this respect pre-eminent, for not only are the three outer feathers greatly curved, but their quills are unusually strong, dilated, and flattened: there must be something very peculiar in the flight of these latter, of which, at present, we are quite ignorant.

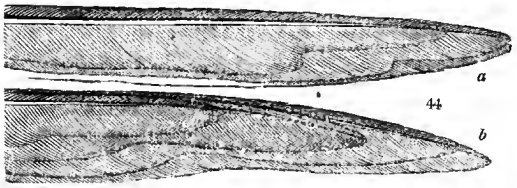
(80.) III. Pointed wings come nearest to those which are more particularly termed acuminated, and the passage from one to the other is marked by numerous gradations, almost too refined for popular comprehension. Pointed wings may be divided under two sorts. In the first, the outermost quill is either the longest, or is nearly equal to the next one or two, but the secondaries and tertials are of the ordinary length; that is, they are two thirds as long as the primaries. This is the leading distinction of the American genera *Sylvicola*, *Setophaga*, and *Seïurus*.† A slight variation from this proportion in the primaries is seen in the parrots. In that common, but most beautiful, species the *Trichoglossus Swainsoni*‡, the first quill may be still called as long as any of the others, although the second

* *Trochilus niger*, Zool. Ill. vol. i. pl. 82.
† North. Zool. vol. ii. p. 203.
‡ Jardine and Selby, vol. ii. pl. 111. See also Zool. Ill. vol. ii. pl. 92.

and third are of the same length; but there is a falling off among the white-eyed warblers (*Zosterops*), where the first quill begins to shorten, and this leads on to a gradual shortening of the two next quills, until the form of the wing becomes rounded. The second description of wing which is termed pointed, is seen in the hooded and other genuine crows, in the Drongo shrikes, and in many of the flycatchers of the old world (*Muscicapinæ*). In most of these the wing is long, either reaching to the middle of the tail or beyond it, but the first quill is little more than half the length of those which are longest, which are generally the fourth and fifth. An inspection of the wing of the hooded crow will at once give a more correct idea of the relative length of the three first primary quills than the most exact description could do: it will be perceived that the fourth quill is the longest, the third and fifth being equal to each other, but rather shorter than the fourth. There is but little variation from this structure in the Drongo shrikes, which, nevertheless, according to Le Vaillant, possess great rapidity of flight. He states that these birds, natives of Southern Africa, assemble together in the evening upon trees, from which they make frequent and rapid excursions, much in the manner of swallows, after bees and other peaceful insects which are wending home from their day's labour.

(81.) Emarginated wings are obviously formed for rapid flight, but they have no fixed character in the proportion of the exterior primaries; for in some groups the first quill is as long as any of the others, while in other instances, the first, second, and third quills are gradually shortened, as we see in the Drongo shrikes; the true distinction of an emarginate wing consists of a sudden notch, or sinuosity, more or less abrupt, which is found on the margin of the inner shaft of the longest quills. This notch in the true falcons is situated near the end of the shaft(*fig.* 44 *a.*), but in the sparrow-hawk, and other of the "ignoble" hawks, it is placed at the base. (*b*) The flight of these latter birds is well known

to be less powerful than that of the typical falcons; for their three first quills are gradually shortened, whereas



the "noble" race has the first quill feather nearly as long as any of the others. In the owls, the situation of the notch varies; for in some it is near the end, in others, towards the middle of the quills. This structure, the precise use of which it is difficult to explain, although universal among the rapacious birds, is only extended, out of their circle, to the typical tyrant shrikes; and which represent the *Raptores* in their own particular family group. A modification of this sinuous margin of the *inner*, is frequently found on that of the *outer*, web, not only in the rapacious birds, but in many others. It is particularly strong in the genus *Aster;* for the sparrow-hawk has the terminal half of the outer web of the primaries only half as broad as the remaining portion; but in *Falco Sparverius**, and the genuine falcons, the second quill only has a slight *external* emargination towards the middle. Many of the parrots, crows, and other birds have the exterior much broader at the base than it is towards the tip, but then the change in the breadth is gradual, and in no instance that we are acquainted with, is it sufficiently sudden to be termed *emarginate.*

(82.) Rounded wings are always short; and there is so little difference, either in point of length or shape, between the last six or seven primaries and the secondaries, that the difference of the two series can hardly be distinguished. The tertials, also, are nearly of the same dimensions; so that when the wing is fully expanded,

* North. Zool. vol. ii. pl. 24.

all its quills appear to be nearly of the same length, and the contour forms a semicircle: this is the precise form under which this modification of the wing is most developed, and our common wren (*fig.* 45.) exhibits it in full perfection. It is customary, however, in ornithological descriptions, to say that a wing is rounded when the three first quills are graduated, that is, of very unequal lengths; yet as this is not only seen in the wren, but also in the Drongo shrikes, and nearly all the true flycatchers, where the wing, taken as a whole, is decidedly long in proportion to the bird, it seems advisable to restrict the term *round* to such as accord with the definition here given. Nevertheless there are so many gradations between the pointed and rounded shapes, by which the two are immediately connected, that perhaps some term might be used with advantage to designate such as are of an intermediate character. The robin (*Erythaca rubecula*), for instance, has a wing intermediate in shape between that of the flycatcher and the wren, the three first quills being graduated; and there are scarcely any perceptible divisions between the three series of quills; nevertheless the fourth, fifth, and sixth are much more lengthened than the others, so as to give the wing, when closed, an appearance of being pointed. Such a wing is, therefore, as to length, *moderate*; and, as to its form, *slightly pointed*. By attention to these lesser modifications, much greater precision and accuracy would result than from adopting the present use of the term *rounded*.

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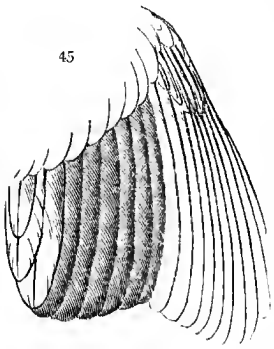


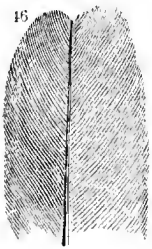
(83.) A RASORIAL wing is characterised, not by any particular arrangement in the proportion of the primaries,

but by their peculiar shape, and by the great development of the secondaries; these latter being often so long, as nearly to equal the primary quills. This structure, in fact, is the very opposite to that which we see in the wings of the humming-birds, where the secondary quills are so small that they become almost obsolete. Indications, showing a tendency to this structure, may be traced in many perching birds possessed of rounded wings; but those which we term *rasorial* differ from these last sufficiently to authorise a distinct name being applied to them. This will be evident on examining the wing of a partridge (*Tetrao Perdix* L.), and comparing it with any of the common birds we have already named. The primary quills, in their substance, have an unusual strength and rigidity: their shape is almost falcate, and their form very narrow; their curved shape gives to the wing a great degree of convexity, and also indicates much strength; although, when the wing is closed, the primary quills are hardly half an inch longer than the tertials, while the secondaries are near three-fourths as long as the primaries. It is well known that the noiseless flight of the owl originates in the looseness, or rather the disconnection of the points, of the laminæ of the quills, which breaks the sudden resistance which the act of flight makes to the air: it may therefore be supposed that a wing, constructed on an entirely opposite principle, would have as opposite an effect; and this we accordingly find. The wing of the partridge, from the peculiar rigidity and compactness of its quill feathers, may be said with truth to *cut* the air; and as the owls are the most silent flyers of all birds, the partridges are the most noisy: the sudden whirring produced by their wings on first arising, is entirely caused by the sharpness and equality with which the air is beat, and is probably intended to startle the intruder from that fixed attention he would otherwise pay to his game. In the Brazilian Tinamou partridges (*Crypturus*), the lesser quills and the tertials are more developed than in

the European genus, and are as long, and nearly double the breadth, of the chief quills. This structure, with no very considerable variation, runs through the greater portion of the rasorial or gallinaceous birds. The quail, however, deserves a separate notice: its powers of flight are well known to be far greater than those of the partridge; for it annually performs two long migrations, on its passage from Africa to Europe, and back again. We consequently find that its wing unites the rasorial with the acuminated form; the first and second primaries being the longest, and double the length of the secondaries: this union of the two forms is also observable in the sand grouse of Africa (*Pterocles*), whose wings, for the size of their body, are much longer than those of any rasorial bird. The only examples of the rasorial form of wing among the Perchers, are restricted to the *Trogons*, the rasorial type of the *Fissirostres*.

(84.) Ample wings, which we shall now describe, may perhaps be thought so closely allied to the rounded form as not to deserve a separate character; nevertheless they produce a very different and peculiar sort of flight, and are, consequently, formed upon a different model. The heron is the most familiar example of this structure. In nearly all the species, the tertials are almost equal to the scapulars; but the secondary quills which intervene rapidly diminish in length from the tertials, and become very short where they join the last of the primaries. Much of this form of wing, however, belongs to nearly all the natatorial and wading tribes; but in the herons, and other ample-winged birds, the primaries are short, and the secondaries and tertials remarkably broad: so that, although the flight is slow and heavy, it is regular, lofty, and can be long sustained. Any one who has seen the slow but steady course of the heron, immediately perceives that it flies like no other bird with which he is familiar, excepting, perhaps, the lapwing, which has much of the same character. By this broad expanse of wing the heron mounts high in

the air, flying steadily and surely to its distant retreat, or wending its way from the banks of the Nile to the pestilential swamps of Sicily.* Besides these peculiarities in the wing of the heron, there is another, which it



possesses in common with the bee-eaters and some of the swallows; for although the ends of the quills are very obtuse, as if cut off obliquely, they are notched or sinuated in the middle of the tip (*fig.* 46.), a sure indication, in all birds where this emargination is found, of very perfect mode of flight, whatever that mode may be. Nor is this sort of wing strictly confined to examples in the grallatorial order; for we find it in the green chatterers of India (*Calyptomina*), in the cock of the rock (*Rupicola*), and in the genus *Promerops*. In the first of these the secondary quills are remarkably broad and deeply notched, and the tertials of the latter are divided into those long filaments which form such an elegant ornament to the egrets, and to the sacred ibis. This form of wing is perhaps at its minimum in some of the African *Cinnyridæ*, or sun-birds, where the secondaries are little shorter, but much broader, than the primaries; but the tertials, instead of being lengthened, as in the *Ardeadæ*, are of the same length as the quills which precede them.

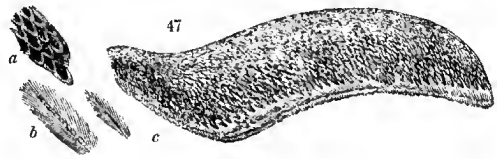
(85.) Lastly, we come to ABORTIVE wings, or such as are incapable of being used as instruments of flight. These are of two kinds; the first belong to land birds of the ostrich family, the second to the swimming order, and chiefly to the penguins, grebes, and awks. The difficulty of examining with critical accuracy such large birds as the *Struthionidæ*, which are generally placed in glazed cases in our museums, will oblige us to confine the short notice we shall here take of their wings to

* The lakes of Leontini are the resort of numberless migratory aquatic birds; but the miasma proved the death of many of the best sportsmen in the Mediterranean army, between 1806 and 1814.

what has been said of them by former writers. The ostrich is described as having no quills, properly so called; yet the wings are clothed with those beautiful waving feathers so well known to every one as ornaments, and each wing appears to be armed with two spurs, about an inch long. The cassowary, on the contrary, has five naked shafts, entirely destitute of webs; and the tips are pointed like the quills of the porcupine. The wings of the American rhea, as being the fissirostral type of the family, are consequently much more developed than in any other. They "stretch from tip to tip no less than eight feet; but, on account of the webs being disunited, they are useless in flight—hanging over and hiding the tail."* In the New Holland emu (*Dromiceius*) the wings are again very short: they are covered with feathers like the rest of the body, and, when the bird is at rest, can scarcely be perceived. Finally, in the genus *Apteryx*, the wing is equally rudimentary: it is covered with feathers similarly constructed to those of the adjacent parts, and is so small that it is quite concealed by the surrounding feathers.† The foregoing are the only instances of abortive wings among the existing land birds: they are entirely confined to one family, and appear totally incapable of being used for flight, or even for any especial purpose. But on turning to such birds as inhabit the water, and whose wings are equally short, we find that they are constructed and used in a different manner. However short these members are among the grebes, they can still be employed to accelerate the speed of the bird; for, when close pressed, we have seen them come to the surface of the water, and, by a shuffling sort of flight, aided by their feet, escape pursuit. The awks probably do the same; but being marine birds, their precise manners do not appear to be known. Both families, however, have all the usual series of feathers, — the primaries, secondaries, and tertials, — so that it is only in the ex-

* Latham, Shaw, &c.
† Zool. Trans. vol. i. p. 73.

treme shortness of their quills that they differ externally from the coots and other short-winged birds which fly. The wing of the penguin (*fig.* 47.), however,



is of a totally different construction. In form it is more like the fin of a fish: the feathers assume the appearance of narrow scales, and they lie upon each other like the true scales of fishes (*a*), without any inequality of size, further than that those adjoining the bones (*b*) are smaller than such as are placed in the situation of the quills. (*c*) As instruments of flight they are of course entirely useless; but when the bird is once in the water (which it rarely leaves), their fin-like wings become a pair of powerful oars, urging on these birds at a prodigious rate. All the accounts, in fact, given by navigators, favour the belief that the penguins, however helpless upon land, are yet the swiftest family of swimmers in the feathered creation, just as the swallows, which represent them among the *Insessores*, are the swiftest flyers. Thus does Nature, under structures the most opposite, preserve her uniformity of design, and tenaciously adhere to that law which gives a pre-eminent celerity of motion to the natatorial type. Thus, also, does it appear, that notwithstanding the vast difference in their conformation, the swallow and the penguin pursue their prey with a rapidity far superior to that which can be accomplished by any other birds.

(86.) There are a few deviations from the ordinary shape and regularity of the quills, which may be here noticed, but which do not affect the general form of the wing. One of these consists in the sudden contraction, or unusual development of some of the quills only; the reason of which deviation is entirely unknown. In most of

the genus *Psaris*, for instance, there is a very slender, lanceolate feather inserted between the first and second quills, which seems totally useless for any purpose of flight, but which must have some especial reference to the habits of these birds. The second quill of the white-headed tody of the old authors* is precisely of the same structure as that seen in *Psaris*, yet here it is not shorter, but longer than the preceding, and therefore must be used as much for flight as an ordinary quill. The four first quills of the *Pipra pareola* are nearly of the same shape as the preceding, that is, remarkably narrow and pointed, while the fifth and those which follow are of the ordinary breath; these narrow quills, moreover, have their outer web indented like the blunt teeth of a little saw, a circumstance that has never been noticed, and which is highly curious. In the genus *Oxyrhynchus*, the outer web of the first quill is constructed precisely like that of the owl, the lip of each lamina being curved back, in the shape of a hook. Sometimes, on the contrary, one half or more of some of the quills are of the usual breadth, while their terminating end is suddenly contracted and obtusely pointed (*fig.* 48.): this formation is seen in some few species of the exotic pigeons belonging to the genera *Peristera* (*a*) and *Ptilonapus* (*b*). It cannot, how-

ever as some have imagined, be taken as a subgeneric character, because perhaps the next species in the series has it not; and it is probably only a sexual distinction. The *Cassicus coronatus* of Mexico shows us another example of unequally formed primaries. These are instances of unusual narrowness. Among those of an opposite descrip-

* The situation of this curious bird is uncertain. It may probably enter into the circle of the *Fluvicolinæ*, or water chats.

tion, we may notice the very singularly formed wing of the Cape honeysucker (*Ptiloturus*), distinguished no less for its very long plume-like tail, than for the form of its fifth quill feather, which is suddenly contracted, midway, to about half its length: and although the third and fourth have a slight indication of the same structure, the sixth is of the ordinary shape. We have drawn the attention of the ornithologist to these instances of unusual structure, because they have never been pointed out; and several others could be mentioned; but, as we are unacquainted with their influence on the habits and economy of the birds, the enumeration might be tedious.

(87.) Migration is performed by the wings; but as this subject is more connected with the habits and instincts of animals, we shall merely give it, in this treatise, a passing notice in reference to external structure. If there was any particular shape of wing more peculiar than any other to birds which migrate, it would seem to be that which we have designated as *acuminated*, that is, having the first two or three primaries fully developed. The swallows, in this respect, are pre-eminent, and they are accordingly both the swiftest and the most distant migrators. Next to these are the bee-eaters, the rollers and the quails, which come from the shores of Africa in the spring, and after spending the summer in the southern half of Europe, return to their home at the commencement of autumn. Nearly the whole of the American warblers (*Sylvicolæ*), together with the Maize birds (*Agelainæ*), migrate in a similar direction, from south to north, and after breeding in the United States, return and pass the winter in the Mexican Gulf. All these tribes are characterised by having their wings more or less pointed; a structure peculiarly adapted for such migrations; but, on the other hand, there are numerous other species which annually perform the very same journeys by the aid of wings altogether different. We need only mention the orioles and the hoopoes as companions to the rollers, but whose wings have the three first quills

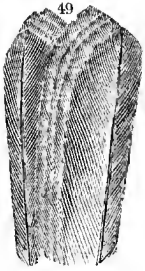
graduated. Many of our own little warblers, whose flight is evidently feeble, and whose wings are almost rounded, leave us in autumn, and only return in the spring; so that probably the very same journey is performed by birds of the most opposite qualities of flight. The ducks, which go to and from the northern regions at stated periods, afford us another instance of very short winged birds habitually migrating to great distances. It is obvious, nevertheless, that the degree of speed with which these several species proceed must entirely depend upon the formation of their wings.

(88.) The TAIL of a bird is formed to act in unison with its wings, in performing the function of flight, during which it is expanded, and it is used as a rudder. There are very few birds without this member, although in many it is very short. It is longest in the Rasorial types, and shortest in the Natatorial and Grallatorial: in the birds of this latter division, however, its office, in a great measure, would seem to be performed by the legs, which are extended backwards during flight, in the direction of the tail. We can scarcely suppose, indeed, that the flight of the heron would be so steady and graceful, was the course of the bird simply directed by a tail which hardly exceeds three inches in length. It must not be supposed, however, that the degree of speed with which a bird flies is to be estimated by the development of this member; for it generally happens that birds with very large tails have proportionably short wings. The peacocks and turkeys are familiar instances of this relative disproportion, and the same may be traced through a large proportion of those birds by which they are represented in other groups. Hence it is evident that the structure of the tail is in some birds more adapted for ornament than for flight. We shall now enumerate the different forms it assumes, and the especial offices, where known, which these forms are intended to perform. In speaking of the comparative length of this member we call that a *short* tail which, at the most, does not exceed half the length of the wings; a

moderate tail is about equal to the length of the body; and all above this are termed *long* tails.

(89.) A *perfect tail*, in the great majority of birds, consists of twelve feathers; but in the Rasorial order, and even in some of its representatives, this number amounts to eighteen, while in a very few birds, as in the Brazilian anoo, there are only eight. The root or base of these feathers are protected by others, generally shorter, both above and below: these are termed the upper and the under tail covers. Generally speaking, those birds which have the broadest tails, have the longest tail covers, as we see in the peacocks. Yet it is somewhat singular, that in the typical Grallatorial birds, both the upper and under covers are nearly, if not quite as long as the tail itself, so that it is really often difficult to separate and discriminate the two. Many of the cuckows (which represent the *Grallatores* in the tribe of *Scansores*) exhibit the same prolongation, though in a less degree, of the upper covers, while those of the *Ceblepyrinæ*, or caterpillar catchers, are remarkably stiff. We may now pass on to the different forms of tails, which we shall term,—1. even; 2. rounded; 3. fan-shaped; 4. graduated; 5. cuneated; 6. arcuated; 7. spatulate; 8. slender; 9. forked; 10. lyre-shaped; 11. boat-shaped; 12. compressed; 13. plumed; 14. scansorial.

(90.) 1. An *even* tail implies, that the feathers, when not expanded, are all of the same length. This structure is not so common as might be at first supposed, for there are comparatively very few birds in which the exterior or outermost feather on each side of the tail is not slightly shorter than those in the middle. It also happens, that in specimens set up by unskilful bird-stuffers, a tail, naturally even, is so much expanded that its form appears to be rounded. The French seem to have introduced the word "even tail," into their language from ours, but have applied it, most erroneously, to such tails only as are fan shaped. 2. *Rounded* tails are the most prevalent; the term being given to such as have



the two or three outermost feathers slightly graduated; that is, progressively shorter than those more in the middle: sometimes the external feather alone is abbreviated, as in the robin; but in the stone-chat (*Saxicola rubicola*), the four outermost feathers (*fig.* 49.) are progressively shortened. The tails, however, of both these birds present a union of two forms, for they are rounded, and at the same time exhibit the divaricated structure, hereafter noticed.

(91.) 3. A *fan-shaped* tail, as its name implies, is so much rounded that the two middle feathers are alone equal in length, all the others gradually, but gently diminishing. A fan-shaped tail is always longer than usual, and the feathers, besides being broad, have this peculiarity, that the two webs are more equal in breadth than in simply rounded tails. This will be evident on comparing one of the feathers of the robin with another of the fan-tailed flycatcher of New Holland: in the first the shaft appears close to the edge, whereas in the other, it is nearly central. This distinction, hitherto neglected, is important, because it enables us to detect a habit of the bird, from its mere skin, which, otherwise could only be known by seeing the subject alive, and even then, under particular circumstances. This structure, however rare among the perchers, is seen in the highest development in the peacocks and the turkeys, where the tail is of the most gorgeous and splendid beauty. It may be considered a law of nature, that all fan-tailed birds are representations of the Rasorial type, since every one whose affinites have been investigated have proved to be so. 4. *Graduated* tails not only exhibit a greater degree of circularity than those which are simply rounded, but they possess this peculiarity, that the external feathers, instead of being very slightly shorter than those of the middle, are abruptly abbreviated, so that the outermost is often not one third

the length of such as are more central. The *Prinia familiaris* *, or wren warbler of India, shows us this structure in great perfection, as does the whole of the beautiful Australian genus, *Malurus*. Most of the exotic jays of the genus *Cyanurus*, all the curve billed cuckoos (*Coccyzus*), and numerous other groups have tails of this formation, although considerably varied. Sometimes, as in the Indian and African flycatchers, (*Muscipeta*) the two middle tail feathers are greatly elongated, and the lateral ones are equally graduated on each side. All these however, are but inferior deviations from the typical form; the feathers are broad and thin, and their termination more or less rounded.

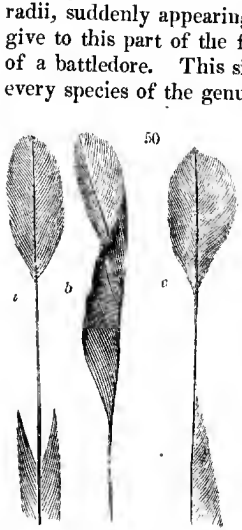
(92.) 5. A *cuneated* tail is shaped like the last, but the form of the feathers are different. The tail of the woodpecker, in addition to its scansorial property is, as to shape, strictly cuneated, each feather being gradually narrowed from the middle, and terminating in a point. Examples of this form may be seen in nearly all the long-tailed parrakeets, particularly in the genus *Pezoporus;* some few may also be found in the genus *Synallaxis*, and among the tree creepers, of which we have a native example in our *Certhia familiaris*. When, however, as in the latter genus, and in the *Picidæ*, a cuneated tail is likewise scansorial, the former appellation merges into the latter.

(93.) 6. *Arcuated*, or *arched* tails, belong only to Rasorial types. This form, in the proportion which the feathers bear to each other, is similar to the last; but, instead of being straight, they are gently arched, and those in the middle are so convex that they lap over, as if to protect the others. The common pheasant shows us this form in perfection, and it is almost general throughout the genus; another magnificent bird, the *Calurus pavonius* †, possesses this structure highly developed.

(94.) 7. *Spatulate*, or *racket-shaped* tails, exhibit a very remarkable form, totally different from any other. It consists in the middle pair of feathers

* Zool. Illust. ii. pl. 97. † Ibid. ii. p. 107.

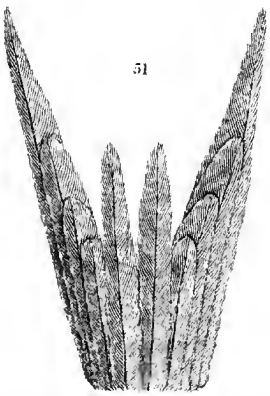
having the shafts, for a certain space towards their ends, entirely destitute of webs on either side; these webs or radii, suddenly appearing again only at the tip, so as to give to this part of the feather the shape of a spoon, or of a battledore. This singular shaped tail is found in every species of the genus *Prionites** (*fig.* 50. *a*), but in other groups it is more partial. Two species of humming birds possess it (*c*), and one of the subordinate types of *Platycircus*. It is highly developed in *Edolius remifer* (*b*), and another species, but with some modification; for in these latter birds (whose generic character is to have the tail forked,) these naked shafted feathers are not the middle, but the outermost. It is impossible to conjecture the use they are applied to, but those of the *Edolius remifer* are no doubt analogous to the exceeding long feather on each of the wings of the Sierra Leone goat-sucker (*Macrodipterus Africanus* Sw.), and we may even fancy some analogy between these latter, and the processes observed in the angle fish (*Lophius piscatorius*).



(95.) 8. *Slender* tails are generally of moderate length, the feathers slender throughout, and sometimes so abruptly truncated that their extremities appear to be cut off. Instances of this form occur in most of the species of puff bird, *Tamatia*, — in several of the American Todies (*Todus*) — and in the African group of *Platystera*: in the latter, however, the feathers are broader than usual; tails having this peculiarity are generally very convex above, as we see in the common wren, and in several other birds not familiar to the general reader.

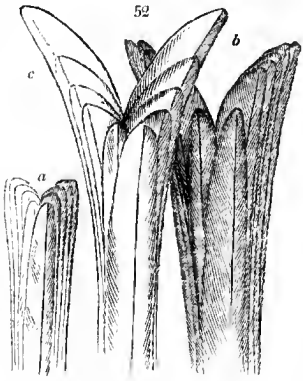
* See Zool. Illus. ii. pl. 81.

(96.) 9. *Forked* tails are of two kinds; one which presents a single, the other a double, fork. There can be no doubt that this structure has great influence in facilitating the evolutions of such birds as possess it; for we invariably find that fork-tailed birds are excellent flyers. Nevertheless, it must not be considered as *necessary* to extreme swiftness, for although it is found in many swallows, one half of the family have the tail more or less even. The swifts, whose rapid flight is perhaps superior even to that of the swallows, have the tail perfectly even; and there are comparatively few of the oceanic birds belonging to the Petrels and neighbouring genera — which rarely approach land — possessing a forked tail. It is hardly necessary to say, that, by this structure, the two outer feathers are by far the longest, the others gradually shortening until the gradation terminates in the central or middle pair. The house swallow is a notable instance of this form, but, perhaps, no two genera possess it in a higher degree, considering their size, than that of *Psalurus*, among the night-jars (*Caprimulgidæ*), and *Milvulus* among the tyrant fly-catchers. The scissar-tail (*Gubernetes*), which is almost equally remarkable in this respect, as stated by Azara, is in the habit of opening and contracting its tail during flight, and has hence received a name from the Indians, likening the tail to a pair of scissars. It is unnecessary to cite further instances of a simply forked tail, particularly as they occur in nearly all natural groups, without having the peculiar characteristic of any one. It is nevertheless remarkable that not one instance of this structure occurs in the Scansorial, or climbing tribe, and very few even among the most aberrant of the *Rasores*. *Doubly-forked* tails, on the other hand, are very rare (*fig.* 51.). The most remarkable is that of a species of night-jar (*Psalarus bifurcatus*) we discovered in Brazil; in this, not only the two outer, but the two middle tail feathers are greatly elongated, the intervening lateral ones being gradu-



ated. A miniature representation of the same form will be found in one of the little European sandpipers (*Tringa Temminckii*). A few other instances might be mentioned, but these are quite sufficient for our present purpose. All those tails which have the two middle feathers shorter than the outermost are, of course, simply forked.

(97.) 10. *Lyre-shaped* tails belong exclusively to the Rasorial order, and to the different genera and groups which are its prototypes. The gradation in the length of the feathers is precisely similar to that in a simply forked tail; but their direction, instead of being straight, as in that of the common sparrow (*fig. 52. a*), is outwardly curved, so as to resemble in some sort the frame work of the ancient lyre (*c*). The development of this form, like all others, is gradual; it commencing with some of the Drongo shrikes, whose external feathers are nearly straight (*b*), and proceeding to others (*c*), where they are conspicuously curved, until, in the *Lyurus tetrix*, or black game of Britain, it reaches its full development. In the Drongo shrikes, which con-



stitute the Rasorial division of the *Laniadæ*, this singular form of tail nearly pervades the whole group. We see it again in the rare *Leiothrix furcatus*, Sw. (*fig.* 53.), which is the Rasorial genus of the chatterers (*Ampelidæ*). But we must look for its most striking and magnificent development in the *Menura*, where it is also combined with feathers of the fan-shaped structure. We may here remark that there is one solitary instance where these long exterior feathers are turned inwards instead of outwards: this occurs in a humming-bird, figured by Edwards, as a native of Jamaica; but we have never yet seen it, nor is a specimen known to exist at this time in any museum.

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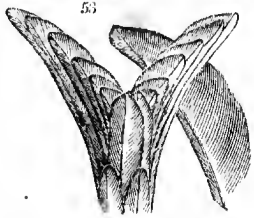

(98.) 11. *Boat-shaped*, or *concave* tails, are still more extraordinary, and appear restricted to two natural groups among the *Sturnidæ*, or starlings, namely, the grackles of America (*Quiscalus*), and the *Lamprotorninæ*, or shining thrushes, of Africa. In the former we know at present but of one species; but the whole of the latter appear to have tails, the sides of which, when expanded, are bent up like the sides of a boat, so as to leave the central part hollow and very concave: this appearance, however, is generally lost in the preserved specimens, so that these birds then appear to have only an ordinary rounded tail. Of the probable use of this singular structure we can form no correct idea.

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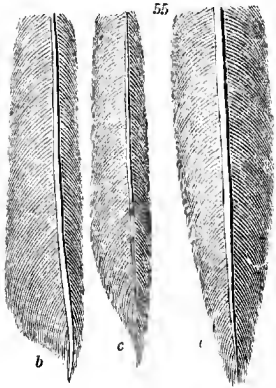
(99.) 12. *Compressed*, or *erect* tails, are nearly and obviously related to those which are boat-shaped, inasmuch as both assume forms altogether different from

the flat direction in which this member is carried by ordinary birds. A compressed tail, however, is even more *concave* than the latter are *convex:* the lateral feathers, instead of being directed upwards, diverge downwards, while those of the centre are the most elevated. But not to perplex the reader with a more technical definition, he has only to look to the tail of a domestic fowl to gain a clear knowledge, at least of the appearance, of the structure we should fully describe but for so familiar an example. There are few instances, however, out of the genus *Gallus*, where this particular structure is met with. Among the perching birds, we only know of the two species composing the genus *Alecturus*, and certain males of the Widau finches; but these latter lose their singular-shaped tail feathers after the breeding season.

(100.) 13. *Fasciculated*, or *plumed* tails, are still more rare than any of those we have now enumerated: the feathers do not, to all appearance, lay in any regular or determinate order, but rather give the idea of being fasciculated, or formed into a bunch. Such is the tail of the ostrich; while the plume-tailed honeysucker of Southern Africa seems to have the feathers equally irregular, but upon closer examination this is not found to be the case: they are inserted in the ordinary manner, but the central feathers are so long, and so flexible, that, instead of retaining their right position in the series, they fall over each other, and thus assume the appearance of being fasciculated at their base.

(101.) 14. A *scansorial* tail is perhaps of more essential importance to the birds which possess it, than any other modification of this member is to other birds; at least, it will appear so because we know more of its particular functions than of any other. Its form, as before remarked, is generally cuneated, but it is sometimes rounded, and in a few birds we have instances of a scansorial tail being quite even. Its distinguishing peculiarity, however, rests on the structure of the shaft, which is at all times remarkably stiff, and in some in-

stances so hard and rigid that it appears more like horn than of the ordinary substance. Thus far all scansorial tails are constructed alike, but there are several curious modifications in the other details which deserve our attention, because they serve to characterise different groups. The most typical form is seen in the woodpeckers (*fig.* 55. *a*), all of which possess it, with the exception of one type, the genus *Asthenurus*, represented by the minute woodpecker of Linnæan authors: in the others, not only the shafts but the webs are unusually stiff, and always show the appearance of being worn at their extremities by their frequent application to the trunks of trees: all these feathers are lanceolate, that is, terminating gradually in a point; the webs diminishing in breadth as they approach the extremity, but which is never naked; most of them, also, have the webs on both sides nearly equal.



The next modification is seen in the family of *Certhiadæ* or creepers, but more especially in the Brazilian genus *Dendrocolaptes*; here we find the external shaft very narrow, while the internal is remarkably broad; both, however, terminate before reaching the extremity of the feather; so that about a quarter of an inch of the shaft, at its tip, is entirely naked, and the tip itself acutely pointed and inclined downward. This structure will be perfectly understood by the annexed figure (*b*), while the the abrupt manner in which the broad *inner* shaft terminates is better seen in the genus *Oxyurus*. (*fig.* 56. *a*) Now it is quite clear, that a tail thus constructed has equal, if not greater power than that of the woodpecker in assisting a bird to climb, inasmuch as

these horny points will enter into crevices and inequalities of the bark, which the more thickened tips of the woodpecker's quills would glide over. A third modification is seen in the tail of our common creeper (*Certhia familiaris*), where the form of the feathers is unequally lanceolate (*fig. 55. c*); that is to say, they gradually taper to a point; but the inner web is near four times the breadth of the outer, the webs themselves being continued to the very tip of each feather: the shaft also is neither enlarged, or is it near so rigid, as in the preceding group. The next variation of the scansorial structure is peculiar to the Brazilian genus *Sclerurus* (*fig. 56. d*) and the Australian genus *Orthonix* (*e*); two forms, inhabiting different regions, but which are unques-

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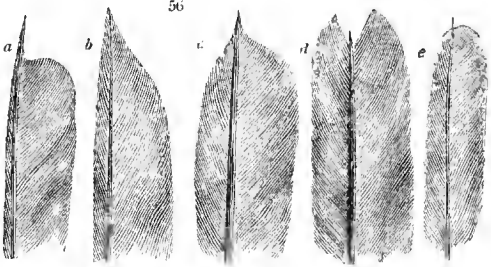
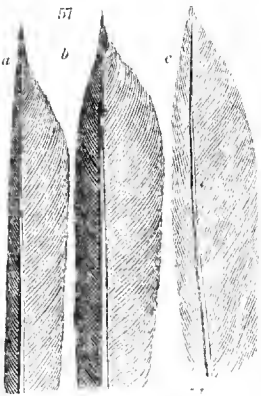


tionably united by the closest affinity: both have the shaft of each tail feather nearly as rigid as that of the *Dendrocolapti*, but the webs are particularly broad and soft: and although, from being worn away towards the tips, the shaft appears to be naked at that part, it is not so in reality, since vestiges of the webs may be traced on both sides, nearly to the extreme point. Now this remarkable breadth and softness of the webs, leaves us in no doubt that each of these genera are the Rasorial types of their own proper circles, the one entering into that of the *Certhianæ*, the other into the *Buphaginæ*. Lastly, we have the genus *Lochmia**, where the scansorial tail

* The only species yet known is the *Lochmia squamulata*, figured in the *Birds of Brazil*, pl. 33.

is reduced to its *minimum* (*e*). No one, in fact, upon a cursory examination, would suppose that this member was otherwise than simply rounded; for not only the webs, but the shaft is of the ordinary flexibility: upon a more careful examination, however, it will be found that the shaft of each is prolonged in the form of a short setaceous bristle, having a slight degree of elasticity, and which is entirely bare. Although scansorial tails, as in all the preceding instances, have the shafts of the feathers more rigid than those of the ordinary construction, it must not be imagined that all scansorial birds exhibit this formation, although they actually belong to the scansorial circle. We can, from personal observation, vouch for the fact that the creepers composing the genera, *Zenops*, *Anabates*, and *Dendroma*, are habitual climbers; and yet, although this habit might be inferred from their feet, it is by no means manifested in that of the tail, which, on a cursory glance, appears simply graduated: on trying its flexibility, however, with the hand, the shafts are found to be less pliable than in ordinary tails; and in some species of *Anabates* the tip projects beyond the webs in a slender point, in the same manner as in *Lochmia*. No appearance, however, of this incipient tendency to the structure of *Dendrocolaptes* is seen in the genus *Dendroma* (*fig.* 56. *b*, & 57. *b*), and yet we have seen these birds running both up and down the trunks of trees, much in the same manner as their congeners. We have no doubt that the genus *Synallaxis* follows that of *Dendroma*, but then it is aberrant, and therefore we may suppose the climbing habit to be less developed. It accordingly is so, for some



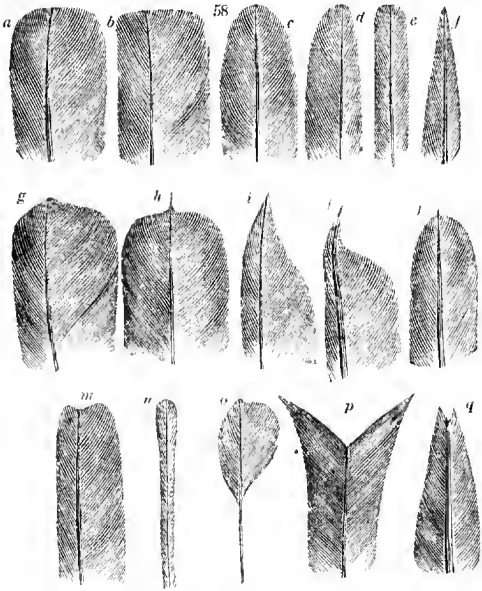
have broad and simply pointed tails (as in *S. canifrons*), while in others (*S. ruficeps, fig. 57. a*) the points are lengthened and slightly stiffened: between this last form and that seen in *Certhia familiaris* (*b*) comes the cinnamon creeper, *Synallaxis cinnamominus* (*c*), which is a true *Synallaxis*, beginning to assume the tail of *Certhia*. The nuthatches again are decided climbers, and yet their tails are of the usual construction. On the other hand, there are instances of birds out of the circle of the *Scansores*, yet representing that order, which exhibit some of the essential characteristics of a scansorial tail. That noble grouse, the cock of the plains (*Centrocircus urophasianus*)*, exemplifies this in a remarkable manner, the feathers being lance-shaped, stiff, and terminating in acute points; of the same structure, in short, as those of *Certhia familiaris*. The maize bird of America, also, (*Doliconyx oryzivorus*) has a completely scansorial tail, shaped precisely like those of *Dendrocolaptes*, with this difference only, that it is less rigid, and the shaft is not thickened. Very many other perching genera have either the naked acuminated tips of *Lochmia* and *Synallaxis*, or the tip of the shaft forms a little *mucro*, or point. We find this latter peculiarity among the cockatoos, (*Plictolophinæ*), as one of the many analogical characters which show them to be the representations of the *Scansores*, in the circle of the parrots (*Psittacidæ*).

(102.) A *divaricated* tail is the last modification of this most variable member which we shall specifically name. Its form is intermediate between the *even*, and the *forked* structure. All the feathers, in fact, are of equal length, but when the tail is closed, they seem to be divided in the middle, into two equal divisions, the points of which turn outwards in contrary directions, and thus, on a casual inspection, have every appearance of being slightly forked or divided. When, however, the tail is spread, the equality of the feathers is at once perceived. The feathers of nearly all tails, thus constructed, have their tips pointed, and as this form is chiefly found

* North. Zool. vol. ii. pl. 58.

in scansorial types,—the *Sylviadæ* and the *Fringillidæ* for instance,—we esteem it as the first indication of the scansorial structure.

(103.) The form of the *tip or termination of tail feathers*, as will appear from what has just been said, is of much importance, as affording both generic and specific characters. Some of these forms have been already noticed; and we shall now briefly enumerate the chief of those which remain, shortly defining the whole. The point or tip of the tail feathers, are either, 1. *truncate*, the feathers appearing as if abruptly cut off or squared, as in *Lampornis holosericeus* (*fig.* 58. *a*) and the genus *Trogon* (*b*); 2. *oval*, when the end represents one



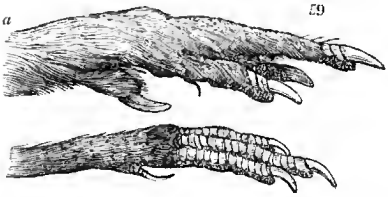
extremity of an egg (*d*); 3. *pointed or lanceolate* (*f*), where there is a gradual diminution to the tip of the shaft, as

in *Picus* and *Certhia familiaris*; 4. *linear* (*e*), where the form of the feather is narrow, of equal breadth, and the tip obtuse or truncate, as in *Tamatia*; 5. *mucronate*, when the end is broad and nearly truncate; but the tip of the shaft slightly projects, so as to form a flexible thorn-like point, as in the common jay, and in *Ptilonorhynchus* (*g*), and *Phonigama* (*h*); 6. *cuspidate*, when this point is more lengthened and slightly rigid, as in *Synallaxis* (*i*); 7. *acuminate*, when the point is naked, rigid, and sharp, as in *Dendrocolaptes* (*k*) and *Chætura* (*l*); 8. *emarginate*, having a notch in the middle of the tip, as in *Merops* (*m*); 9. *filiform*, when the feathers end in long wire-like processes; 10. *capitate* (*n*), when the end of a linear feather is rather dilated; 11. *spatulate* (*o*), when the shaft is naked towards the middle, but suddenly webbed at its extremity, as in the racket-tailed humming-birds, &c.; 12. *divaricated* (*p*), when the webs form a point on each side, as if the shaft was broken, as in *Temnurus maculatus*; 13. *worn* (*q*), formed like the last, but accidentally the shaft and webs, as in the woodpeckers, being worn by friction.

(104.) The FOOT of a bird is nearly of as much importance to its existence as its wings; although it may be supposed that many sorts, the swallow, for instance, would be able to sustain life for a much longer period under the injury of a foot, than it would do if an equally severe accident had happened to the wing. The leg is obviously divided into three parts: 1. the thigh; 2. the shank, or tarsus; and 3. the foot itself, composed of the toes. The thigh is subject to very few variations beyond relative length, and in being more or less clothed with feathers. In aquatic birds it is generally naked before it reaches the knee joint. In the perching and rapacious orders, it is invariably clothed with feathers, more especially in the latter, where the feathers are more lengthened than usual, and often elegantly ornamented with spots and bands; but when the lower part of the thigh is naked, it is covered with scales, nearly similar to those on the next joint: the tarsus and the foot, but chiefly the latter,

thus become the most important parts of the leg, and we shall now proceed to the details of each.

(105.) The TARSUS, by which name we shall always designate the shank, is either feathered, as in many of the rapacious genera, or naked, as in the generality of birds. The first of these different structures is most prevalent in the owl family, where the whole of the legs, from the thigh down to the claws, are generally covered with soft feathers, those upon the tarsus and toes being short and and compact. Several of the falcon family equally possess this structure; but in these the toes are always naked, as in the *Buteo lagopus*, or rough-legged buzzard of Britain. The only instances of feathered tarsi which occur out of the circle of the *Raptores*, are found among the *Tetraonidæ*, or grouse, where the feet and toes (*fig.* 59. *a*) are generally as thickly clothed as any among the owls. It has been thought that this additional clothing has been given to the grouse, the greatest number of which live in the coldest regions, as a protection to the rigours of winter, and we can have no doubt of the feet being preserved much warmer by such a comfortable covering; yet this reason totally fails in the case of the owls, for these are spread over all latitudes, and many of those from India have feathered tarsi, although the toes are usually bare. The sand-grouse again, of the genus *Pterocles*, which seem to delight in basking on the hot sands of the African deserts, have their tarsi (*b*) covered with feathers, not so thick, indeed, as the ptarmigans, yet still sufficient to serve as an additional covering. It is difficult, therefore, to arrive at any just conclusion regarding the use of feathers upon the tarsi, because we cannot reduce the above facts to one common principle.



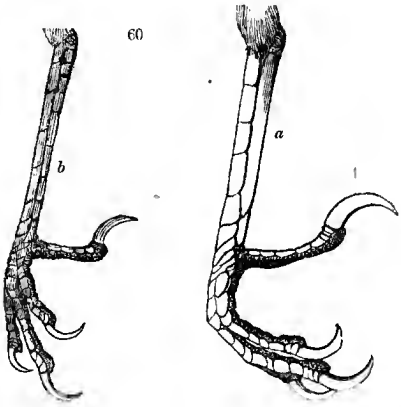
(106). A naked tarsus is protected by SCALES. Next

to the relative length of the tarsus, it is the form and disposition of these scales which supply us with the best discriminative characters taken from this part of the foot. As no writer has yet given this subject the attention it deserves, we shall here endeavour to elucidate it. The generality of naked footed birds have the tarsus protected by three series of scales, each of which is frequently of a peculiar form. The first series is in front; the second occupy the two sides, and the third is at the back of the leg. The front scales are called the *anterior*, and are either composed of one or of several pieces. When the anterior scale is simple, or in one piece, it extends from the front of the knee to the articulation of the hinder toe; and its external surface, consequently, is very smooth. The next deviation from this is seen in the sparrow-hawks, where the tarsus is still very smooth, but there are slight transverse divisions, which, upon a close inspection, seem to be rather beneath than upon the surface; for they are imperceptible to the touch. The next modification is seen in these transverse divisions being, in some degree, imbricate; that is, the edge of one lying over the edge of the next: this is the general appearance of the anterior scales in most birds, the number being variable in the groups, though not in the individuals; in most of the small perchers the anterior scales are five or six, the longest being in the middle of the tarsus, and the smallest at its two extremities. Wading and aquatic birds have the anterior transverse scales very narrrow, and numerous. Tracing this modification onward, we find that in some of the falcons the transverse scales begin to be of unequal sizes,—next a few of them are divided, as if to break the regular series, until, in the *Falco sparverius*, and its allies, the whole of the anterior scales, which would otherwise be transverse, are divided by a suture down the middle of the front into two sets: this prepares us for a new pattern of scales, which we term angulated or hexagonal, because the sutures of these scales, or the lines by which they are connected, often appear irregularly angulated. This latter form is more especially found in the Rasorial birds, and the different

groups which represent them. Lastly, we may notice the tarsi of the parrots, which are covered, both on the front and sides, with numerous small scales, never touching each other, but being so disposed, that their interstices, or the spaces between them, resemble the lines of a net; such a tarsus, therefore, is said to be *reticulated.* In *Platycircus, Pezoporus,* and *Leptolophus,* these scales are much closer to each other than in the macaws, and in some of the neighbouring genera, where they are perfectly oval. We need not, however, proceed into the variations of the anterior scales of the other orders, since other characters are found in the *Grallatores* and *Natatores,* which are quite sufficient for the correct discrimination of the subordinate groups, without having recourse to these.

(107.) The *lateral scales* of the tarsus, as already mentioned, protect the sides; but, although they are not always present, their office is supplied by the anterior scales, which are then extended round the leg, so as nearly to envelope it. The tarsi of many groups are thus constructed; but the tyrant flycatchers are the most perfect examples that can be mentioned. The only scales on the tarsus of the *Tyrannus intrepidus,* or the kingbird of the Americans, are those here termed the *anterior:* they consist of five unequal pieces, and envelope the tarsus so completely as nearly to meet on the back part, and thus preclude the necessity of either the lateral or posterior series; the common robin has the lateral scales, no less than the anterior, of one entire piece, except that there is the slight appearance of a small division at each extremity, and the two lateral scales on each tarsus are so closely brought together on the hind part, that there is no room for the posterior series. The scales, however, we are now describing, are very conspicuous among the falcons and shrikes. In the *Falco sparverius* they are much smaller than the anterior, and are regularly pentangular; in the true butcher-birds (*Laniancæ*) and the African bush shrikes (*Malaconotus, fig.* 60. *a*) they are entire, while in the

American genus *Thamnophilus* (*b*), they are divided into several distinct pieces; the two last groups afford a strik-



ing illustration of the regularity and constancy with which, in some groups, the scales of the tarsi are constructed. The American bush shrikes, and those of tropical Africa, were united in the genus *Thamnophilus*, until we detached the latter as a distinct genus, under the name of *Malaconotus*. So closely, however, do these shrikes of the two continents resemble each other in all but their tarsi, that it is very difficult for an ordinary naturalist to distinguish them otherwise than by their lateral scales. Why such a marked and invariable distinction should exist in the simple covering of the tarsi, between birds so closely alike in all other parts of their general form and structure, cannot possibly be explained. It is probable, however, that entire lateral scales give much more strength to the muscles of the tarsus than would be effected by a number of small pieces, and we, consequently, find that the true shrikes, whose feet are obviously more powerful than those of the American group, have the scales entire; and as this latter structure belongs also to the American *Malaconoti*, we may conclude that they are more rapacious than their American

brethren. However this may be, the facts cannot be disputed; and they place in a very strong light the necessity of paying great attention to the scutulation of the tarsi in nearly all ornithological groups, but particularly in the order of Perchers. In further proof of the last position, we may advert to the family of the *Ampelidæ*, or chatterers, the typical groups of which (*Ampelis* and *Casmarhynchus*) have the lateral and posterior scales oval, and very small, while the anterior are very broad, and embrace one half of the circumference of the tarsus: this structure, with some very slight differences, extends to all those groups, as *Psaris, Pachyrhynchus, Querula*, &c., which are nearly connected to the *Ampelidæ*, although not in the family circle. It would be nearly impossible, and altogether tedious, were we to describe the different patterns which the lateral scales assume on the tarsi of the different genera: those we have already noticed will be sufficient to direct the attention of our readers to the subject.

(108.) *Posterior scales* are more rarely seen among the perchers than either of the preceding series; and in that order they seldom extend, even when they are present, much farther than the upper part of the tarsus adjoining the knee: they do not exist in the robin, their use being superseded by the junction of the lateral scales behind, which thus form a sharp ridge or keel. In the *Tyrannula calcarata* (*fig.* 61.) these scales are perhaps more developed than in any other percher, as in this bird they form a short line of acute but very small spines, which would almost tempt us to believe they were employed as a means of defence, something analogous to the spurs of gallinaceous birds. Throughout the Tanager family we find no instance of posterior

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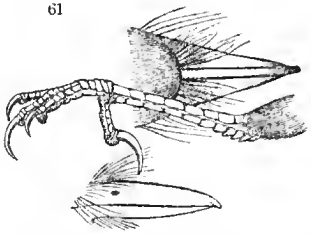

scales: and it may be remarked, generally, that they are almost obsolete in the perching order. The rasorial birds, on the contrary, possess them in the highest state of development. To ascertain this, let the student examine the leg of a common partridge: the anterior scales of this bird are large and transverse, but divided by an undulating line down the middle of the foot into two series: on each side of the leg are placed the lateral scales, very small, of a lengthened oval shape, and occupying but a narrow strip, although they are arranged in three series: following these are two rows of posterior scales, one on each side of the leg, divided in an obliquely transverse direction, and fully as large as those in front. There can be no doubt that a leg, thus strengthened and protected, possesses much more power than if its covering was less perfect, and this will be farther manifested upon examining the legs of the Brazilian partridges, forming the genus *Crypturus* (*fig.* 62.): here the anterior scales are thin, with their divisions finely, and even obscurely marked; the lateral are almost obsolete, but the posterior, which are arranged transversely, are remarkably broad and strong, as if to compensate for the weakness of the others. Now, as the legs of this genus are obviously less robust than those of our partridge, although both live equally upon the ground, it would seem to follow that the posterior scales, above all the others, are more especially essential to terrestrial birds, and that it is for this reason we find them more prevalent and more developed in the *Rasores* than in any other order. The strong and acute spurs and knots, with which so many of the feet of these birds are armed, are seated in the line of the posterior scales, and seem, in fact, but the excessive enlargement of some one or two of them: this singular developement of a spur may be traced in the young bird, when

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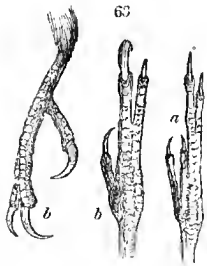
it first appears only as a posterior scale, double the size of the others. As the bird increases in age, so does this scale increase in size and elevation, until it finally becomes a solid acute spur. We pass over several other variations of the tarsal scales, as seen in different groups, and now proceed to other parts of the legs.

(109.) The Toes of birds, by their leading variations, furnish the primary characters by which the whole class is divided into orders, and the subordinate modifications of their structure indicate, for the most part, natural groups. In this respect they consequently deserve even more attention than the tarsi. We have already described the peculiarities of retractile, perching, walking, wading, and swimming feet, and shall therefore at once proceed to enumerate their several variations. The great majority of birds have four toes to each foot, three of which are usually placed before, and one, which is called the *hallux*, or hinder toe, is placed in a backward direction. The exceptions to this number of toes, and to their disposition, are comparatively few; the most remarkable instances, as regards the number, are found in the ostrich family (*Struthionidæ*). The toes of the ostrich are only two, one large, the other small: this extraordinary structure, for a bird, is in perfect harmony with its station in the great scheme of creation, for it is by means of this animal, half quadruped, half bird, that nature passes from the feathered class to that of the mammalia; and yet, although the ostrich would appear absolutely deprived of all those powers which enable birds to escape from their enemies, either by perfect wings or highly developed toes, she has nevertheless made the ostrich, with its two toes, one of the swiftest running birds in creation. The cassowary, the emu, and the American rhea, have three toes upon each foot, but the latter only has the vestige of a fourth, which merely shows itself in the form of a tubercle; but in the *Apternyx*, or New Zealand emu, the most aberrant of the ostrich family, we find the hinder toe, although

short, yet perfectly formed. Now it deserves especial attention that all groups which represent the *Struthionidæ* in other circles, either have the fewest number of toes, or their disposition is variable; as if this was the point in the circle where these members changed their character, and number, even in the genera. Hence it is that the whole of the typical Grallatorial birds have the hind toe so short, that it may be termed obsolete. By the same law we find nearly all the *Charadriadæ*, or the plovers (the most aberrant of the *Grallatores*), with only three toes, like most of the ostriches, which in every thing else they symbolically represent. Thus, also, we account for the disappearance of the hinder toe in the sub-genus *Apternus*, or the three-toed woodpeckers, — the variation of the structure of the foot, among the *Halcyonidæ*, or kingfishers, — and in the *Musophagidæ*, or plantain-eaters, one genus of which (*Colius*) has all the four toes placed forward. Each and all of these groups represent the *Struthionidæ* in their respective circles, in which they are the most aberrant. We may now proceed to the variations of the toes in regard to situation.

(110.) The toes vary in their *position* no less than in their number, even in such birds as have only three. The direction of these members, in cursorial or three-toed birds, is forward, and their divisions are mostly cleft to the base; but in the three-toed woodpeckers, where the hallux is wanting, one of those which are versatile, and which is generally called the exterior hind toe, is directed more backwards than usual; so that there are two before, and one behind. The usual structure of the kingfishers is to have three anterior, and one posterior toe (*fig. 63. a*); but in such as have only three it is the inner anterior toe which disappears, so that the hallux, which is wanting in *Apternus*, remains in the sub-genus *Ceyx*. (*b. b.*)



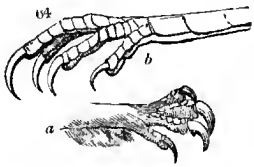
(111.) We may now pass on to those feet which are furnished with four toes, where we have three distinct variations from the ordinary position: 1. when there are two before and two behind; 2. when the exterior toe is more or less versatile, and may be brought forward if required, although it is usually directed backwards; and, 3. when all the four toes are directed forward. Of the first there are several important modifications, as seen in the trogons, parrots, and woodpeckers; the second structure is versatile, and is general among the puff birds and the cuckows; the third is of rare occurrence, and is only seen in the swifts, the colys, and the cormorants. It has been customary to call all feet *Scansorial*, which have the toes placed in pairs, that is, two before and two behind: hence has originated the error, fallen into both by MM. Cuvier and Temminck, of classing many birds with the true climbers, which have not, in their natural economy, the least affinity with the Scansorial tribe. There are, in fact, no less than five different variations in those feet which have the toes disposed in pairs, each being accompanied by a corresponding difference of function. It is important, therefore, that these should be named and defined. First, then, we have a *prehensile* foot, as seen in the parrot family: here the soles are remarkably broad, and the toes divided to their origin; the two exterior toes are the longest, one of which is decidedly in front, while the other, although almost always directed backwards, can nevertheless be brought half way in front, so as to make a curve outwards; thus, if a parrot was to grasp a perfectly round fruit, its four toes would hold it at four points of its circumference, and at four equal distances: thus it is that these birds have the most varied powers of prehension in their feet of any of the *Scansores;* for when assisted by their bill, they can not only climb, but feed with their feet, this latter faculty being denied to all other groups. The toucans, cuckows, and puff birds, have the arrangement of the toes like unto the parrots,

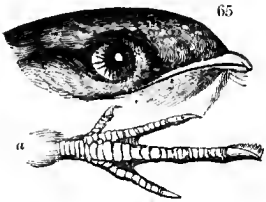
but there is no breadth of sole, the tarsus is much more lengthened, and the toes, instead of being thick and strong, are slender and weak. These birds never climb, but as they sit much, and often very long, upon branches, it is necessary their feet should be of such a form as to enable them to preserve an equal hold on all sides: we accordingly term their feet *grasping*. Next come the trogons, whose toes are arranged quite differently, although, like the last mentioned groups, they have two before and two behind, but the latter are *perfectly* posterior; and as they are altogether incapable, from the manner of their insertion, of being moved from their ordinary position, the trogons might be termed the only birds whose toes are absolutely in pairs: they are, perhaps, the most sedentary birds in creation, and hence their feet, which are also the weakest, seem to be constructed for the sole purpose of sitting still. We shall retain the appellation of *Gressorial* to this form, the characters of which are, in addition to the toes being disposed in pairs, that the two anterior are by far the longest, and are connected together to nearly half their length; the two posterior being separated, and the outer one nearly half the length of the inner.

(112.) The true *Scansorial* foot is seen only in the woodpeckers. We must still consider these birds in the same light as we have done the parrots, that is, in having the toes placed in pairs; for although the base of the outermost seems to be on the same level with that of the two which are anterior, this outer toe cannot be brought even half way forward, at least in any of the species we have examined in a fresh state, without violence; and, indeed, this latter faculty is not at all required by the habits of these birds, for they never use the foot either in feeding or in grasping. On flying from one tree to another, the woodpecker generally alights upon the upright stem, rather than upon an horizontal branch, and immediately begins, in a perpendicular attitude, to explore the bark, and detect the

external signs that may appear of its insect food lurking within. But although we thus distinguish the foot of the *Picidæ*, as pre-eminently scansorial, it must not be supposed that they are of the only structure which is quite adapted for climbing. Infinite and harmonious variety is the great principle which pervades the creation, one result of which is the accomplishment of the same purpose by a great diversity of means. Thus we shall find, even in the Scansorial tribe, other modifications of the foot admirably adapted for climbing, although the toes are in the same position as those of ordinary birds.

(113.) We now come to those few examples where all the four toes are placed forward; these, as we have already intimated, are found in the swifts (*Cypselus, fig.* 64., *a*), Colies (*Colius, b.*), and corvorants (*Carbo*). We might almost have included the *Caprimulgidæ*, or night-jars, in this list, for their *hallux*, or hinder toe (*fig.* 65. *a*), although incapable of being brought on a level with the others, is still placed so far forward, even as when seen in a dried specimen, that it seems inserted on the side of the foot, rather than behind the others. It has been mentioned by some writer, that these birds never perch, like others, *across* the branch of a tree, but always parallel with it; so that in such a position the hinder toe would have no power of acting like that of other birds. If this fact is correct, it favours the supposition that, when at rest, the hallux of the *Caprimulgidæ* is placed forward, and that such is truly its natural position. Some of our field naturalists, who may be in the way of procuring a fresh specimen of the





European species, would do well to investigate this subject. Returning, however, to the more perfect examples of this type, we may observe in the common swift (*fig.* 64. *a*), that, although all the four toes are directed forward, the two outer, which are the shortest, have a sidelong inclination, something in the same way as our thumb, which, although placed forward like the other fingers, is yet able to grasp an object in a direction very different from that which can be accomplished by the others. Of these two lateral toes, the inner one is the true hallux, and it is, like the thumb of the human hand, placed much more backward than the other three. We have not yet found, in any author, certain information of the manner in which these singular footed birds perch, or rest themselves; for although we have frequently witnessed their surprisingly rapid evolutions on the wing, their retreats are always in dark caverns or inaccessible heights. We think, from the peculiarity of their feet and their strong prehensile claws, that the swift rests in a semi-perpendicular attitude, clinging, and supported alone by the feet, all of which are, therefore, anterior, for it is quite obvious they cannot, like ordinary birds, perch upon a branch. The *Colies* of Africa present us with another instance of this structure; the toes, indeed, are disposed like those of the swifts, but the feet are obviously intended for walking, which those of the swifts are not: the tarsus, in fact, considering the size of the body, is unusually thick and strong, and nearly as long as in the sparrow: the length of the toes are proportionate, but the two outer (including the hallux) gradually diminish, leaving the inner next in length to that which follows it, and this latter corresponds to the middle toe of the true perchers: the claws of all the toes, although much more slender than those of the swifts, are more curved than in ordinary birds, so that they must be instruments also of protection. The economy of these birds, for a knowledge of which we are indebted to Le Vaillant*, confirms what we

* Ois. d'Afrique.

should have conjectured from this singular and, in many respects, unique construction of foot. The colys walk but badly; but, when at rest, unlike all other birds, they hang from the branches with their heads downwards! — precisely similar to bats! Lastly, we may number the corvorants, whose four toes are all directed forwards, and all of unequal lengths, gradually diminishing from the outermost; a broad web connecting the whole. Of the use this particular structure is to these birds we can form no idea. It is known, indeed, that they are most expert divers and good swimmers; and that, when upon land, they stand almost erect, supported by their rigid scansorial tail.

(114.) We are now to consider those *Four-toed* feet, which are constructed upon the common principle of three anterior and one posterior. This disposition is seen in the great majority of birds, and consequently it admits of much greater variety in its secondary modifications than those structures we have just been describing. It is impossible to assign to any one of the forms of foot, possessing this disposition of the toes, a decided superiority of perfection in all functions, any more than can be done in the qualities or functions of the birds themselves. A raptorial and a perching foot are equally perfect; yet their perfections are of different kinds. A union of many qualities, without having any one *more especially* developed, is always found to indicate typical pre-eminence; and upon this principle the most perfect feet are possessed by the perching birds of the order *Incessores*. Then as to size. The smallest feet are found in the Natatorial or swimming order, while the largest belong to the Rasorial. This may be considered a law of nature, not only among birds, but throughout the class of quadrupeds; and it is as apparent in the animals really belonging to these two types as in those groups which analogically represent them in other circles. It must be remembered that it is only the *hinder* feet of quadrupeds which can be justly compared with those of birds, because the fore feet of the former be-

come the wings of the latter: bearing in mind this analogy, we find that the lemurs (*Lemuridæ*), opposums (*Didelphidæ*), and kangaroos (*Marsupidæ*)*, are among the largest footed quadrupeds. While the water rails (*Rallidæ*), the greatfoots (*Cracidæ*)†, the honeysuckers (*Meliphagidæ*), and the large-legged thrushes (*Crateropinæ*), among birds, have the largest feet, with the largest claws, in the circles which respectively contain them: they are all, in short, so many instances of the Rasorial type. Size and strength of foot must not, however, be confounded with *length*, for those birds which have the longest, have generally the most slender legs; the whole of the typical *Grallatores*, or waders, but more especially the genera, *Himantopus*, *Avosetta*, *Mycteria*, and *Tachydromus*. The flamingos (*Phœnicopterus*) among the *Anatidæ*; the serpent-eater (*Gypogeranus*), in the rapacious order, and the larks in the circle of the *Fringillidæ*, are analogous types, and show that unusual *length* and *slenderness* of leg, where it exists, is generally prevalent in the *Grallatorial* types. The shortest feet, as just remarked, are almost always found in the aquatic type, whether belonging to the class of quadrupeds or to that of birds. The seals and walruses, thus representing the pelicans, ducks, awks, and divers, in the Natatorial order, and these find their representatives among the perching groups, in the night-jars (*Caprimulgidæ*), swifts (*Hirundinidæ*), flycatchers (*Muscicapidæ*), short-legged thrushes (*Brachypodinæ*), and numerous other groups. Moderate feet (that is, when the tarsus is only slightly longer than the hind toe) is the average structure in the rapacious and perching orders, but the claws of the former, like the feline order of quadrupeds, are retractile, while the latter agree with the feet of the *quadrumana* in having superior powers of grasping, or of prehension. Thus we perceive that the *relative size* of the feet, throughout the class of birds, is regulated by fixed laws, and that

* See Classification of Quadrupeds, pp. 82. 106. 232.
† This family includes *Menura* and *Megapodius*.

these same laws can be also traced in the class of quadrupeds.

(115.) A RAPTORIAL foot has some striking peculiarities in the direction of the toes, which have been passed over by all ornithological writers, who have described their members as having the same toes in the same positions as those of the perching order. On a superficial examination they seem, indeed, to be so; but this is not strictly the fact. On examining the foot of a hawk, or more particularly that of an owl, it will be observed that the outer toe is placed more obliquely, than directly in front, so that it admits of grasping laterally, on the same principle, though much less developed, as we have already explained in the instance of the cuckow. This inclination of the exterior fore toe towards assuming a versatile structure, can only be rightly seen in birds which are fresh; for in dried specimens the three anterior toes appear all on the same plane; but even then the claw of this subversatile toe is always more inclined *inwards* than those of the two others; a proof that they are not employed to grasp the same side of the surface of an object. An examination of the American sparrow-hawk (*Falco sparverius*), (*fig.* 66. *a*) a bird we have so often instanced, will show this fact. But it is among the owls that this peculiarity of structure is most apparent (*b*): the three anterior toes in this family are more equal in length than in any of the *Falconidæ*, or in the perchers; so that the foot bears a great resemblance to that of the swifts; both being Fissirostral types. The foot of the owls, nevertheless, differ materially both from the swifts and the falcons; for it may be said that, of the three toes opposite to the hallux, only one, that in the middle, is directed forwards; the other two being so inserted as to grasp in a lateral di-

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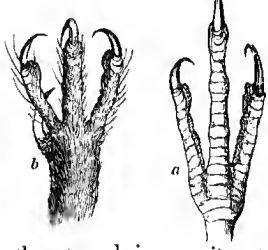


rection: by this particular structure the bird could bring the tips of all the four claws to touch each other, when grasping a small round substance, a faculty which no other birds, from the different position of their toes, can possibly possess. The annexed sketch (*fig.* 66. *b*) of the foot of the little horned owl, or *Scops*, will illustrate this singular conformation of foot, which is altogether peculiar to such birds of the rapacious order as prey upon living animals. The vultures, who do not seize their food by their talons, have no occasion for such a foot, and their toes are consequently placed in the ordinary direction.

CHAP. IV.

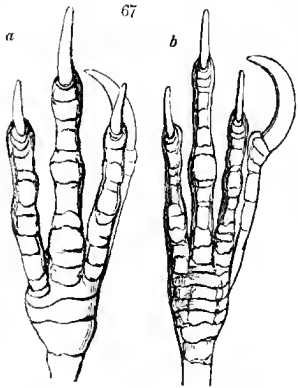
THE SAME SUBJECT CONTINUED. — ON THE DIFFERENT MODIFICATIONS OF PERCHING, CLIMBING, WADING, AND SWIMMING FEET. — THE VOICE AND NESTS OF BIRDS.

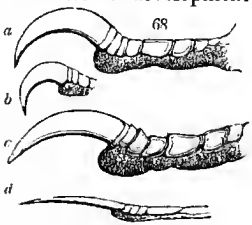
(116.) A PERCHING, or *insessorial foot*, for the reasons already stated, is pre-eminently typical of this member in the class of birds. Feet of this form are adapted both for walking upon the ground and clinging to branches; thus uniting the properties both of the grasping and the walking foot, hereafter defined. The three anterior toes are not only directed forwards, but those two of them which are on the sides have no power of being turned in a different direction to the middle toe, and this constitutes their essential difference from the raptorial structure. Nevertheless, it by no means follows that all birds, having three toes directed completely forward, and one backward, belong to the Perchers. The definition we have already given of the orders of birds (14.) will have informed the student, that the *Rasores*, the *Grallatores*, and the *Natatores*, notwith-

standing their differences in other respects, possess the common character of having the hinder toe elevated above the plane, or level, of the others; so that its insertion is *above* the heel of the foot, and not, as in the *Raptores* and *Insessores*, directly *upon* it. As it will be necessary, in the sequel, to notice the feet of these aberrant orders more particularly, we confine ourselves in the following observations to that structure which especially belongs to the Insessorial, or perching birds, in all of which the three anterior toes, and the one posterior, are placed upon the same level. These we shall term insessorial feet, and we shall now describe the numerous variations which they present, according to the peculiar habits and economy of the very great number of genera composing the *Insessores*, or perching order. This structure of foot is either formed more especially, 1. for walking; 2. for perching; 3. for clinging; 4. for climbing; 5. or are sindactyle feet. We shall then notice the different sorts of scansorial feet, wherein the toes are disposed as above mentioned, which will render unnecessary any observations on the impossibility, or the inexpediency, of giving definite names to the minor variations.

(117.) WALKING feet, among the perchers, do not imply a similarity of structure to those of the *Rasores*, which never have the hind toe upon a level with the others; but rather that feet, so formed, are adapted both for walking and perching. Thus every one knows that the crows and starlings walk more frequently than they hop; and it is therefore essential to birds of such habits, whose chief food is upon the ground, that their feet should have a particular conformation. Hence we find that nearly all terrestrial birds, strictly so called, have the lateral toes perfectly equal, that is, of the same length. The crow (*fig.* 67. *a*), rook, starling, and blackbird, besides many others, familiar inhabitants of our fields and lanes, sufficiently illustrate this fact. In proportion as the habits of a bird are arboreal rather than terrestrial, so is this equality of the lateral

toes diminished, and the inner one becomes proportionably shortened. This we see in the jays (*b*), which seldom alight upon the ground, even in situations like this*, where their wild and discordant cries echo through the coppices, and evince that such wooded retreats are their proper haunts. Another character, indicative of walking habits, will be found in the claws; those of the crow (*fig.* 68. *c*) are always less compressed and curved than in the jay (*a*), and other birds which live in trees. This structure is carried to its extreme development in the larks (*d*), and the neighbouring genus *Anthus*, where the claws are unusually straight and slender, while the opposite extreme is seen in the genus *Buphaga* (*b*). We must, however, observe that there are several exceptions to this rule; for not only the typical shrikes (*Lanius*) which never, or very rarely, alight upon the ground, have the lateral toes equal, but this equality is seen in several other groups which are arboreal; but which, as standing at the head of their tribe, or genus, represent the crows; and thus the character becomes also analogical. The swallows very rarely alight upon the ground, although their toes are equal; yet, as they represent the *Corvidæ*, by being pre-eminently typical





* Tittenhanger Green, in the adjacent woods of lord Calledon.

in their own tribe, they consequently should possess one structure in common with the crows. Setting these comparatively few exceptions aside, which indicate analogical relations, the equality of the toes in the generality of insessorial birds, when accompanied with slightly curved claws, is a certain indication that such birds live habitually upon the ground, and therefore represent either the Grallatorial or the Rasorial type; the birds already mentioned, with hundreds of others, places this position beyond dispute.

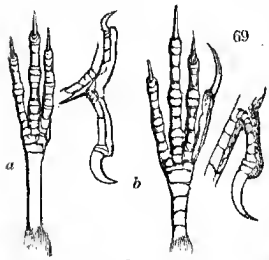
(118.) A PERCHING FOOT, in the restricted sense in which we now use the term, indicates that those birds which possess it live more among trees than upon the ground. We trace this in the habits of the jays, whose inner toes are more or less shorter than the outer (*fig.* 67.*b*). The robin, although so frequently seen upon the earth, looking for worms and terrestrial insects, is yet, upon the whole, more arboreal; and we therefore perceive that its inner toe is very slightly shorter than the external one. This disproportion is rather more apparent in the stone-chat (*Saxicola rubicola*), which, although generally considered a more terrestrial bird than the robin, we should say, from personal observation, was less so; while in the *Motacilla alba*, which may be called a truly terrestrial bird, the lateral toes are perfectly equal. The bush shrikes, both of America and Africa (*Thamnophilinæ*), have the lateral toes very unequal, and the claws broad and well curved: this structure is in unison with their manners; they live only in thickets, the intricacies of which they explore in search of insects and young or sickly birds. We may therefore define a perching foot as of a moderate length, strongly made, with the lateral toes unequal, and the hinder one not lengthened. This latter character, as we shall presently show, being the first indication of a very different type of form.

(119.) *Clinging* feet are restricted to the humming birds, whose structure of foot is perfectly unique. From its extreme shortness, on a cursory glance, it

seems not unlike that of the swifts: but the position of the toes are very different; the three anterior are very nearly of equal length, and sufficiently united at their base to keep them always close to each other, so that the sole becomes much broader than if the divisions were distinctly cleft: the claws, as if to compensate for the brevity of the toes, are remarkably long, being two thirds the length of the toes themselves. The *Trochilidæ* thus present a most curious analogy to the larks and wagtails, for although they never, by any chance, alight upon the ground, where the two latter genera alone reside, yet both may be characterised as having the claws pre-eminently developed. One could hardly have imagined that nature would have established so beautiful an analogy between two groups so diametrically opposite in all other respects, except that of having the longest and the most slender bills of their respective circles. The claws, however, of the *Trochilidæ* are very much curved, broad, and remarkably acute, a conformation which is always found in birds which from living only upon trees, have additional powers given them of clinging to the branches; such, in fact, are the habits of these beautiful little creatures; they never are seen, like other birds, hopping from twig to twig: they are either upon the wing or sedentary; and, as their well curved claws enable them to take a firm hold on the convex surface of slender twigs, we have applied the epithet of *clinging* to the peculiar foot they possess.

(120.) A *prehensile* foot is possessed by those birds, which, like the *Trochilidæ*, rarely, if ever, touch the ground; yet they are continually wandering among branches in search of their food: hence they require great strength of limb, without the necessity of a lengthened tarsus. This structure we accordingly find in the short legged-thrushes, (*Brachypodinæ*) the orioles (*Oriolinæ*), the caterpillar catchers (*Ceblepyrinæ*), the fruit eaters (*Ampelidæ*), and several other groups. The foot of these birds very much resembles that of the

ordinary perchers, but the tarsus is very short, that is, not longer than the hinder toe: the lateral toes are either equal or not, but the middle one is much shorter than in the jays and other birds, which are both arboreal and terrestrial. Another peculiarity of the prehensile foot is seen in the claws, which are short, broad, and unusually curved; by this we know that they are well adapted for enabling the bird to take a firm hold of branches, while they are totally unfitted for terrestrial habits. The common oriole (*Oriolus galbula*) will serve to explain this structure in the absence of any other native bird; but it is much more perfectly developed in the family of short-legged thrushes, including the genera *Chloropsis* (*fig.* 69. *a*), *Brachypus*, *Trichophorus*, &c., all of which are natives of Africa and India. The foot of the *Ampelis garrulus* (*b*) unites this and the insessorial structure, the middle toe being much more lengthened than in any of the last mentioned genera.



(121.) The last form leads us to those of the *Scansorial* structure, as developed in such birds as have three anterior toes, and one posterior. Of such feet as are especially adapted for climbing, where the toes are disposed in pairs, we have already spoken, but there are a great variety of birds possessing the same faculty, and yet exercising it by means of feet very differently constructed. We shall now trace, in the gradual development of this structure, all its variations among birds whose toes have the ordinary direction so characteristic in the typical perchers. The sort of foot last defined, and which we have called *prehensile*, may be considered the first incipient development of the scansorial structure; the primary distinctions of which is in an unusual elongation of the hinder toe, and a great breadth and curvature of the claws. The short-legged

thrushes possess very little of the first of these indications, but the breadth of the claw is apparent in all their minor groups. Nature advances another step in the genus *Parus*, where, as we see in *P. major.* (*fig.* 70. *a*) the fore

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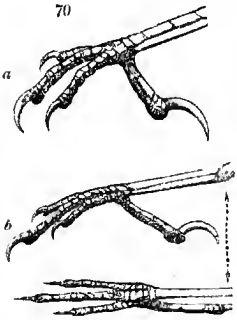

toes are very unequal in length, and the hinder, — as Linnæus well observes, — strong and large; equal, in fact, to the middle toe. Now the *Pari* are well known arboreal birds, not only living among trees, where alone they seek their food, but exploring the most slender branches and twigs in a manner almost peculiar to themselves: these habits render them in some degree, climbers, and they have consequently, in the greater development of the hind toe, one of the scansorial characters. Let us now see how the same structure is developed, but under a totally different form, in a genus which belongs to the very same family. We allude to the *Mniotilta varia*, Vieillot, or black and white creeper of Wilson: now this bird unquestionably belongs to the warblers, and yet it runs up the trunk of a tree almost with the same facility as a nuthatch; the hinder claw (*b*) is consequently much more lengthened in proportion, than that of the titmouse, in order to support and keep the body in equilibrium, whereas the hind toe of the *Parus* is used for grasping, for the bird itself never climbs perpendicularly like the *Mniotilta:* it may, indeed, rather be said to hang than climb; and as greater strength of muscle is requisite for the first than for the last of these positions, we consequently perceive that the foot of the titmouse is much stronger than that of the *Mniotilta*, although the latter bird makes the nearest approach to legitimate climbing.

(122.) Leaving these and similar representations of

the scansorial tribe, we pass to that tribe itself. We have already described the various constructions of foot in four of the families (111.), the toucans, parrots, woodpeckers, and cuckows, all of which have the feet disposed in pairs. The *Certhiadæ*, or creepers, which form the fifth or Rasorial family of this circle, have proportionably larger feet * than any of the others, and the toes are differently disposed. It would scarcely be imagined that much further variation could be found, where all had three toes forward and one backward, and yet there are greater diversities in this group than in all the other families of the *Scansores* put together. We shall commence with the wrens, as the most aberrant of all the creepers, in which we consequently find the faintest indication of the typical characters. So little, indeed, do the majority of these birds climb, in the true sense of the word, that it is only by tracing their close and unquestionable relation to others, in which both the scansorial structure and the faculty of exercising it is more apparent, that we arrive at the positive certainty of their belonging to this family. The length and form of the bill, and the brown cast of the plumage of our common species accords with the rest of the family, but it is the peculiar length of the hind claw (*fig.* 71.) which shows that this genus occupies a station in the same circle with *Lochmia*, *Tichodroma*, *Platyurus*, and *Thryothurus*, each of which have additional scansorial characters. The *hind claw* in *Troglodytes* (*b*) is hardly as long as that in the middle, and the tarsus exceeds both; but in the nuthatch (*Sitta*, *fig.* 72.), the length of all the toes is greatly increased, yet the hinder and the middle are of the same length, and both of them

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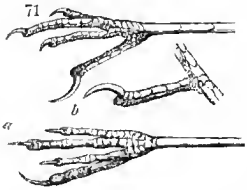

* Thus preserving their analogy to the *Cracidæ*, *Rasores*, *Rallidæ*, *Megapodia*, &c., all of which they represent in the circle of the *Scansores*.

shorter than the tarsus. It is only, however, in the Australian genus *Climacteris* that this excessive development of the posterior toe is at its maximum (*fig.* 73. *a*): in this genus, owing to its enormous claw, the hinder far exceeds the length of the middle toe, and this latter is connected to the one that is external, nearly to the end of its first joint (*b*). To account for this extraordinary enlargement of the toes in all the preceding birds, it must be remembered that their faculty of climbing is entirely derived from these members; they receive no assistance whatever from their tail, which is not only destitute of naked points, but of all rigidity, so that, as a means of support, it becomes quite useless.

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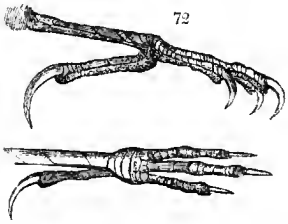

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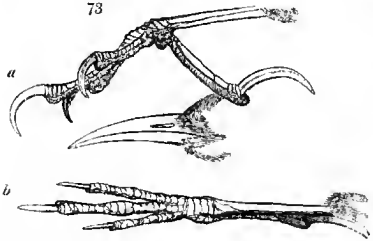
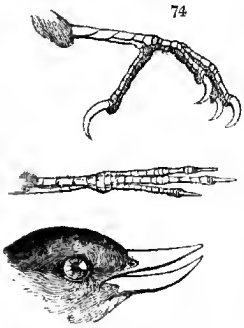


(123.) Let us now see what further variations occur in genera where some assistance must be derived from the tail, a fact we gather from the feathers possessing different degrees of rigidity, without their being absolutely stiff or terminating in naked points. The genera whose tails are thus formed are *Zenops* (*fig.* 74.), *Anabates, Dendroma,* part of *Synallaxis, Oxyrhynchus,* and *Buphaga.* In the four first the tail, although possessing but a very slight degree of stiffness, is yet sufficiently firm to give some aid to the bird in climbing,

and therefore we find a corresponding diminution in the length of the hind toe, which is rather shorter than that in the middle; but additional strength is given to the claws, all of which are stronger, broader, and much more curved, than in the genera we first noticed: the toes, also, are cleft to their base, and the lateral ones are of the same length. Few ornithologists, indeed, would suspect these birds to be climbers, seeing that their feet are of the ordinary size, and that there is no very striking development of the scansorial structure in any one part. Nevertheless, we may arrive at this conviction by the form and elongation of the hinder toe, the strength, curvature, and compression of the claws and the diminished flexibility of the tail feathers, when compared with these parts in ordinary perchers. It is at this point of the series that nature determines upon a third and new modification of the scansorial faculties. In the long-toed nuthatches, first described, she has concentrated this power solely in the feet. In the genera *Zenops, Anabates, &c.*, it is divided between the toes and the claws, some little aid being derived from the tail. But in the third modification of these powers, which we shall now describe, greater facilities for climbing are given to all these members, so that we come to the highest development of the scansorial faculty in birds whose toes are not arranged in pairs. This change, however, like all her other operations in the physical world, is marked by harmonious gradation. The gradual diminution of the characters last enumerated among the more slender clawed *Synallaxi*, would lead an ornithologist, who merely saw some two or three of the species, to suppose they had no connection with this family, whereas it is in this very genus that nature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marks out and effects the change we have just intimated, and all this is accomplished within the limits of a single genus.* We have already had occasion to illustrate this very beautiful transission, as shown by the gradual change exhibited by the structure of the tail (101.), and it is equally so if we merely looked to the foot: that of *Synallaxis cinnamomeus* is of the same robust form as its congeners, but the toes, both before and behind, are longer, and their claws more slender, especially the hinder one. The tail preserves the broadness peculiar to *Synallaxis*, but then it assumes the pointed and almost naked ends of *Certhia familiaris:* a more beautiful union of the characters of two genera cannot, perhaps, be exhibited in the whole circle of ornithology; and so much may be taught by frequent examination of these two species, in conjunction with a *typical* example of *Synallaxis*†, that they are the first birds which every ornithologist should possess, who wishes to study, not the bare and technical nomenclature, but the true philosophy of our charming science. We thus arrive at a group (forming our sub-family of *Certhianæ*) which answers to the description already given, that is, where nature gives a higher development than she has hitherto done, to every organ employed in climbing, so as to constitute the *Certhianæ* the pre-eminent type of the scansorial creepers. We regret our space will not permit us to trace this development in any other member than the foot. Commencing, then, with that of the common creeper, we observe all the indications exhibited by *Synallaxis cinnamomeus*, brought, as it were, to perfection: the toes are very slender, the inner one considerably the shortest, and the hinder one again so lengthened that it equals that of the middle: all the claws are large, very slender, and acute, but while those in front are greatly curved, that behind is much less so; its great length, however, added to the general character of

* The genera of the *Scansores*, *Tenuirostres*, and *Fissirostres* are equivalent to the sub-genera of the *Insessores*.

† The typical species are *Sy. Caniceps* and *Ruficeps*. See Appendix.

the whole foot, would make us believe that nature was giving us a repetition of the structure we have already had in *Sitta*, and that we were again returning to that type. But this similarity can be satisfactorily accounted for upon other principles* ; and now, for the first time, we perceive the tail decidedly assuming the scansorial structure. *Certhia* conducts us to its representatives in the new world, the genera *Oxyurus Dendrocolaptes* (*fig.* 75.), and both of which, in regard to their feet, are the same, and both differ in this respect from *Certhia* as well as from all the genera we have yet noticed. The scansorial powers of the foot, hitherto chiefly thrown into the hallux, is now transferred to the foremost toes, the two exterior of which are of the same length, and are also equal to the tarsus, while the inner, although considerably shorter, is yet longer than the hinder toe. Here then, a superficial reasoner might be led to exclaim, is a complete refutation of the theory but lately advanced on the importance of the long hind toe of the nuthatch ; for if the great development of that toe was so essential to climbing birds, how is it that in the *Dendrocolapti*, notoriously the most typical of all the scansorial creepers, this very toe, which according to our theory should be unusually large, is actually less than any of the others? The theory, as these critics would declare, and honestly believe, refutes itself!† A little more consideration, however, will show the absurdity of such a conclusion.

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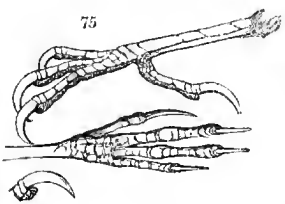

* This relation of *Certhia* to *Sitta* is at once explained by the law of representation, *Certhia* representing *Sitta* in the circle of the *Certhianæ*.

† It is by this sort of partial reasoning that reviewers, altogether ignorant of natural history, maintained, upon a former occasion, that we could not possibly be right in asserting that the glossy feathers of the vultures were for defending the skin from blood and offal, because this structure was not found in *all* the species ; as if *all* had the same habits,— as if, in short, there were no gradations in nature!

The anterior and the posterior toes of scansorial birds are constructed for performing two very different functions, although both are essential to the act of climbing. Those in front are formed for speed, and may be compared to the arms of a man. When in the act of ascending a tree, his hold is secured in the first instance, not by his foot, but by his arm, and in proportion to his muscular strength and the firmness of his grasp does he make his way upwards from branch to branch, the foot merely serving to keeping him steady in the progress he has first secured by his arms. This fact every one must know, either from experience, observation, or reason. Hence we find that the long-armed monkeys are the most expert climbers; and the sloths, whose hinder legs are not more than half as long as the others, are the most expert, in ascending trees, of all quadrupeds, monkeys alone excepted. These facts establish the position upon which we shall argue. The anterior toes of scansorial birds perform to them the office of hands or arms; it is these that are first applied to seize the bark of a tree, into the crevices or soft covering of which the crooked claws enter, and obtain a firm hold. It therefore follows that the more powerful these anterior toes and claws are constructed, the more facility the bird has in climbing. Now, the *Dendrocolapti* and their congeners are the only scansorial creepers that have two of the anterior toes of the same length, so that the outer one is as long as the middle (*fig.* 75.), and both, as if for giving additional strength, are considerably united at their basal joint. Let us now explain the reasons that, with such unusual strength in the anterior toes, the hinder one is so small, while that of the *Sittinæ* is enormous. It follows, from what has already been said, that the functions of the hallux are altogether different from those of the fore toes. In these, and in all other birds, it is merely an organ of *support*. And as the scansorial tribe, in climbing trees, assume a semi-perpendicular attitude, they consequently require

much more support backwards, in such a position, than any other birds. In order to effect this, nature has recourse, so to speak, to other means than those she usually employs. The hinder toe and claw is either enormously developed, and the tail has no additional power given it (as in the case of *Climacteris* and *Sitta*), or, — if still greater support is necessary than would be acquired by this structure, — the tail itself, by a peculiar formation, is made to perform the same office as the hind toe, but with infinitely more effect. This brings us to the point at issue. The *Sitta* derives its sole support when climbing from its posterior toe, which is consequently unusually large. *Dendrocolaptes*, on the other hand, being a much more powerful and rapid climber (as we have proved by the structure of its anterior toes, and have *witnessed* by personal observation), requires a much greater support *backwards*, proportionate to its power of advancing *forwards*. The tail is, therefore, enlarged and strengthened in such a way, by rigid points which stick into the bark, that the office of the hind toe is almost superseded, and its size is consequently not greater than in the generality of birds. We should not have gone into these explanations merely for the purpose of refuting the sort of criticism to which on another occasion we have been exposed*, but because they will deter the young ornithologist from forming hasty judgments upon matters which more extended investigation would place in a different light. These details will also demonstrate, what is of far greater interest, another and a new proof of that *harmony of design*, and that infinite "diversity of operations" which the INFINITE BEING has manifested in these his glorious, yet lower, works.

(124.) There are yet three other modifications of the scansorial foot which must not be passed over,

* *Vide* the periodical critics, on the "Preliminary Discourse." The few of our readers who may possibly be influenced by such misrepresentations and falsehoods, will find them very neatly exposed in the "Entomological Magazine" for April, 1835.

although this part of our subject has expanded itself to wider limits than were originally anticipated. The first of these is seen in the singular and rare genus *Orthonyx*, one of the very few scansorial birds of Australia, and which seems to partake of the anomalous, or rather unusual structure so prevalent among the animals of that region. It will be necessary, however, before we can understand how a bird like *Orthonyx*,—whose great and long foot resembles that of the rasorial order,—can be connected with *Dendrocolaptes*, that we look to the genus *Sclerurus* (*fig.* 76.), an equally rare type, from the forests of Brazil, and of which the only specimen we have yet seen is in our museum. The foot of this bird has much of the general character of *Dendrocolaptes*, but the tarsus is much longer, and the outer toe (*a*), instead of being equal to the middle one (*b*), is shorter; the claws are also smaller, weaker, and less curved: in all this diminution of the scansorial powers in these parts, we see a considerable falling off from the typical perfection, and adverting to what we have just advanced on the use of the anterior feet, it is obvious this bird cannot ascend a tree so rapid as a *Dendrocolaptes*. The same diminution of strength can be traced in the tail, the shafts of which, although rigid, are comparatively weaker, and do not extend beyond the webs, as in all the rest of the *Certhianæ*. Yet still, as this bird belongs to the pre-eminent group of the tree creepers, its powers should not be so very much diminished; and we consequently find that the comparative weakness of its other members is made up by a great elongation of the hinder toe (*c*), which is one half as long again as in *Dendrocolaptes* (*fig.* 75.), so that it becomes, as in the nut-

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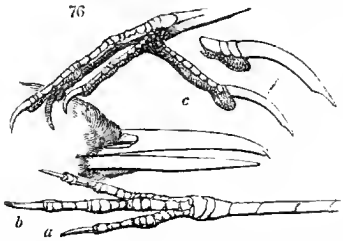
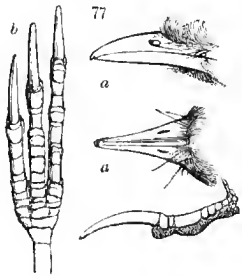
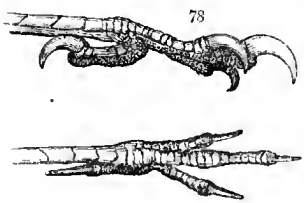


hatches, of equal length to the middle one; yet it is even of greater power than in these latter birds, for towards the end of the claw there is a small notch, apparently intended to give an additional supporting power to the hallux, this notch being constructed for the purpose of resting upon the bark, in like manner as the point itself: there is a very slight tendency to this structure, almost imperceptible, in our common nut-hatch; but it has never been noticed, and probably would not have been now observed, had not our attention been drawn to it by finding it so conspicuous in the Brazilian bird. Having now described the foot of *Selerurus*, the rasorial genus of the circle of *Certhianæ*, the ornithologist will be better prepared to understand the next modification, as seen in the Australian genus *Orthonyx* (*fig.* 77.). Let him imagine, therefore, a bird rather larger than a sparrow, but with the general form and proportions of the *Menura*, except in the tail, which is that of *Selerurus*. Like *Menura*, the bill (*a*, *a*) is short, arched, and rasorial, the wings rounded, and the feet enormously large and strong. The relative length of the toes (*b*) is altogether peculiar; the outer one is actually longer (in a slight degree) than the middle, while the two outer claws (unusually slight in their curvature) are one-third as long as the toes; the hallux is as long as the middle toe, but one-half its length is occupied by the claw. Now we think it quite obvious that claws, so constructed, were never intended to be used for ascending trees, and yet the rigidity of the tail would imply that this most singular bird feeds in a semi-perpendicular attitude, for if otherwise, such a tail could be of no use. Our specimen confirms this supposition, for the ends of the feathers, or rather the webs, are much worn away. We hazard the conjecture,



in the absence of all information upon the subject, that the habits of *Orthonyx* are terrestrial, that it is, essentially, a walking bird, but that it seeks its food not so much upon the barks of trees, as upon steep earthy banks, into which its unusually straight claws could penetrate, and against which the bird may be supported by its tail; it is also highly probable that these strong claws are used for scratching the ground, after the manner of most rasorial birds. At all events the discovery of *Sclerurus* establishes that link between *Dendrocolaptes* and the bird we have been describing, without which we could hardly have guessed on the situation of either. Both, however, are thus seen to be types of the *Rasores*, one in the circle of the *Certhianæ*, the other in that of *Buphaginæ*.

(125.) The genus *Buphaga*, known by the common name of beef-eaters, has been by all naturalists placed with the starlings, merely, as it would seem, because like them they are often seen on the backs of the African cattle, clearing them of *Acari* and other troublesome insects. This error of arrangement has entirely arisen from ignorance of the different forms which belong to the scansorial structure of foot. We may admit this fact in its economy, and yet deny that *Buphaga* (*fig.* 78.) is any other than a scansorial genus. This is evident from its remarkably broad and unusually curved claws, more resembling hooks than those of any bird out of the raptorial circle. Now it is very remarkable that in all the specimens we have seen of this bird, however old, not one has occured in which the points, which are remarkably fine and sharp, have been at all worn: we hence infer that they are not used upon any substance hard enough to blunt their acuteness; the hard bark of trees would unquestionably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do this, as in the case of all other scansorial birds; so that they must either be used to cling to the backs of sheep and wool-bearing animals, or round slender branches. All the accounts we have confirm the former supposition, while the whole structure of the foot shows that this bird never walks habitually upon the ground. We have merely glanced at these facts, which shows the station held by *Buphaga* in the circle of the scansorial creepers, for the purpose of lessening the surprise which will be excited among ornithologists by this new view of its affinities; and we shall now describe its foot. Although the tarsus is very short, the toes are equally so, yet the nails are disproportionably large; the lateral anterior toes and the hallux (when measured with their claws) are equal, but are shorter than the tarsus, while the claw of the hallux is as long as the toe itself. It might be imagined that if this bird really fed, habitually, upon the backs of cattle, the very acuteness of its claws would inflict more pain upon the animal than was felt from the insects which it came to devour. Nay, further, that the bird could not retain its hold upon the ox's hide without its talons penetrating the skin. No theory can be more plausible than this, and yet it is denied by the following experiments. Let any one take a dried specimen of the *Buphaga* that has its toes extended in a natural position, and apply the foot to the fingers of one hand, while he pulls the specimen with the other, exerting the same force, or even greater, as he might suppose the bird to do were it alive and clinging to his naked hand. This done, he will be altogether surprised at finding that the claws, so far from penetrating the skin, do not create the least degree of pain. Let him then make the same experiment with the foot of a sparrow-hawk, and if only one quarter of the same force is used, the talons occasion instant pain, and their points enter the skin; if the force exercised was the same, they would immediately be buried in the flesh. Two such opposite effects pro-

duced by claws which both terminate in remarkably acute points, appears at first exceedingly perplexing, and may well claim our attention. The explanation appears to be this: 1. the claw of the sparrow-hawk, independent of its acute point, has two sharp cutting edges beneath, one on each side, which are continued to the tip; by this structure it becomes a three-sided weapon, and enters the flesh immediately upon the least force being applied; 2. the claw reaches its termination very gradually, so that its power of penetration is doubly augmented. No such characters belong to the claw of the *Buphaga;* it has no lateral cutting edges, although the sides (occasioned by the flatness of its under part) are bluntly angulated; added to which the termination is remarkably abrupt, so that the extreme point would act as a little hook, without penetrating farther. This, in fact, is established by the experiment just alluded to, and which it is in the power of any one, having skins of the birds in question, to verify. It is quite obvious that if the claws of the *Buphaga* would not excite pain upon the human hand, it would have no such effect upon the thick hide of an ox, but rather excite an agreeable irritation, like that which is felt on scratching an inflamed part of the human body. The large *Acari* of tropical countries are well known to create sores, and the gentle irritation round these parts, according to every principle of analogy, would have the same effect upon the skin of the ox, as upon that of the human species. On attentively considering all these circumstances, we feel persuaded that the *Buphaga* not only seeks its chief food from the *Acari* and other parasitic insects infecting cattle, but that it actually climbs about their bodies for that purpose, in all directions; this latter belief being sanctioned by the great development of the hind claw, and its very rigid, although not pointed, tail.

(126.) There is only one other modification of foot which seems also belonging to the scansorial type; this

is seen in one genus only, and that genus is at present represented but by a single species, the *Oxyrhynchus cristatus*, or crested sharp bill (*fig.* 79.).* The strength of

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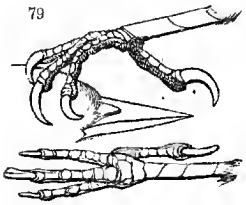

the whole foot, the shortness of the tarsi, and the broad and well curved claws clearly show that this is an arboreal bird; while the large size of the hallux, which is fully equal in length both to the middle toe and to the tarsus, is almost conclusive evidence of its being scansorial. If any other peculiarity of conformation was necessary to give support to this belief, it will be found in the acutely conic bill, which almost perfectly resembles that of *Yunx*. In other respects the foot of *Oxyrhynchus* is of the ordinary perching shape; the lateral toes are equal, the middle toe is not much longer, and is united to the outer rather more than to the inner toe.

(127.) The feet of the *Meliphagidæ*, or honey-suckers of Australia, are generally termed scansorial, although they possess only one of the characters belonging to this type, namely, a very strong and lengthened hind toe and claw, formed, however, as in ordinary perchers. In every other respect the foot would indicate (from the length of the tarsus) that these birds occasionally frequented the ground, although (from the inequality of the lateral toes) their chief residence was among trees: this latter supposition is confirmed by their habits; their food, as already intimated (53.) consists of the nectar of the flowering trees of New Holland, which they lick with their brush-like tongue, together with such insects as frequent the same blossoms. We can readily fancy that in such situations the honey-suckers would often have occasion to assume those

* Zool. Illust. i. pl. 49.

strained and unusual attitudes seen in the tomtits (*Parus*), sometimes hanging by their feet to reach a bunch of flowers, which could not otherwise be approached; the feet, therefore, of the two families, in all essential points, are precisely the same.

(128.) The name of *Syndactyle* has been given by writers to all such feet as have the outer toe more or less joined to that of the middle: hence, as such feet occur in almost every natural group among the perchers, the term has become altogether vague, from its indiscriminate use. M. Cuvier, more especially, has so far neglected a due restriction to the meaning of this term, that he has actually, from this one circumstance, classed the hornbills (*Buceridæ*) with the bee-eaters, and the kingfishers! *Syndactyle* feet, in short, are even more varied than the scansorial, but with this essential difference, that the birds possessing them do not, like the *Scansores*, constitute a natural group; but are merely *one* of the indications of the natatorial type. Hence it follows, that every modification of foot which we have described (even among the *Raptores*) presents instances of this union of the two outer toes, which, according to M. Cuvier's views, makes them syndactyle, and entitles them to a place in his artificial tribe of *Syndactyles*. As it is quite unnecessary to point out the inconsistency of such a classification, we shall merely observe that the most striking examples of this union of the two outer toes will be found in the genera *Malaconotus, Pitta, Eurylamus, Prionops, Dasycephala, Buceros, Leiothrix, Myothera, Rupicola, Todus, Phœnicircus, Pipra, Dendrocolaptes*, &c., genera, in fact, which are spread over the whole order *Insessores*. Nevertheless, the term is good, if limited to such feet, with united toes, *as are of a different formation to all others*, and would not, even if their toes were free, come under any of the definitions we have already given. Such a form of foot will be found in the genera *Merops* and *Alcedo*, containing the bee-eaters and the kingfishers, to whose feet, *par excellence*, we shall limit

the term *Syndactyle*. The habits of these two groups, so far as concerns the use of their feet, are nearly the same, for in neither are these members ever employed but to *rest* the body. The kingfisher watches patiently from a fixed station,—generally a naked twig, overhanging the water,—for such fish as come within its reach, and then, after a time, flies to another station; where it alights, it remains. The feet (*fig.* 80. *a*), from not being used for walking or standing, are consequently very small, and the toes imperfectly developed; there are three in front, and one behind, but two of the former might be almost reckoned as only one, since they are united together even to the commencement of their respective claws; the inner toe is not half the length of the others, and seems rudimentary: it has a claw, and is rather more detached at its tip than the other two: in some, as in the three toed kingfishers, this inner toe disappears. The hinder toe (*b*) is very short, and scarcely longer than the inner one; the scales of the whole foot are so thin and transparent, that they can scarcely be seen in the small species by the naked eye. Those who have seen much of the true kingfishers, so scarce in England, but so common in tropical America, know that they never perch upon any other than small or slender branches; and this we might infer from the shape of the foot. The two outer anterior toes are very long, so that they would completely clasp two thirds of the circumference of a small branch, the other third being embraced by the hinder toe: this fact is further confirmed by the unusual flatness of the soles of all, and by the acuteness of the claws (*c*), which, from being but slightly curved, would not, upon a small branch, come into contact with the wood: the

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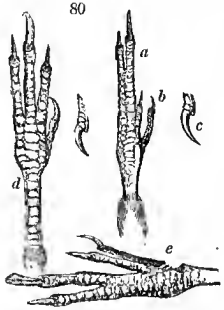

union of the three anterior toes, by producing considerable breadth of sole, gives an unusual degree of steadiness to the bird highly conducive to its remaining very long in one position. Thus we see that the foot of the kingfisher, which at first appears so very imperfect, and so totally useless for ordinary purposes, is that which is most of all suited to the habits and the wants of the bird. The bee-eaters, like the swallows, feed upon the wing, yet, unlike those birds, they never perch upon the ground; at least, we can affirm this of the European species (*Merops apiaster*), which visits the island of Sicily every year in great numbers, and remains for near a month on its passage from Africa to middle and southern Europe. During this period we have sought for many years every opportunity of detecting these birds in their *resting* position, but never were successful in finding them otherwise than on the tops of the olive trees, where they rest immoveable, until they again dart off for another long excursion. It is indeed obvious that they could not walk, for their feet (*d*) are much the same as those of the wood kingfishers (*Dacelo, fig.* 80. *e*), with this only difference, that the three anterior toes are divided the whole length of their last joint, the scales being rather more conspicuous.

(129.) We shall here notice the foot of the genus *Buceros*, not as an example of the true syndactyle form, but rather to show the wide difference in its construction from that of the kingfisher. The species before us is that generally called the *Buceros nasutus*. The general structure of the leg, although somewhat short, is strong and robust; the tarsus is nearly twice the length of the hind toe, which is shorter than any of the others; the middle toe is connected to the outer only as far as its first joint, the inner being entirely free, or cleft to its base; the claws are stout, and the scales thick and strong. The great breadth of the sole, as well as the partial union of the toes, clearly shows this bird habitually lives among trees, and yet the strength of the foot, length of the tarsus, its claws, &c., favours the suppo-

sition, that it can occasionally walk tolerably well, and hop with facility from branch to branch: both these motions, however, are completely denied to the kingfishers and the bee-eaters, a conclusion that may be arrived at even by an inspection of their feet. Nevertheless, as the *Buceridæ* are the Fissirostral family of the *Conirostres*, they *represent*, by analogy, the kingfishers, and the Natatorial order, the leading character of this type being to have the feet short, and imperfectly developed.

(130.) The feet of the *Musophagidæ* or plantain-eaters, must not be passed over, seeing that no author has correctly described their structure, which is very peculiar. (*fig.* 81.) Isert, the original discoverer and describer of the magnificent *Musophaga violacea*, says that its toes are three before, and one behind; others maintain that its feet are like those of a cuckow, and even very recently it has been asserted that all the toes are unequal *, like those of the variegated species, and of the genus *Corythaix*. A beautiful skin of *Musophaga violacea*, is now before us, with the feet relaxed, so that the parts have all the pliability of life. The middle toe (*a*) is much lengthened, and the hinder (*b*) is the shortest, but the two lateral are perfectly even, and there can be no doubt that their or-

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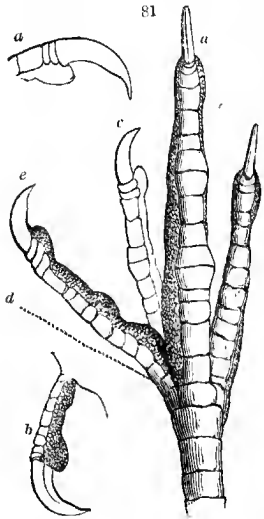

* Species Avium. "*Digiti omnes inæqualis*," articles *Chizaerhis* and *Phimus*; the latter, the *Musophaga* of all other ornithologists. The attempt of this author to strike out the name of *Musophaga* from our systems, and substitute one of his own coinage, will be as futile as it is silly and pedantic.

dinary direction is in front, although not equally so, for the external toe (*c*) has a more sidelong direction than the inner, just as we see in the owls, the structure of whose foot we have already described: so far from this toe being sub-versatile, it cannot be brought even a quarter way round (*d*) without an unnatural effort, so that its ordinary position (*e*) would be about double that distance from the middle toe, which is between the middle and the inner one. In support of this opinion we find that this outer toe is actually connected to the middle one by a distinct membrane, as if to prevent it from having that versatile power which is seen in the cuckows (*fig.* 82.), where this membrane is completely wanting. Other writers, unacquainted, apparently, with the true structure of the *Musophagidæ*, have imagined that these birds connected the order *Rasores* with that of *Insessores;* but we see nothing to justify this opinion, and very many facts and considerations against it. The feet are evidently a union of the perching and the aberrant scansorial characters, without any of the rasorial.

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(131.) Having now attempted to define, with that precision which the present state of science demands, the numerous modifications in the form and functions of the feet in those groups belonging to the Insessorial order, we shall but slightly touch upon such as are peculiar to the others: we have done this briefly; first, because the variations are much fewer, and secondly, because the student will not have the same facilities of comparison, except in such species as are indigenous. Very many of the Rasorial, Grallatorial, and Natatorial genera are composed of very large birds, whose size excludes them from private collections, and which can only be seen through the glazed cases, — often placed in bad lights, and unfavourable situations, — of public museums. Where, as in this case, the greatest accuracy

of description is desired, repeated personal examination is essentially necessary; and this, under the above circumstances, cannot be always attained.

(132.) Feet of the rasorial type, as we have before observed, are remarkable for their size and strength: this holds good in nearly all the rasorial types among the perchers; but their full development is only met with in the order *Rasores* itself. The habit of walking, even among the *Insessores*, is always indicated by a leg whose tarsus is much longer than the hind toe. This is, consequently, a universal character in the Rasorial order, to which is added a smallness and elevation of this toe, not to be met with in the perching order. The lateral toes are always of equal length, and they are connected at their base to the middle one by a short web or membrane: now, was this membrane broader than it really is, it would obviously impede the free action of the joints of the toes; but, by merely extending for a quarter of an inch or so, it gives strength and stability to the walk of the bird. The claws are altogether different from those of the perchers, because they perform different functions: they are very slightly bent, that they may not be injured in walking; they are robust, because they are employed in scratching the ground, and they are greatly depressed, or rather horizontally flattened, that this function may be more effectually performed. The reader will find all these marks of discrimination in the claws of the partridge (*fig.* 83. *a*) when compared with those of the blackbird. The smallness of the hind toe is not a peculiar character of this order, but is common to the two others which form the abberrant circle of the class; namely, the *Grallatores* and the *Natatores*. But as this member is longer in the perching order, it is necessary that some of the rasorial birds should have it of an intermediate length, that the passage from one to the other should be easy, and preserve the universal law of progressive development. We accordingly find that in the family of the *Cracidæ*, which connects the *Inses-*

sores with the *Rasores,* the hinder toe is nearly as long as in the cuckows, and is considerably more developed than in any other group of rasorial birds. We will say nothing of the genera *Megapodius, Palamedia,* and *Menura,* whose feet are well known to be enormous; or of *Opisthocomus,* because specimens of these large and rare birds are not upon our table. Confining ourselves to the genus *Penelope,* we may remark that the toes, considered by themselves, might be taken for those of a cuckow, if the outer one was only versatile; it is evident also, from the structure of the claws, that these birds are much more arboreal than their congeners, for their claws are more curved; and from their *lateral,* and not *horizontal* compression, as well as from their acuteness, we conclude that they are very little, if at all employed in scratching the ground, their structure being similar to those of perchers, and adapted only for clinging. The foot, in fact, of the *Penelope* is not a rasorial, but an *insessorial foot,* for it does not possess any one of the rasorial characters. Even the hind toe, which, in all other rasorial birds, is raised above the heel, is here *placed upon the same level as the anterior toes* (*fig.* 84.). That no ambiguity should rest on this fact, we beg to call the ornithologist's attention to the particular species now

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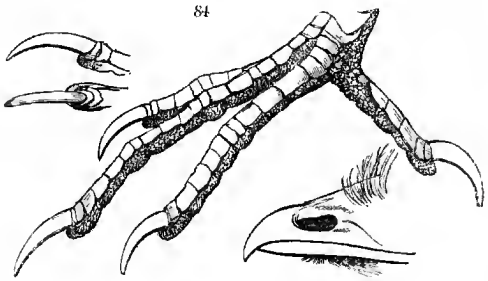

before us, the *P. aracuan* of Spix (ii. *pl.* 74.), one of the most common of the genus. How this remarkable forma-

tion in the foot of the typical *Cracidæ* should hitherto have been completely overlooked, — even by those who have speculated so much on the mode by which the *Rasores* and the *Insessores* are united, — is somewhat extraordinary; we can only account for it by the custom of examining specimens set up in cases, or on branches, instead of preserving them in skins, in which state they can be handled in all directions. But however this may be, the fact itself decides the long-contested question as to which family of the *Rasores* makes the nearest approach, or rather forms the passage to the *Insessores;* while, if this question be reversed, and it is asked which of the *Insessores* makes the nearest approach to the *Rasores*, we need only direct our search among some of the long-legged Brazilian cuckows, or at once point to the singular genus *Opisthocomus*.

(133.) The *spurs* on the feet of Rasorial birds constitute one of the most remarkable peculiarities of the order. They are always placed on a line with the posterior scales, and appear externally of a bony or horny substance, very sharp and conical in some species, and slightly curved, like a thorn, in others. These appendages characterise the male sex, and are used as weapons of defence and offence, chiefly in those battles which take place at the season of courtship. Thus they are analogous, and perform the same functions as the horns of the ruminating quadrupeds, which represent this order in the circle of the mammalia. It is very curious, indeed, to trace the numberless points of analogy between these two groups, and to see how nature herself, in despite of their different forms, makes them represent each other. Rasorial birds and ungulated quadrupeds (*Ungulata*) are the only vertebrated animals* which defend themselves by *kicking* at their enemies.

(134.) The formation of the foot in the order of waders is rather more varied than in the last; for it is in this group, the most aberrant of the class, that we find

* The kangaroo also kicks; but then it is a type of the *Rasores*, in the order *Glires*. See Classification of Quadrupeds, p. 333.

more instances of the disappearance of the hind toe than elsewhere: in this order, also, we have some very remarkable forms, by which the passage from the simply webbed shape to the swimming foot is gradually and distinctly marked. The typical structure is found in the sandpipers (*Tringa*), tatlers (*Totanus*), and snipes (*Scolopax*). In these the three anterior toes are very long, slender, and deeply cleft to their base, and the lateral ones not much shorter than the middle; the hinder toe is much shorter, proportionably, than in the *Rasores*, and is placed rather higher up the leg. The hallux, in fact, in all the above genera, and in most of the others, is obviously rudimentary, and therefore can in no wise be depended upon even as a distinction for a genus, notwithstanding the undue stress that has been laid upon it in two or three instances in the *Règne Animal*. But, as we quit the typical waders and approach the swimmers, we meet with feet totally different; the most remarkable of these forms characterise the Phalcropes, the coots, the jacanas, and the rails: the two first are swimmers, the latter walkers. There may be observed in some of the tatlers a projecting margin or rim on each side of the anterior toes, which appears to indicate in birds so formed, some little power of swimming: now this margin appears the first, or incipient development of the lobed foot of the *Phalerope hyperboreus* (*fig.* 85.); the margin gradually enlarges in *Ph. Wilsoni**, and the toes are connected at their base by a short web; a structure, as Dr. Richardson well observes, which seems to fit it more for walking on the surface of marshes filled with aquatic moss (*Sphagnæ*), than for exercising the full powers of swimming possessed by *Ph. hyperboreus*, and *Fulicarius*. In these two species the membrane on each side the toes is not only enlarged, but divided into distinct lobes, or deeply scalloped membranes; the webs

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* Northern Zoology, vol. ii. p. 405. pl. 69.

also are now greatly enlarged, and embrace two joints of the outer, and one of the inner toe. In consequence of this structure, we find that both these birds are excellent swimmers. Of the first, the same observing naturalist says, "It frequents shady ponds, in which it swims with ease and elegance; its attitudes much resembling those of the common teal, and, like that bird, it is continually dipping its bill into the water, picking up the small insects which constitute its food. *P. Fulicarius* "was often seen swimming on the sea, far from land, on the northern expeditions."*

(135.) The Coots (*Fulica*) have their feet constructed on the same principle as the *Phaleropes:* they are well known to be most expert divers and swimmers, but such bad walkers, that they appear to stagger in their gait, and use their wings as flappers. In no part of the world have we seen this bird in such abundance as on the lakes of Leontini, in the island of Sicily: flocks of 400 or 500 are very often seen sailing on the larger lake during the day, but so shy that it requires great skill for the sportsman to approach them: upon being fired at, the greatest number immediately dive. For this operation their foot is admirably fitted. Next to the jacanas, it has the largest claws among the rail family; the middle toe often measuring four inches, while the size and strength of the whole foot is unexampled in the Grallatorial order: the hind toe, however, is more like that of a duck, and hence we find that, although the coot dives and swims admirably, it walks with difficulty and unsteadiness. The external toe has two, and the middle three, lobes on each side, each pair distinctly divided; these correspond with the number of the joints: the lobes on the inner toe are all united, and the number of four can only be traced by the articulations, and by the margin of the membrane being very slightly scolloped adjoining thereto: the claws are moderately long, strong, very acute, and nearly straight.

* Northern Zoology, vol. ii. p. 407.

(136.) The most extraordinary shaped foot among the Grallatorial birds is that of the jacanas, or spur-winged water-hens. These birds, whose geographic range appears restricted to the tropical latitudes of both hemispheres, are particularly common on the low and inundated grounds of Brazil; and we have frequently seen twenty of them at once, in different parts of a swamp, walking almost upon the water. Such, at least, is their appearance; and, although startling to one who is a stranger to their habits, the deception can be thus explained:—More than two-thirds of the surface of these swamps, where the water is generally shallow, is partially covered with the broad leaves of water lilies and other aquatic plants: it is upon these that the jacana walks while seeking the aquatic insects upon which it feeds. It is clear, however, that, to accomplish this, it must have a very peculiar shaped foot; for, otherwise, the bird would sink in the soft mud below by its own weight. The toes and claws are therefore developed to a most extraordinary length, in order that the bird should be supported by the great extent of surface which its foot covers. The African jacana*, whose body is about the size of

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our green woodpecker, has yet such an enormous foot, that its fore toes measure no less than three inches and a quarter, and its hind one (*fig.* 86. *a*) two inches and a half: the claws are obviously constructed for the sole purpose of supporting the bird upon a smooth and level plain: they are perfectly straight, and of such uncommon length, that the hinder one measures at least two inches. By this remarkable structure the bird is enabled to walk upon half floating leaves, which would

* Zoological Illus. vol. ii. pl. 2.

themselves sink, and plunge any other sort of bird into the water not one third the weight of the jacana; who thus appears, at a distance — where its fragile support is not seen — to walk upon the surface of the lake. It is precisely upon this principle that the snow shoes of the Canadians are constructed, by which they are enabled to walk with ease upon the snow, whatever may be its depth beneath. The foot of the rails (*Rallidæ*), whose habits lead them to the edges of muddy ponds, and who habitually live in marshes and swampy grounds, exhibit a subdued modification of the same structure: the toes are remarkably long; but as these birds roost upon the low boughs which overhang the water, and even in trees eight or ten feet from the ground, their claws (*fig.* 86. *b*) are consequently small in comparison, and sufficiently curved to render them instruments of prehension. It is quite evident that this family (*Rallidæ*) is the scansorial group of the *Grallatores*, and equally represent the *Cracidæ*.*

(137.) For a swimming, or natatorial foot, we have been prepared by the genera *Phalaropus*, *Fulica*, and *Podoa:* the last of which is perhaps the connecting link between the *Rallidæ* and the *Anatidæ*, or ducks: the long legs, however, of the waders are still continued to the *Flamingo*, the most aberrant type of the circle of the *Anatidæ*, to which, in every other respect, it has an intimate and unquestionable affinity, as will subsequently more fully appear when we come to the Anatine circle. The typical form of a natatorial foot is to have the tarsus very short, the three anterior toes lengthened, and united by a mem-

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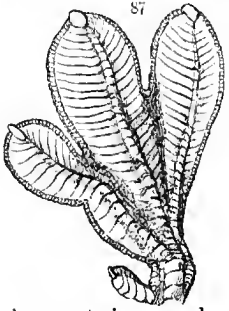

* *Fig.* 86. *c* represents the bill of a most singular rail from Senegal; while the hinder toe and claw (*d*) does not differ in the least from that of the generality of the species (*b*). It is our *Rallus carinatus* of the Appendix, and of the "Birds of Western Africa."

branaceous web, which extends to their extremities; by this means it is transformed into a paddle or oar, and it is found that all birds having a foot thus constructed, are better swimmers than those of any other order. Superiority in diving, however, seems to require a structure of foot more similar to that of the coot; for in this respect no genus is so highly gifted as the grebes (*fig.* 87.)

(138.) The webbed form of foot is the most prevalent in the natatorial order; but it has three or four modifications which deserve notice. When this structure is accompanied with a more than usual length of tarsus, and the thigh is naked just above the knee, we may feel assured that the power of walking is superadded to that of swimming. Every one knows how awkwardly a duck walks, or rather waddles, in comparison to the goose: this difference entirely arises from the length of their respective tarsi; that of the former is very short; that of the latter much longer. Hence the flamingo, which has the longest legs in the Natatorial order, is so good a walker that it only swims occasionally. It is by this formation that the gulls so materially differ from their congeners the terns, whose very short and weak legs are incapable of traversing the shore in search of those marine animals which the gulls walk after, and collect at each ebb of the tide. We have seen that the grebes, which are the most expert divers, have their hind toe broad and lobed. As an additional proof that such a form, although not essential to swimming, is yet, in some inexplicable way or other, very important to great powers of diving, we need only look to the oceanic ducks of the sub-family *Fuligulinæ*, which are only distinguished in external structure from their brethren of the rivers (*Anatinæ*) by having their hind toe broad and lobed, which the fresh water ducks have not. It is well known that, while the former dive with great expertness, the latter do so but seldom.

(139.) In the penguins and the cormorants the hinder toe differs from that of all the other natatorial

families, in being placed almost as forward as in the swifts. We know too little of the manners of these birds in their watery element, to conjecture the sort of influence this structure would exercise during the act of swimming. It seems, however, from the united testimony of voyagers, that when upon land the penguin's attitude is perfectly erect: indeed, it could not be otherwise, the legs being placed so far back, and past the equilibrium of the body. The same position is assumed by the cormorants when watching for their prey; and yet the form of the hind toe in these two genera is so different, that this general character in their habits will not explain the reason of the variation. In the penguin (*fig.* 88.) the tarsus is so short as almost to be confounded with the sole of the foot; and it is probably rested upon the ground for its whole length when the bird walks, just as in the bear and other plantigrade quadrupeds; it is also remarkably broad: the hind toe is placed in front, and on the inner margin; but it is so unusually small, that, but for its short, but well defined claw, it would not be perceived. This claw is without any vestige of a web, or of a lobe, and is quite disconnected with the others: of the three anterior toes, the middle is the longest, the outer rather less, and the inner by far the shortest. The whole foot is remarkably flattened, being near twice as broad as it is thick, as if to enable the bird to cover a greater breadth of ground than ordinary. The cormorant's foot agrees in having the hinder toe brought forward; but here its similarity to that of the penguin ceases. The tarsus is somewhat longer, and instead of being compressed in front, is compressed on the sides; the toes are long, and so arranged in their relative lengths, that the outermost is the longest, and the three others rapidly diminish in length; all four being connected to each other by a membrane which reaches to the claws. From this it would appear that such


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a foot is more adapted for swimming than that of the penguin ; and yet it is asserted by voyagers that these latter birds swim with such amazing rapidity that they will pursue and overtake even fishes ; upon which, indeed, they chiefly live. This fact would be perfectly incredible, did it not explain indirectly the true use of the abortive wings of these singular birds, which being used as fins, gives them this superiority of swimming over all other birds ; and confers upon them the possession of four members for this express purpose, when all other birds have only two. That law of nature pervading every part of the animal creation, which preserves the balance of powers and of faculties, by giving additional power to one organ, if another is unusually weak, is no where more strikingly and wonderfully displayed than in the penguin and the frigate pelican (*Tachipetes*). The one is, perhaps, the longest, and the other the shortest, winged bird in creation, and yet it is in these very members that the law in question is demonstrated. The feet of both birds, upon land, can do no more than barely support the body ; but, to compensate for this apparent deficiency, nature has thrown such additional powers into their wings, that all other birds must confess their own inferiority. And yet these powers are of a totally different kind ; nay, they are the very antipodes of each other. The penguins would seem to make their way under water with almost the same celerity as the swallow does in the air ; but this is entirely owing to the peculiar structure of their wings. In the air the bird is utterly helpless, and would fall to the ground like a lump of lead. Now the *Tachipetes* has a foot even still more useless for all other purposes than the penguin ; it is fully as short, yet the membrane between the toes, from scarcely reaching to the first joint, precludes the bird from swimming : its foot, in short, like that of the humming-bird, is a mere instrument of rest to support the body. How then, it may be asked, does the bird live. It may almost be said to live in the air. Its immense extent of wing,

when compared to the size of the body, is almost without parallel, excepting, perhaps,in the swifts. The flight of the eagle, strong, majestic, and beautiful, as it certainly is, cannot be compared to that of the frigate birds either for grace, celerity, or loftiness. Few will be disposed to believe this assertion until, by crossing the tropics, they become eye witnesses of the astonishing powers of flight which nature has bestowed on these birds. They seem to delight in that war of elements which would overpower almost all other birds, but which to them appears the season of pastime. At one moment the frigate bird may be barely perceptible as a moving speck above the mast, while the next, a sudden splash in the wave will tell that it has fallen upon a fish, or caught one that had been previously captured by the boobie, who had relinquished it on the appearance of this irresistible flyer. It has been said, and we believe the fact, that the frigate bird has been seen near a thousand miles from any known land, for the rapidity with which it flies appeared to us far greater than that of the swallow, and to be effected with scarcely any motion or beating of the wings. Thus has nature adhered to her law. No birds in this order are gifted with such extraordinary powers in their wings as these two; and to no birds are the usual functions of the feet so much denied.

(140.) The SONG or the language of birds, has been a subject of fruitful speculation among the French writers, and a useful abstract of what they have advanced will be found in some of our recent compilations; nevertheless, there is much of error, and some exageration, in these statements. The subject is in many respects interesting, but, as it is more physiological than scientific, we shall in this place treat it with brevity: passing over what has already been published, for the purpose of treating the subject with reference to the natural classification of these songsters. The powers of voice are certainly greater in birds, when their size is considered, than in any other class of animals, or even in MAN. This

fact is established by experience, and by comparative anatomy: we know that the crowing of a cock may be heard at a far greater distance than the shout of a man, even had he the lungs of Stentor, and it may be even questioned whether the same remark may not be applicable to the full and sonorious warbling of the thrush. We have no data to estimate the comparative loudness of voice between quadrupeds and birds, in proportion to their sizes; nor is it very material to labour upon such nice distinctions. It is only in these two typical classes of the vertebrated circle, if we except the hissing of serpents, and the croaking of frogs, that the voice is sufficiently developed to emit sounds, audible and definite. The voice of many quadrupeds is capable of different degrees of intonation which, as they are understood by their kind, is without doubt a language. The lowing of the cow, when slowly wending "o'er the lea," to the farm yard, is very different from that which it utters when separated from its young; and, again, from the bellowings of fear or of rage. In the dog, how many varied intonations will be found: but it is among birds alone that these sounds assume harmonious gradations. But has nature restricted the power of uttering sounds to the vertebrated circle? Every entomologist knows the contrary. A large portion of the natural order of *Hemiptera* Lin., among insects, are, perhaps, the most noisy beings in creation; nor is this noise altogether unmusical: the ancients, indeed, so much admired the shrill chirpings of the Cicada, that one of their poets has made this insect the subject of an ode. Now the order *Hemiptera*, in the circle of the class *Ptilola*, or winged insects, occupies precisely the same station as the class of birds fills in the circle of the vertebrata. So that nature, ever true to her beautiful system of representation, makes the *Hemiptera*, by this peculiar faculty, to be the birds of the insect world: both perch upon trees and both sing (though by different means), for a long continuance, and in their most alluring notes, during the season of courtship. Detach the *Cicadas* from the

Hemiptera of Linnæus, as some entomologists have lately done, and this most beautiful and perfect analogy is altogether lost.

(141.) Without attempting to assign causes for every thing we see in nature, it may safely be affirmed that one, at least, of the reasons why so much strength of voice has been given to the feathered creation, is, for the purpose of mutual recognition and companionship. Quadrupeds living upon the ground, when in quest of their mates, can discover them by sight, and by smell, for this latter faculty they enjoy in a much higher degree than birds — besides, they do not wander so far or so often from each other, and even then, being more or less exposed, they may be detected by the sight, or at most by a slight exertion of the voice. But with birds the case is far different: they separate from their fellows at wider distances, and even when comparatively near they cannot recognise each other (at least those of the arboreal tribes) by reason of their diminutive size, and the foliage of trees or plants. Hence it will be observed that the sexes of those species which habitually live together at all seasons, utter at intervals a peculiar sort of twitter whenever they quit one tree for another, as if to keep their mates constantly informed of every fresh movement. We particularly remarked this fact in a pair of bullfinches which crossed our path in a shady lane this morning: sometimes they were both on the same side of the hedge, and sometimes opposite each other, never separating to a greater distance than fifteen or twenty yards: when nearer, this calling note was not heard, but so soon as one flew to another bush, in search of fresh food, it apprised its companion, who immediately followed. The same little signal notes are used by perching birds, which feed in societies, as the goldfinch and long-tailed titmouse, no less than by the wren in the spring, when exploring with its mate the best spot for erecting their new nest, or gathering materials for its construction. In autumn, however, this latter bird is solitary, and it flits across our path, or explores the tangled hedge, a silent

and a solitary rambler. That this is the chief reason of the great development of the voice in birds, will be further manifested by looking to the *Mycetes*, or howling monkeys of Brazil. The Brazilian hunters assert that those whose voices are the most powerful are solitary, and that they do not live, like the other monkeys, in troops. When in quest of their mates, they ascend one of the lofty trees of the forest, and from thence send forth those hideous howls, which can be heard at a distance of near a mile. This cry is always made after sunset; so that, although we frequently heard it, the nature of the trackless and almost impenetrable forests where these monkeys reside rendered it dangerous, if not impossible, to verify this account by personal observation. There is strong analogy, however, in support of the fact; for, as neither sight or smell would at all serve this quadruped for the accomplishment of the alleged object, the powers of voice have been wonderfully increased, precisely upon the principle that it is highly developed in the generality of birds.

(142.) The musical intonation of the voice in birds does not appear connected with any function absolutely necessary (as in the last case) to its well-being, but is rather a faculty given them to increase their enjoyment and happiness. There can be no doubt, as we shall presently see, that this faculty is intimately connected with that of love, in the season of incubation; but the sensibility and the sentimentality of Buffon and his lively countrymen is carried too far, when they assert that the song of birds is nothing but the expression of love, and that after the time of incubation the woods are in general silent.* It is really time that the historians of nature, at least, should throw aside these and similar fictions, which have either been long refuted, or which the slightest knowledge of the subject is sufficient to dispel into "thin air." It is very true, that as the autumn, in our northern climates, advances, the woods

* Griffith's Cuvier.

are in general silent; and it would be strange, indeed, if they were not, seeing that the greatest part of our song birds have taken their departure! Had a little further inquiry been made, there are many travellers who could have told Buffon, that in more genial climates, and especially between the tropics, the forests resound all the year round with the notes of birds, both before and after the season of incubation, while the autumnal song of the robin, long after that period, refutes the idea that birds do not naturally indulge themselves in this delightful harmony except in the season of courtship. The faculty, in short, is indicative of general pleasure, for we see it exerted at all seasons by canaries and other birds kept in cages, where food and warmth is provided. It is, of course, most apparent, in our latitudes, in the spring, when all nature seems to burst again into life, and the instinct of reproduction pervades both the vegetable and the animal world. Whether or not the power has been given more especially to the male, for the purpose of attracting the female, in the first instance, may be a matter of doubt; but that this faculty is intended to solace her during the long, and otherwise tedious, period of incubation, cannot be questioned. Few persons are aware that the common house swallow has one of the most varied and long continued songs of all those birds which come to us in summer. A pair of these have now for four years built their nest within three yards of our study window, and while the female is sitting, the male perches on an adjacent prominence, and continues to solace her, and please himself, at frequent intervals, all the day long. Our little wren, on the other hand, seems to send forth his quick and sharp song in the spring, from the mere overflow of animal spirits, and at times when he is completely alone, and flitting from hedge to thicket in search of insects.

(143.) To attempt the description of the different modes of singing, or more properly of the different languages of birds, is quite impossible, even would our

space admit of the discussion. Almost every bird has a peculiar language, understood only by its kind. The notes of all birds, indeed, are of two very different sorts. One may be compared to speaking, the other to singing; the first of these probably pervades the whole feathered creation, for there is no birds yet discovered which, even so far as they have been observed by man, are altogether silent. The power of song, however, is confined, comparatively, but to few, all of which belong to the two great typical orders of the class, the *Raptores* and the *Insessores*. The gallinaceous birds, however, have by far the loudest voice, while that of the waders and of the swimmers can be compared only to a scream. Few persons would suspect that any of the rapacious birds possessed the faculty of song, for the hoot of the owl is probably only a call or signal to its mate, and cannot be supposed to recreate itself. Vultures are still more taciturn, at least we never heard them utter, in Brazil, more than a gruff *caw*. But there is a species of falcon, discovered by Le Vailliant in the interior of Africa, and named by him *Le Faucon Chanteur*,* which is a remarkable and almost a unique instance of melody in a bird of prey: the sexes are truly conjugal, living together at all seasons: the song of the male is particularly strong when the female is sitting on the nest; he will then solace her for hours together, beginning with the dawn and continuing at intervals until sunset; nay, so completely is this bird the nightingale of the rapacious order, that its song is not unfrequently heard during the greatest part of the night. It would seem that this falcon belongs to the Accipetrine group of the family, which represents the *Insessores* in its circle, and thus the analogy already remarked between birds and hemipterous insects is continued to the circle of the *Raptores*.

(144.) Melody of voice may be considered altogether peculiar to the vast order of perchers, for the only ex-

* Ois. de l'Afrique, vol. i. p. 117.

ception to this law, we at present know, is the instance just cited. Yet, although the Insessorial birds are thus distinguished, the faculty is restricted to certain families, while it is totally denied to others. The Dentirostral tribe is more especially distinguished in this respect, for in that group we have the whole of the thrushes, mockbirds, warblers, nightingales, robins, &c. The Conirostral tribe, in the typical examples, does not contain many songsters; but in such groups as blend into the adjoining tribe, we have the whole family of finches, which includes the bullfinches, linnets, goldfinches, canaries, and all the thick-billed songsters, whose strong and varied notes are commonly heard in the woods of Europe. It appears difficult among so many songsters, each varying in its style and intonation, to decide which family is entitled to the most pre-eminent station. The chirping school, however, must give place to the warbling style of the thrushes and the nightingales, whose full and rich melodies are certainly superior to the notes of the canary. But when to the perfection of the thrush is superadded the power of imitating the notes of all others, the mockbird (*Orpheus polyglottus*) must be enthroned as the queen of the feathered songsters. The astonishing vocal powers possessed by this celebrated bird have been dwelt upon by one whose description unites the truth of prose with the feelings and beauty of poetry. The English reader may be inclined to think the picture of the American mockbird drawn by Wilson, is somewhat too highly coloured; but even admitting this, for the sake of argument, still the simple fact would remain, that this species can naturally imitate, "to the life," the song of every other bird, almost of every animal, which it once hears, while at the same time it possesses a rich and peculiar song of its own. We cannot say thus much of any European bird, and their powers are consequently inferior. Birds possessing this natural habit of imitation are not, however, confined to the genus *Orpheus*. Some of the shrikes employ this faculty for the purpose, we may conjecture, of alluring small birds

within their reach; while in one or two of the hang-nests (*Icterinæ*) it is used, probably, as a recreation, since these birds feed only upon fruit and insects. One of the Brazilian water-chats (*Fluvicola*) is also stated to possess the same faculty. But setting these, and a few other isolated exceptions aside, we shall find that, out of twenty-five families of birds composing the order of the perchers, five only may be said to enjoy the faculty of melodious singing to any great extent; three of these are in the tribe of *Dentirostres*, and consist of the thrushes (*Merulidæ*), warblers (*Sylviadæ*), and such part of the chatterers (*Ampelidæ*) as compose the genera *Vireo* and *Pachycephala*. The remaining two are the finches (*Fringillidæ*), and the starling (*Sturnidæ*), in the adjacent circle of the conirostral tribe (*Conirostres*). Both series, however, are conterminous, for they follow each other without the intervention of any other family: thus showing, that however partially nature has distributed this gift, she has acted with all the regularity of system in its allotment. The instances just before cited of the swallow and the wren, neither of which birds are within the limits alluded to, does not invalidate the general force of this rule, but must be rather looked upon, like that of the musical falcon, as resemblances of analogy, rather than as marked deviations from a general law.

(145.) Of the remaining families of perching birds it may be more correctly said that their voice is restricted to the use of language, or in other words, is employed only to express their wants or their desires. The crow does not sing, but every field naturalist must have remarked how much its *caws* are varied when the bird is engaged in different occupations: this is particularly observable during their flight, when two or three companies meet in the air, and when the whole are obviously reconnoitering the fields below them, and consulting where they should next alight. To the ordinary pedestrian, all these curious, if not interesting, traits are lost; but we know not a more agreeable rest,

after a long spring day walk, than a sunny bank of primroses, where we can watch the varied evolutions of different companies of these birds, and "idly speculate" upon the meaning of their language, by the results which follow. Sometimes a single crow will leave the flanks of its company, and after uttering two or three *caws*, in a very peculiar tone, wheel off in a totally different direction to that in which the rest are going, without turning to see whether his companions will follow him; but the signal is not lost to the leaders of the company; they turn the column, and, after a semicircular evolution, they all follow after the instigator of the movement, who is then, perhaps, a quarter of a mile ahead. Human language cannot speak more plainly than this; it is the expression and the communication of ideas, and yet the crow is destitute of the power of singing. Further instances are quite unnecessary to show the radical difference between the two sorts of language in birds; a distinction which those who have written on the subject seem to have completely overlooked.

(146.) STRENGTH of voice is one of the characteristics of the Rasorial order, and of its types through the whole of the Insessorial circles; but the volume of sound which they utter, is not only devoid of all melody, but is monotonous and discordant. The crowing of the cock, although in some measure pleasing from poetic or other associations, is nevertheless harsh and grating to the ear, particularly if often repeated, while the cackle of the hen is quite as tireing and monotonous as the clapper of a mill. The natural cries of the parrot family are only loud and hideous screams, which echo through their native woods, and stun the visitors of menageries. Turkeys, partridges, and peasants, have more or less the same character of voice, so that the only harmony to be found among the whole of the *Rasores* must be looked for in the most aberrant family—the pigeons, whose cooing is particularly soft and soothing. We may trace the discordant voice of the true Rasorial birds

through nearly all others which represent them among the perchers. Thus, for instance, the long-legged thrushes (*Crateropodinæ*) are the loudest of their tribe, and one species, the *Donacobius vociferans** of Brazil, is such a perpetual monotonous and discordant babbler, that we have frequently rushed out of the house to drive it away. The *Fluvicola nengeta*, a water-chat of the same country, is stated to have a loud and most disagreeable voice.† We can certify this to be a fact in regard to the genus *Synallaxis*, for we have named a species from this very circumstance.‡ Similar instances are found in the genera *Brachypus*, *Seïsura*, and many others; setting aside the wild scream of the woodpeckers, which are much more discordant than that of the jay. The parrots we have already mentioned. Now each and all of these groups are Rasorial types, that is to say, they represent the gallinaceous birds in their own circles; and while they tend to show that the voices of birds have been regulated by fixed laws, they serve for a list of the most discordant birds in creation. The wild notes of the wading and the swimming tribes are too partially known to admit of any general conclusions being at present drawn respecting them; and, in a work of this nature, detached facts are only introduced when they illustrate others of more general import.

(147.) The power of *imitation*, or of mocking, is either natural, or is acquired in a state of captivity. We have touched upon the former because it belongs to the *natural* history of a bird; but we have no space to enter upon the various acquirements in which tame birds, by dint of perseverance, have been instructed. Several species, to whom melody has been denied, and others whose natural language is monotonous and discordant, have been taught to whistle tunes and to pronounce human words. The crow family and the starlings, but

* Zool. Illus. ii. 72.
† See Latham's Synopsis, on the authority of Maregrave.
‡ Zool. Illus. i. Synallaxis garrulus, pl. 138.

more especially the parrots, are well-known to be susceptible of these sorts of acquirements; the superiority of the latter, in this respect, can be traced to the pre-eminent docility which characterises the Rasorial type of nature, whether seen in the parrot, the fowls, or the ruminating quadrupeds.

(148.) In reference to the peculiarly loud and discordant voices of the Rasorial types among birds, we may draw the reader's attention to the singular fact, that the very same principle is to be traced in the order of quadrupeds which represent the *Rasores;* namely the *Ungulata*, which is typically represented by the ruminating animals. The loud bellowing of all the different species of oxen, buffaloes, and large antelopes, afford a striking contrast to the comparative feebleness of voice in most other quadrupeds. The lion is the greatest exception, and it has no more influence to invalidate this argument, than the musical falcon has to overthrow that which proves the Insessorial birds to be the musical order. There is nothing gentle or harmonious in the bellowing of oxen, although, from custom and the association of ideas, it is not at all disagreeable. The roar of a bull we know is terrific, and that of a bison must be equally so; and if not superior, we should think fully equal in strength to that of a lion.

(149.) The NESTS of birds is the last subject which strictly belongs to this part of our treatise; and although it is replete with much of scientific as well as of popular interest, our space will not permit us to treat it otherwise than in a general way. With the exception of the beavers and a few of the mouse-like *Glires*, birds are the only vertebrated animals which construct temporary habitations. In this peculiarity we have an additional point of analogy between them and the winged class (*Ptilota*) of insects. This instinct seems to be a necessary consequence of their oviparous nature; for, as warmth is essential to the hatching of the egg, it is obvious, that, were all to be exposed to the heat of the sun, like those of the ostrich, no eggs could be matured

in temperate and uncertain climates like our own; or where there was little or no sand to protect them from observation and external injury. Hence it is that nature has endowed these little architects with an instinctive knowledge of fabricating temporary abodes, which are often patterns of skill and contrivance; and, when we consider the fabricators, almost miracles of execution. And yet this faculty, like most others, is neither given to all, or in the same degree to such as possess it. Hence we see as great a variety in the form and construction of nests, as in the situations in which they are placed. All writers on the subject have observed this, which is indeed apparent even among our native birds; but no one seems to have had any idea that in this infinite diversity, there is every reason to believe as much order and system exists as can be found in the form and structure of the birds themselves. Some birds build in trees, some upon the ground, some beneath the surface, and some not at all. Each of these again present us with a diversity of operations, of forms, and of circumstances, all calculated to display that endless and astonishing variety which gives such a charm to creation, and silently, though emphatically, speaks of its great and wonderful Author.

(150.) We shall commence our remarks on the subject with such birds as build their nests upon trees, and which may be therefore termed arboreal. Of these there are many sorts, differing both in form, construction, and situation. Now as this art is one of the grand characteristics of the feathered creation, we are naturally led, by analogy of reasoning, to expect that it will be most conspicuous in that particular order which shows us, in every other quality, the perfection of the class. In this we shall not be disappointed; for the most elaborately constructed nests are those of the Insessorial birds; that order, in fact, which is pre-eminent both in faculties, in song, and in building. Previous, however, to entering upon this extensive order, we shall briefly notice that of the *Raptores*, or birds of prey, premising that in

whatever circle they are placed, nearly all groups or forms which represent the *Insessores*, are the most perfectly typical of that particular sort of nidification which is most general in their own circle.

(151.) The nests of Raptorial birds are seldom met with: this arises both from the comparative rarity of the birds themselves, and from the secresy or loftiness of their situations. Our information, therefore, upon the greater part of the species, even those which are natives of Europe, is very defective: the best modern work on European ornithology scarcely informs us of any thing more than that the majority build in lofty trees or inaccessible rocks or precipices, without even stating whether the nest is composed of a natural cavity, or fabricated by the bird. It cannot, indeed, be expected that field ornithologists should risk life and limb in order to ascertain such points. We merely advert to the fact as explanatory of our defective information, and the impossibility of generalising our remarks to the extent that might be wished. Even when our systematic writers allude to the nests of these birds, it is generally from hearsay, or from the vague accounts of ill-informed travellers or other persons. Such accounts cannot, in consequence, be depended upon, particularly if they are at variance with the testimony of such men as Azara, Wilson, Hutchins*, Richardson, and Montague. Of the nidification, for instance, of the different genera of vultures, we know absolutely nothing further than the account of the *Cathartes aura* given by Wilson, who says that it makes no nest whatsoever, but deposits its eggs on the rotten wood of the excavated stumps, or the top part of the broken hollow of a tree. Eagles seem to be the most perfect builders of their order, fabricating strong and capacious nests from the materials used: these nests appear to be rude, but they are, in reality, not more so than those of the most delicate Pas-

* Both Pennant and Latham are indebted for all their knowledge of the manners of the Northern American birds to the patient and accurate observations of this little known, but truly eminent, ornithologist. See Northern Zoology, vol. ii. preface by Dr. Richardson.

serine bird. Could we magnify, for instance, the nest of a chaffinch to the same dimensions as that of an eagle, it would appear just as coarse, the delicate grass and moss of the one would be as thick as the twigs and sticks of the other; the difference, in short, is not in the degree of skill that is employed, but in the materials which are used; and these latter are proportioned to the size and weight of the bird which is to lodge within. There is as much difference, in point of delicate materials, between the nest of the chaffinch and the humming bird, as between the former and that of the crow; and it would be utterly out of character that an eagle should construct its habitation of moss, lichens, and such slender materials as could not possibly support the weight it was intended to bear. We merely introduce these remarks to do away with the impression — certainly erroneous — that because the nests of eagles and some other large birds are "rude," that is, of strong materials, they are consequently ill or carelessly made. It would seem, from all we can gather from authors, that the nests of eagles are exposed, that is, built either on the loftiest trees, or upon the ledges of rocks; such, at least, are the situations chosen by the golden and the white-headed eagle: of the latter, Dr. Richardson says, that it makes a "rude nest of sticks, lined with hay, on the ledge of some inaccessible rock, generally overhanging a rapid (the reach of a river), or in a lofty and solitary tree."* The typical falcons, on the other hand, build theirs in the natural excavations of old trees: this has been observed of the kestrel; and Wilson, speaking of the *Falco sparverius*, says that its nest is formed in the hollow of a tree, "pretty high up, where the top, or a large limb, is broken off." The Accepitrine hawks, closely allied to the last, choose the same situations; but in what manner — that is, the degree of skill — the nest is made does not appear. Indeed, it may be even questioned whether they fabricate any nest; for birds which, like the kestrel, breed in the

* Northern Zoology, vol. ii.

"*holes* of rocks*," very often deposit their eggs among the loose and decayed vegetable substances that are generally found within. The buzzards differ materially from the three preceding groups of falcons in their nidification, no less than in their general structure; for their nest is either placed upon, or very near to the ground. Thus Bewick remarks that the nest of the moor buzzard is placed a little above the surface, or on hillocks covered with thick herbage, while that of the *Circus cyaneus* is stated to be placed on the ground: the American variety builds indifferently on the ground, or on low bushes.† The common buzzard seems to differ materially from the foregoing, inasmuch as it builds in trees. It may be questioned, however, whether this species really belongs to the *Buteoninæ*, for its manners, in other respects, are totally different from such falcons as hunt, like swallows, for their prey. As to the nidification of the kites, we can find no account sufficiently explicit to be quoted as an authority. Meagre as our materials are, we yet see that, so far as they appear authentic, there is presumptive evidence that each family, or group, even among the falcons, have a peculiarity of nidification, which a better acquaintance with other species would substantiate by more numerous examples. The owls are no less peculiar; whether they deposit their eggs in a tree, or in a building, or upon the ground, a *hole* is always selected for the purpose; and the great majority, if not the whole, never appear to construct any nest. We shall subsequently have occasion to advert to this fact.

(152.) The order of Perchers not only comprehends nearly the whole of the remaining arboreal builders, but contains examples of all the other modes of nidification found in the remaining orders. We shall commence with such as build in trees, either singly or in societies, and then proceed to notice such other groups in the order as deviate more particularly from this typical character of the whole.

* Bewick. † North. Zool. vol. ii. p. 56.

(153.) In regard to *solitary* builders, we find all the purely insectivorous genera are of this class. Among the shrikes, thrushes, warblers, titmice, and fly-catchers, there is not an instance of one species either living or building in societies. The same may be said of carnivorous quadrupeds, which, with the single exception of the genus *Canis**, pursue their sanguinary habits alone, or accompanied only by their mates. In proportion to the development of the social principle is the disposition, not only to live, but to breed in societies; but neither one or the other is manifested in the birds we have just mentioned, at least to any extent. Fieldfares, it is true, are seen congregated into loose flocks towards autumn, and the long-tailed titmice form small parties, probably family ones, at the same season, but neither are known to build together.

(154.) To describe the construction of an ordinary nest would be superfluous; the coarsest materials are always used in the first instance, as if to form the basis of the whole, and as the building proceeds, finer materials are selected; last of all comes the lining, which is generally composed of hairs, or some other elastic substance, to preserve the form of the concavity, and with feathers to create additional warmth: for an arboreal nest of this description a firm support is necessary; hence it is generally placed between the forked branches of a tree: this answers many purposes; the nest is not liable to be shaken by the wind, its base is firm, and being, as it were, in the centre of the foliage, it is more effectually screened from observation. Numerous instances of this sort of nest occur among our insectivorous and granivorous small birds; the most delicate of these are made by the chaffinch and the goldfinch. Variations from the structure and situation of these are seen in the nests of sparrows and fly-catchers, where the materials are coarser, and the fabric placed on the side of a building. The hedge accentor, again, builds near the ground, and

* This comprehends the wolves, dogs, foxes, and hyæna-dogs. See Classification of Quadrupeds.

the larks upon it: but the construction of all these nests is upon the same general principle, however different may be the materials employed, or the degree of its elevation.

(155.) *Pensile* nests are altogether peculiar to perching birds. They show many variations both of form and construction; but all these are very different from those of the ordinary shape, both in the plan upon which they are fabricated, and the mode by which they are secured. The first indication of this fabric is seen in the nest of our common wren, one of which was erected this spring among the creepers trained round our portico. Its shape is irregularly oval, and is so disproportionate to the size of the bird, that its greatest length measured near twelve inches; externally, it seemed like a large bunch of withered leaves that had accidentally got entangled among the slender and sinuous stems of the clematis, and the thicker branches of a sweet-brier. Upon looking at it more attentively, however, a round opening appeared on the side, just large enough to admit the entrance of its little architect. Now a nest of this description has not a regular base, and yet it cannot be termed pensile or suspended; it is evidently between the two, being as much supported by the twigs above and on its sides, as by those upon which it would seem to rest: perhaps we might call this form a *roofed* nest, inasmuch as by the entrance being lateral, its inhabitants are completely screened from the weather, and from external observation.

(156.) The change of nidification from ordinary nests which are exposed, to those which are concealed or covered, is marked by a beautiful gradation; for those of some of the tomtits are open above, and yet they are covered. This union of styles is effected by the nest being fabricated in a natural hole; by which it is, as it were, roofed in, without any additional labour of the bird. The blue titmouse (*Parus cæruleus*) has for several years built its nest within a crevice of an outside wall, caused by the giving way and bulging out of the stucco; the

external crack, however, is so narrow, that we could not at first be persuaded there was sufficient room for a bird to enter: wishing, however, to ascertain the fact, we endeavoured to get in the fore finger and thumb, but quickly withdrew them upon hearing a loud and determined hissing noise, exactly like that of a serpent; and such we began to fancy was the real inhabitant, until, retiring to a short distance, we presently saw one of the parents fly into the crack and soon emerge again. To show that the laws of nature in regard to nidification are as strongly implanted in birds as are their other instincts and habits, we shall here relate another anecdote of the same species, which places this fact in a singularly strong light. The pump in our garden has an outer frame work of wood, the top being roof-shaped, and lifting on and off, in order the more readily to facilitate its repair. The spring of the year 1832 being rather wet, the pump was not used for some few weeks; the weather, however, soon became dry, and on trying the pump, and finding great obstruction, we removed the cover, which had only been half put on, in order to ascertain the cause: this was at once apparent, for the cylinder was completely choked up with hay, moss, and feathers, all the materials, in short, and in great quantity, for a nest; and upon getting these out, five or six eggs were found of the blue titmouse. Surprised at the oddity of the bird in selecting such a situation for its nest, we cleared the pump, and concluded the affair was settled. But, no. Three or four days after, upon attempting to get water again, the pump was as much obstructed as before; two or three handfuls of hay and moss were again taken out of the cylinder, and the pump was again used; before, however, the same period had elapsed, it became again choked, and, for the third time, it was again cleared of even more litter than before. Now it was quite evident, on the two last occasions, that the birds continued, with unexampled perseverance, to bring fresh materials as fast as those they had deposited became wet; for, after the

first nest had been destroyed, the pump was in daily, although not frequent use — perhaps for an hour every evening: this fact was evident from the surprising quantity of materials that was taken out at each time, and which were sufficient to have constructed five or six ordinary nests. How long these most industrious little builders would have persevered in this effort to build, as it were, upon water, it is impossible to say. But as either the garden must have suffered, or they be fairly driven out, we chose the latter alternative: to put an effectual stop to further attempts, the top of the pump was taken entirely off; the removal of this *natural shelter* had the desired effect, and no other attempt was made. It should have been observed, that owing to the decay of the wood work, there was a small hole on the side, which enabled the birds to pass in and out of the frame, even when the top was covered over. This inveterate habit of building under cover is not peculiar to the blue titmouse. Montagu, the best authority on this subject we can quote, has the following observations upon our British species.* "The Cole titmouse likewise builds in some hole, either in a wall or a tree. The great titmouse has all the habits of the blue species, and builds in a hole of a wall or tree;" and, he adds, curiously enough, "we once found it in the barrel of a garden pump." But let us proceed a step farther, and having traced in the titmouse the passage betwcen an uncovered, or ordinary nest, to a roofed one, as seen in the wren, we shall proceed by another gradation, also exhibited in the genus *Parus*, which will lead us at once to the pendant structure.

(157.) The long tailed titmouse (*Parus caudatus*) observes Montague, "makes a curious oval nest in the fork of some bush or branch of a tree. In this particular it deviates from the rest of its class, which invariably build in some hole; the bearded† and crested

* Ornithological Dictionary, original edition.
† The nest of this species was not then known to British naturalists.

titmice, perhaps, excepted, but which remains to be discovered. The nest of this bird, however, is equally well secured, being made of white moss and liverwort, curiously and firmly wove together with wool, covered at the top, with only a small hole on the side, and lined with a prodigious quantity of feathers." Bewick, however, is more to our present purpose: — "The nest of this bird is singularly curious and elegant, being of a *long* oval form, with a small hole on the side, near the top, as an entrance; its outside is formed of moss, *woven* or matted together with the tree and the stone lichens, and *fixed with fine thread* of the same silken material: from the thatch the rain trickles off without penetrating it." We may here trace a further, although a slight advance to the pendulous structure, in the words marked by italics; and equally gradual is the progress towards the pendulous, or purse shaped, form, indicated by the fact of the marsh titmouse making the bottom of its nest (which is built in the hollow of a decayed tree) "larger than the entrance."* Of the nest of the bearded titmouse, although by no means a very rare native bird, we have not met with a description by British writers; but, if either of the two following accounts are in any degree correct, they will sufficiently answer our purpose. Dr. Latham says, "as to the nest and its construction, we are in no certainty about it: one brought to me for such, was composed of very fine materials, suspended between three reeds drawn together. Kramer says it makes the nest among the willows, *in the shape of a purse*, and of downy materials."† Now, it is clear, that as these birds build among reeds, whose stems are never forked, their nest cannot, by any possibility, repose upon a *base*. The only way in which it can be attached must be by being entwined, or interlaced, round three or four perpendicular

* Latham's General History of Birds, vol. vii. p. 252.

† This is the structure of the nests fabricated by many of the European aquatic warblers of the genus *Curruca*, several of which will be found figured in Sepp's Birds of the Netherlands.

stems, which would thus be brought nearer together*, and support the nest on its *sides*, but not on its bottom. This is, consequently, a pendulous nest, because it hangs; and yet it is very different from what may be called the typical perfection of this style of building in the architecture of birds. This perfection, however, is developed in the very same genus, as will be apparent in the following account of the *Parus pendulinus* L. "The most curious circumstance," observes Dr. Latham, "of this species is the nest, being of a most singular construction, in shape roundish, not unlike that of the long-tailed titmouse, but composed of still finer materials. The nest is made of the down of the willow and poplar, as also of the thistle. These it entwines with its bill into a close body, strengthening the fabric outwardly with small fibres and roots of plants, and lining the whole with some of the loose soft down above mentioned. This is hung on the extreme end of some weak branch which projects over the water, and is wholly covered, except a hole left for entrance, which appears on one side, and generally that which faces the water. By this cautious instinct neither quadruped nor reptile will venture to attack it." So wonderful does this nest appear to the simple people of Bologna, in the marshes of which place this species is found, that "the peasants thereabouts hold both bird and nest in great estimation, hanging one of the latter near the door of their huts. As to the bird itself, it is accounted almost sacred; and they behold it with that superstitious veneration which is so commonly the effect of unenlightened minds."† But, perhaps, the most elaborate of the pendulous architects, at least among the European birds, is the Languedoc titmouse (*Parus Narboniensis*), mentioned by the author we have just quoted, as "similar in manners to the penduline species, and not inferior in respect to the

* General History, vol. vii. p. 259. It is much to be regretted that the notices under the head of "Propagation" in Temminck's Manual, are so short, and at the same time so vague, as to render it of no authority upon these questions.

† Latham, General History, vol. vii. p. 262.

nest, which is pretty large in comparison with the size of the bird. The shape is like the egg of an ostrich, and not much less in size; the longer diameter six inches, the shorter three inches and a half. This is fixed on the forked twig of a poplar, surrounding it with wool; employing the downy part of the poplar flower and such other materials as are made use of by the former bird. This (nest) is also open on one side; but the entrance (is) more surprising, for it (the bird) constructs a kind of portico over it (the aperture), projecting almost three quarters of an inch, whereby there is an additional security against accidents from wind, rain, and other inconveniences."* Before closing our account of the gradual change from fixed to pendulous nests, we are tempted to mention that of the bird called by Linnæus *Parus capensis*† (but which stands in our MS. *Ægithalus capensis*), because, if there is no exaggeration in the account, which rests on the authority of Sonnerat‡, it is still more complicated than the two which we have last described. The form of the nest is purse, or bottle, shaped, which is suspended on a branch, but not at its extremity. It is composed of a kind of cotton plant, and placed in the most thorny thickets. The neck, or upper part of the nest, is narrow, and on the outside is a sort of additional nest, or rather portico, which serves to lodge the male, while the female is sitting or taking care of her young within. But now comes the extraordinary part of the account, "It is said, when the female goes out of the nest, the male strikes against the outside with all the force of his wing, by which the edges of the entrance collapse together, so as to prevent the intrusion of any thing to injure the young in her absence." Mr. Barrow, who writes as an eye-witness, makes no mention of this extraordinary proceeding. The following is his account:

* General History, vol. vii. p. 263.

† Figured and described as a new species by the name of *E. Smithii*, vide Jardine and Selby, Illustrations of Ornithology, pl. cxiii. fig. 1.

‡ Voyage aux Indes et a la Chine, vol. ii. p. 106. pl. 115., as quoted in Sonnini's Buffon, vol. xvi. p. 290.; also General History, vol. vii. p. 264.

— "The Cape titmouse constructs its luxurious nest of the *pappus*, or down of a species of *Aselepius*. This nest is made of the texture of flannel, and the fleecy hosiery is not more soft. Near the upper end projects a small tube about an inch in length, with an orifice about three-fourths of an inch in diameter. Immediately under the tube is a small hole in the side, that has no communication with the interior part of the nest. In this hole the male sits at nights, and thus they are both screened from the weather." Mr. Barrow makes a general remark, that "most of the small birds of of Southern Africa construct their nests in such a manner that they can be entered only by one small orifice, and many suspend them from the slender extremities of high branches."

(158.) The pendulous nest of the American hang-nests (*Icteridæ*), formerly called orioles, are much of the same shape as that of the *Parus pendulinus*. These birds, however, are much larger, few of the species being under the size of a thrush, and two or three, like *Cassicus cristatus**, twice as big. The nests are consequently much larger, some of them measuring between four and five feet. It is a most beautiful and novel sight to the European to see hundreds of these pensile fabrics suspended from the extremity of the branches of a single tree†, generally the most lofty, and accompanied by the birds themselves, either thickly crowded on the branches, or going and returning in all directions: the vivid yellow and black‡, or black and red§ of their plumage, giving a splendour to the animation of the scene, which does not belong to the rookeries of Europe. There can be no doubt that pendulous nests, which are much more common in tropical than in temperate latitudes, are admirably calculated to guard the eggs and young, not only from the numerous snakes which frequent trees, but also from the insidious arts of the cuckows, or the maraudering habits of the bush

* Birds of Brazil, vol. i. pl. 32.
† Birds of Brazil, pl. 4.
‡ Cassicus icteronotus, ibid., pl. 8.
§ Cassicus affinis and C. hæmorrhous, ibid. i. pl. 1, 2.

shrikes and the toucans. The first, however, seem to be rather scarce in South America, but the two latter are very numerous, and both of them are well-known suckers of eggs and destroyers of young and old birds.

(159.) There is a style of building peculiar, we believe, to the Brazilian genus *Synallaxis*, which is intermediate between a fixed and a pendulous structure. Nests of this sort we observed more particularly in the interior of Bahia, and they belonged to the *Synallaxis garrulus*.* This little bird is no bigger than a sparrow, but its nest is enormous. It is built in low thickets, and, from its size, is apparent to every one, even at some distance. The best idea that can be formed of it is to suppose that a very thick band of beansticks, about four feet long, had got entangled in a hedge, and had been left there in an obliquely perpendicular direction. Sometimes two of these nests appear as if joined together, and there appeared an opening on the side as well as one on the top. The birds are generally seen close to the nest, uttering a shrill, incessant, and monotonous chirp, particularly in the morning and evening. It is to be regretted that one of these nests was not then taken to pieces for the purpose of ascertaining whether there were, as it then appeared, two openings; for, if so, the circumstance would seem to imply that there were two chambers. These nests were particularly common in one tract, and we satisfied ourselves with bringing home a specimen of the bird. Had their nests been built in England, the mischevious disposition of our countrymen, and their wanton unfeelingness towards the brute creation, would have extirpated nests and birds in a few years; but no such traits are found in the African or the Brazilian character: animals not used for food, are left quietly to themselves. These little birds were so full of confidence that they might have been touched by a stick on the threshold of their nests. *Synallaxis*, although a creeper, is a rasorial type.

* Under the name of *Malurus garrulus*. Zool. Illus. i. pl. 138.

(160.) There is a third sort of pendulous nest, which is more remarkable in its construction than either those of the titmice or the cassicans; but it seems to be constructed by very few birds only. It is composed of two or three leaves, of a long and broad shape, which the bird artfully unites together, and constructs the real nest within: the leaves, by this additional weight, of course become pendant, and hang by their natural stalks. Much obscurity hangs over the true affinities of the celebrated little bird which builds this nest; which is the *Sylvia sutoria*, or tailor warbler of the old writers. As we have never yet been able to examine a specimen either of the bird or its habitation, the reader must be contented with the following account given by Dr. Latham *: — "This bird is chiefly remarkable for the nest, which is curiously constructed, being composed of two leaves, one of them dead: the latter is fixed to the living one, as it hangs on the tree, by sewing both together in the manner of a pouch or purse; it is open at top, and the cavity filled with fine down, and being suspended from the branch, the birds are secure from the depredations of snakes and monkeys, to which they might otherwise fall a prey. In my own collection," continues our author, "is a nest of an equally singular construction; it is composed of a single large leaf, of a fibrous, rough texture, about six inches long, independent of the stalk, five inches and a half in breadth, and ending in a point: the sides of this leaf are drawn together, so as to meet within three quarters of an inch: within this is the nest, which is about four inches deep, and two broad, opening at the top, and the bottom of the leaf is drawn upwards, to assist in the support of it. This inward nest is composed of white down, with here and there a feather, with a small portion of white down intermixed; the stalk about five inches long. This was brought from China. Among the drawings of sir J. Anstruther, is not only a drawing of this nest, but another of an equally curious fabrica-

* General History, vol. vii. p. 79.

tion. It appears to be composed of several leaves, like those of some kind of hazel, and an inner nest, formed of dry bents, fibres, and hairs, suspended from a tree by the main leaf, to which the others are fastened. In this are figured two young birds, but with bills stouter than in the warbler genus, the colour of them being rufous above and white beneath. By the side of the nest are painted two ferruginous or rufous coloured eggs. The name in (on) the drawing (is) Baya." * These notices are interesting as far as they go, but on the most curious part of their structure (particularly of that which is in the writer's possession) they are altogether silent. By what process were these leaves "drawn together?" Were they actually sewed, as some authors assert? — were they interlaced? — or were they fastened by any resinous substance? This point, which regards the most interesting part of the fabric, is altogether passed over. By what species, or even genera, these nests were constructed, must be left to future discovery. We strongly suspect these curious foliculated nests are made by many oriental birds. We have been also assured, by an officer who had passed several years in India, and had paid much attention to its natural history, that the greatest part of the sunbirds (*Cinnyris*) of that continent build their nests much in the same manner as those we have just described.

(161.) There is still another sort of suspended nests, mentioned by Barrow †, as fabricated by a species of *Loxia*, or grosbeak (probably of the modern genus *Euplectes*), which, unluckily, he neither describes or names. It seems always to build on a branch extending over a river or pool of water. The nest is shaped exactly like a chemist's retort; is suspended from the head; and the shank, of eight or nine inches long, at the bottom of which is the aperture, almost touches the water. It is made of green grass, firmly put together, and curiously woven.

* "This name is given to the Philippine grosbeak; but the nest of that is described as being in the shape of a long-necked bottle, and made of grass, quite different from the Baya here described." — *Latham.*

† Travels in Africa, 4to, p. 323.

(162.) Another very curious fabric, in this order of bird architecture, is exhibited in a nest now before us (*fig.* 89). It was brought from Southern Africa, together with the male, female, and eggs of a species of *Ploceus*, or

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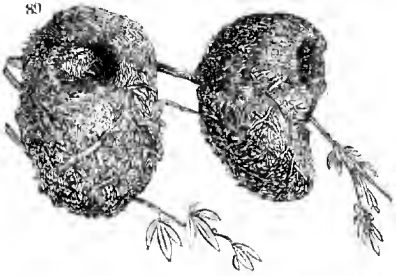

weaver, which we have named, P. *icterocephalus*.* The nest is somewhat kidney shaped, seven inches long, and four and a half broad: it is attached to a very slender branch, from which there are four other young shoots, which serve as so many holds for its support, and to which it is firmly fixed by bendings of strong grass leaves. The whole is very compactly made of the same materials, interlaced most ingeniously, and far more firmly, than what is seen in the chaffinch or other of our most skilful builders: the lining are the heads or panicles of the grasses, thus uniting softness and coolness, the latter being an obvious advantage in so sultry a climate. The aperture is lateral, near, but not upon, the top, so that it serves the purpose of a window to the inmates; who are sheltered overhead by the convex top of the nest.

* *Male.* Above, yellowish olive, brownish in the middle of each feather; beneath, full, deep yellow; head, sides, ears, chin, and throat rufous or buff yellow, blending into the adjacent colours; tail, quills, and wing covers brown, the two latter with light yellow margins; tail very short, even; bill black; legs pale.

Female. Head, above, and all the upper plumage olive, the feathers brownish in the middle; under parts from the chin to the tail covers, and margins of the wing feathers, pale yellow; bill and legs pale. *Eggs*, lengthened oval, entirely blue, unspotted.

Obs. Total length seven and a half inches: bill, from the gape, one; from the front, seventeen-twentieths; from the nostrils, seven-tenths; wings, three and three-quarters: tarsus, one: tail, from the base, two and a half; beyond the wings, one; first quill very short and spurious; second, one-tenth shorter than the third and fourth, which are the longest.

There is something very ingenious in the construction of this opening, which is not, as it first appears, round, but semicircular (*fig.* 89.), the arch being bound round with a stronger band than usual, and the plane, or base, much stronger, and composed of straight pieces of the stalks of grass, evidently for the purpose of giving to that part upon which the birds perched greater strength and substance. Mr. Barrow, as we have seen, remarks that lateral openings to the nests of the African birds are very common. The rains of Southern Africa and of tropical America are, perhaps, equally violent while they continue; but then the small leaved and scanty foliage of the trees in the former, leave the nests of such birds that are upon them much more exposed to these torrents than are the nests of the Brazilian birds, where the foliage of the trees is particularly thick and broad. May not this be one of the causes, at least, why nature has so especially taught the African birds to construct their nests in the manner alluded to? Snakes are equally common in both regions, yet with the exception of the hangnests and a very few others, as *Synallaxis garrulus*, *Donacobius vociferans*, &c., we are unacquainted with any other Brazilian birds which depart from the ordinary style of building.

(163.) *Hive* nests are constructed alone by such birds as live in vast societies under one common roof. They are only to be met with in Africa; and although Patterson, who first discovered them, gives us a very intelligible account of their construction, yet what he has said of the bird or birds by whom they are built, is too vague to enable a modern ornithologist to understand either their genera or their species. Hence the name of Republican Grosbeak has been applied to several totally distinct sorts. Patterson's account of these extraordinary nests is as follows:—"The industry of these birds seems almost equal to that of the bee. Throughout the day they appear busily employed in carrying a fine species of grass, which is the principal material they employ for the purpose of erecting this extraordinary work, as well

as for additions and repairs. Though my short stay in the country was not sufficient to satisfy me by ocular proof, that they added to their nests as they annually increased in their numbers, still from the many tress which I have seen borne down by the weight, and others that I have seen with their boughs completely covered over, it would appear that this is really the case. When the tree which is the support of this aërial city is obliged to give way to the increase of weight, it is obvious that they are no longer protected, and are under the necessity of building in other trees. One of these deserted nests I had the curiosity to break down, to inform myself of the internal structure of it; and found it equally ingenious with that of the external. There are many entrances, each of which forms a regular street, with nests on both sides, at about two inches distance from each other. The grass with which they build is called the Bushman's grass; and I believe the seed of it to be their principal food, though on examining their nests, I found the wings and legs of different insects. From every appearance, the nest which I dissected had been inhabited, for many years, and some parts were much more complete than others. This, therefore, I conceive to amount nearly to a proof, that the animals added to it at different times, as they found it necessary, from the increase of their family, or rather of the nation or community." But we must here pause; since our space will not permit us to prosecute this inviting subject farther.

PART II.

ON THE BIBLIOGRAPHY, NOMENCLATURE, AND PRESERVATION OF BIRDS.

CHAPTER I.

AN ENUMERATION OF THE CHIEF WORKS ON ORNITHOLOGY, WITH CRITICAL AND EXPLANATORY REMARKS.

(164.) As it is our wish to render this volume of our ornithological treatise as complete an introduction to the science as is requisite for all scientific and practical purposes, we shall, in the following pages, touch upon some few points upon which the student will desire information. The view we shall now take of the Bibliography of Ornithology will bring before him those works most essensial to possess or to consult, and this will naturally lead to some observations on the present state of the science. We shall then, under the head of nomenclature, enumerate those "rules and regulations," most of which, by having the sanction of the highest names in zoological science, are already considered as aphorisms. Lastly, we shall give such concise and practical directions for the preservation of birds as will enable any one to commence a collection, however far he may be removed from civilised countries, and from the means of acquiring the niceties and elaborate processes of Taxidermy. All these subjects are intimately connected with this introduction to the science; which is addressed, alike, to the philosophic ornithologist, the student, and the amateur.

(165.) To form a just estimate on the state of any branch of natural history at a given period, it is neces-

sary to view it in two positions; first, in regard to the principles upon which it is prosecuted, and secondly, how far these principles have been applied to practical use, or in other words, to the clear determination of the species. The first of these views contemplates ornithology as an inductive science, and its rank in the scale of human knowledge will be determined by the greater or lesser accordance of its fundamental principles with those which regulate every other branch of the physical sciences, — by the simplification and reduction of its innumerable facts to a few universal laws — and by the analogy which can be traced between these laws, and such others that have been determined in higher and more extended portions of creation. For although the study of this branch of zoology is so vast, compared to our limited faculties, that an ordinary life would hardly be sufficient for thoroughly understanding it, yet it is but a very small point in the circle of the physical sciences, which embraces all matter and all creation. When, therefore, we have advanced in the philosophy of any branch of natural history, so far as to assimilate its laws with others that have been determined in conterminous branches, we have demonstrative evidence that our assumptions are correct; but if two or three of these laws can be still farther traced throughout the visible creation, and even to extend themselves to all that is known of the spiritual world, our evidence is of a much higher cast. The truths of the one, become not only connected, but, as it were, amalgmated, with the truths of the other; they cannot, in minds accustomed to inductive reasoning, be separated; and we become as much inclined to question the circular progress of the planets round the sun, as the circular development of the variation of forms in the animal and the vegetable creation.

(166.) Ornithology, no less than other branches of zoology, is rapidly approaching, in its fundamental principles, to the state of demonstrative certainty just intimated. Enough has been already published to show that the principles upon which it is now founded, as a

science, are safe and sure. The circularity of the primary groups, upon the whole, has been successfully established, by Mr. Vigors*, and very many of the natural families rightly located; but as this was the result of synthesis, — in other words, an implicit adoption of the theory of Mr. Macleay, so it naturally followed that the theoretic errors of one would be transferred to the other: and as this sketch, as the author himself designates it, of the leading affinities among birds, is evidently not the result either of analysis, or of an intimate acquaintance with the details, there was left abundant room for improvement in every way. Having already pointed out the fundamental errors of both these theories, and the effects they have produced in their application†, they need not be again adverted to. In the same year another attempt was made to see how far the theory of Mr. Macleay could be substantiated in a single family of birds, the investigation being carried on, not by synthesis, as in the former case, but by analysis; — the only sure basis of inductive philosophy. The results which followed are already before the public. Both these attempts, however, so far as regards a system of ornithology, are partial and imperfect. The paper of Mr. Vigors, enumerates only the families‡, and these, although indicated, can scarcely be said to be defined; while, from the nature of the subject, very few groups of the order *Insessores* are analysed in the *Fauna Boreali-Americana*, with the necessary degree of rigour. To those who are acquainted with the difficulties and tediousness of analysis, no apology will be necessary for the partial treatment of the groups contained in the last mentioned work. Neither dismayed or disheartened by these difficulties, we have slowly but steadily prosecuted the same mode of investigation; our present treatise will con-

* Linnæan Transactions, vol. xiv. Northern Zoology, vol. ii. Introductory Observations.

† Northern Zoology, vol. ii. preface. Classification of Animals.

‡ The catalogue of genera, &c. by the same author, being a mere list of names, does not, of course, possess any authority. Indeed, it leaves every one to make out the supposed affinities as best he can.

tain the results of the last six years' study, and whatever may be its defects or deficiences, it nevertheless becomes the only system of ornithology upon the circular principle of variation, yet given to the world.*

(167.) We now turn to the other point of view in which the actual state of this science must be contemplated. We have seen that, so far as the principles are concerned upon which it is now prosecuted, we are upon safe and solid ground. Although these principles are of very recent discovery, they will soon be verified in this work by a mass of details in all parts of the animal kingdom. By the labours and nice discrimination of Illiger, Cuvier, Vieillot, and Temminck, a very large proportion of the most remarkable genera, or types of form, have been detached from the Linnæan groups, and distinctly named and characterised. All these, together with near two hundred others, we shall here attempt to refer to their natural rank and station.† Our framework, therefore, is nearly complete, for it may be questioned, whether from among the birds already known from description, &c., more than forty sub-genera will be found uncharacterised. But with all this, our labour has not yet reached to that point which is to make it productive of practical and ordinary purposes. The house is built, and the apartments ready, but the furniture and the ornaments are yet to be selected and arranged therein. In other words, it is probable, that, out of six thousand species of birds, described in the general systems now in use, not more than one-fourth, certainly not a third, can be referred to the modern genera. The causes of this are various. The progress of discovery has far outstripped our inclination for suitable arrangement. The Linnæan list of genera was almost stationary for fifty years, although in that time our cabinets were probably aug-

* For an account of the principal artificial systems of ornithology, the reader is referred to the "Classification of Animals." However useful such systems may be, they have nothing to do with philosophic zoology, because they are not founded upon any one general principle.

† This systematic arrangement will be given in the second volume.

mented with five times the number of species contained in in the *Systema Naturæ*. A misplaced veneration for their great master, or personal inertness, induced his disciples to go on appropriating all these new species to the old genera, without venturing to construct others for them, when they plainly and palpably would not agree in a single essential character with any one of the old genera. It was sufficient for a bird to have a flat bill to constitute it a *Muscicapa*, and all slender-billed birds became warblers (*Sylvia*). The consequence has been that these groups, and numberless others, became common receptacles for almost any thing, and if a student, or even a practised ornithologist, attempted to find out the name of a species, he must often read over the descriptions of near 300, without, in all probability, attaining his object. In the most recent and voluminous work on general ornithology in our language, there are 237 species of *Falco*, 177 of *Muscicapa*, 298 of *Sylvia*, 121 of *Loxia*, and 150 of *Fringilla*. One would have imagined that in such a genus as *Merops*, — where the remarkably short, weak, and syndactyle foot, is such a strong and obvious character, — no mistake could possibly arise. But even here, so little were these authors accustomed to adhere to the definitions of their master, that we actually find a large number of strong-footed thrushes (*Brachypus*) mixed up in their systems with the true Linnæan bee-eaters, because, as it may be presumed, the plumage of both is green; while many of the honeysuckers (*Meliphagidæ*) are placed with *Merops*, notwithstanding their strong and very perfect feet. The student, therefore, even if he follows Linnæus, can place no reliance whatever upon the systems which actually profess to follow this master. These obstacles, great as they are, would not altogether be insurmountable, if the descriptions of the species were sufficiently full or accurate to lead to the determination of a bird, even if it should be placed in a wrong genus. But here our difficulty is increased two-fold: it has, until

very lately, been the universal custom to confine the description of a bird to its size and colour, as if the peculiar modification of its bill, wings, and feet (the most important of all characters) were either undeserving of attention, or were sufficiently explained in the generic character, which character, as we have already seen, was often violated at every point. There are, perhaps, fifty warblers to which the description of "Olive above, yellowish beneath, bill and feet dusky," is perfectly applicable, and yet each are not only different species, but of widely different genera. The same remark is, in a less degree, applicable to the tyrant flycatchers (*Tyranninæ*), the drongo shrikes (*Edolinæ*), and some other groups, where the greater part of the species are clothed in nearly the same coloured plumage. To identify such birds is utterly impossible. When, indeed, these happened to be figured, however rudely, as in the *Planches Enluminées*, we may be allowed to guess what is meant; but even then, in many instances, from the carelessness or inaccuracy of the artist, such figures must be quoted with a mark of doubt. But when, as in numberless instances, these descriptions rest only upon mere private drawings, or on loose descriptions, there is no alternative but to pass them over in silence. It has been well observed, that, in a science which requires the nicest examination and the most scrupulous accuracy, "a bad or imperfect description is worse than none." The remark, although severe, is yet perfectly just; yet, were it strictly acted upon, we should have to expunge from the general systems four-fifths of the species therein contained. From the above facts we may therefore draw this inference, that in proportion to the number of division or genera, as they are called, in any work professing to be a general system of ornithology—so are we to estimate its usefulness and its authority in modern ornithology, provided of course that these divisions are clearly defined, and are founded on tangible characters. We have no doubt that very many of the birds which

we ourselves, and other modern writers, describe as "new species," or as "apparently unrecorded," have actually been known to, and mentioned by, the older ornithologists, could they themselves point out the description intended to be applicable; but this sort of information cannot, of course, be obtained; and we have consequently no other resource than to give such a description of our species as will save us from incurring the same censure from those who come after us.

(168.) Another evil that has tended to throw our correct specific nomenclature so immeasurably behind our knowledge of forms, is the habit which some naturalists of the present day have adopted, of distributing the birds which they find described in the old systems, under what they conceive to be their modern genera, *without having seen* or examined the species themselves. Unfortunately for science, M. Cuvier first set an example of this mode of proceeding, which has since been followed up, especially by his translators, to such an extent, that we have merely the confusion of the Linnæan school revived, only under a different form. These compiled classifications are even more detrimental to a sound knowledge of ornithology than if the species had been left in their original obscurity; for the student, seeing the new genera adopted, is led to believe that the species placed under each have been ascertained as truly belonging thereto; whereas, perhaps, three or four only have been actually examined, and the remainder inserted merely from supposition: the ornithologist not being informed which is which. Of the modern genus *Tyrannus*, for instance, it is very questionable if one-half of the species enumerated as such in Mr. Griffith's Cuvier really belong to it. Truth obliges us to repeat that this is the general state of our present position in regard to ornithological species, and we mention it thus candidly that the student may really understand the difficulties he will have to encounter when he ventures to enter investigate species.

(169.) But there are many exceptions to these remarks, and we rejoice in enumerating them. With a

few exceptions, the birds of Europe* are now arranged under their modern genera. The same may be said of those of North America, with the exception of those figured by M. Audubon, whose nomenclature is altogether obsolete. We hope to accomplish the same object in regard to the birds of Brazil, Western Africa, and Australia. A portion of the latter, indeed, have been well illustrated, and correctly named by M. Horsfield and Vigors. Then, in regard to general species, the little volume of M. Wagler† is highly valuable; for not only does its author confine himself to such species as he has personally examined, but he rectifies the errors of his predecessors, and refers to their modern groups all such species as have been improperly associated with the genera he has investigated. A considerable number of the birds figured in the *Planches Colorrées* of M.M. Temminck and Logier, have been placed in their modern groups; but by far the greater part, particularly the *Raptores*, the *Columbidæ*, *Psittacidæ*, *Picidæ*, *Muscicapidæ*, *Sylviadæ*, *Merulidæ*, and *Trochilidæ*, are left in their *family*, rather than in their *generic* station. In concluding this short but comprehensive survey of the present state of systematic ornithology, we feel much gratification in perceiving that the principles advocated in a former volume‡ are widely and rapidly gaining ground, and that a British school of zoology may be said to be already founded. The science has been taken up by several who possess that union of natural and cultivated talent, hitherto so rarely met with in writers of our own country. It is at length perceived that zoology is no longer a study of names, or of crude technicalities—that no honour is to be reaped by the invention of artificial systems, or even

* We cannot allude to this portion of geographic ornithology without adverting to the beautiful and even masterly figures in Mr. Gould's work on the birds of Europe. It is only necessary to compare the drawing and execution of these figures with the most costly works of a similar description recently published on the Continent, to show the decided superiority of the British school of zoological painting over all others of the present day.

† Species Avium. ‡ Preliminary Discourse.

by imposing names upon new species. We have, it is to be hoped, outlived the age when the bare *dictum* of authority was implicitly believed and followed. Inductive and analogical reasoning will soon obtain its legitimate influence in this, as it has long been paramount in all other branches of physical science, "through which one principle and one spirit alike prevails."* In the writings of such labourers, in the different departments of zoology, as M.M. Bennett, Owen, Ogelby, Westwood, Doubleday, Walker, Halliday, Gray, Gould, and many others, we already see those who will become worthy successors to such veterans among us as were "first in the race:" who have more or less contributed to lay the foundation-stone of philosophic classification, or who have already "won, and passed away." And if we refrain from mentioning others whose talents are no less promising, it is only because they are wisely employed in that preparatory study which is essential to the real advancement of our favourite science, and to the acquisition of any fame that is to be permanent.

(170.) Adverting to what we have already advanced on those points which constitute the merits of ornithological works, whether general or particular, we shall now arrange such as are the best known, or are the most valuable, under the following heads:—1. General systems; 2. General systematic descriptions; 3. Partial scientific descriptions; 4. Local or geographic ornithology; 5. Illustrative or iconographic ornithology. To each of these we shall subjoin short critical notices on its execution and contents.

(171.) Of GENERAL SYSTEMS, which do not embrace the details or descriptions of the species, the most popular or esteemed are those of Illiger, Cuvier, Vieillot and Temminck. As we have explained the peculiarities, and compared the several merits of these in a former volume†, it will be unnecessary to repeat the same details in this place. The groups of Illiger

* Sir William Herschel's Preliminary Discourse.
† Classification of Animals.

are defined with great accuracy, and with that high degree of finishing, which leads us the more to regret that his genera are comparatively so few. His reformation in the nomenclature was most extensive, without being, in hardly one instance, uncalled for; and he purified the science of a host of barbarous appellations which were scarcely worse than those revived and invented by some modern French writers in this department. They are, in short, the reformations of a profound naturalist and an accomplished scholar; and as they obviously have not proceeded from selfish vanity, so they have been universally adopted. The groups of M. Cuvier are in general good, but they are in many cases so loosely defined, that the mere student would never be able to detect them, were it not for the familiar examples under each, which he has either named or described. His characters have been taken almost exclusively from the bill and feet, not with reference to the food or the habits of the bird, but merely as to the form of these members; while the different modifications in the structure of the wings and tail are very rarely noticed. M. Vieillot first perceived the importance of these characters; and, although no great praise can be given, in other respects, to his definitions, the introduction of the characters we allude to enables us to determine his genera,—which, for the most part are natural,—much better than could otherwise have been done. It must also be remembered that this author's "*Analyse*," is in fact but a synopsis of his system, which is given more at length in another work hereafter noticed, and where he has defined the greater part of his new genera much more fully, and with considerable tact and ability. To M. Temminck's system we have already given due praise, so far as concerns the definition of the very few new genera it contains, and which are mostly so remarkable that they could not be well passed over. M. Temminck, however, does not attempt to grapple with the more difficult and intricate groups, such as the old genera *Picus, Psittacus, Sylvia,*

Columba, &c., all of which he leaves nearly in the same state as they are to be found in Latham, and other Linnæan writers. In this respect his divisions are far inferior to those of Vieillot, and even of Cuvier. We deem it unnecessary to notice some other artificial systems that have appeared more recently: some are merely in the form of a catalogue, without a single definition, or a single reason assigned for proposing the new orders, families, &c., that occur throughout; while others seem to have been invented merely from caprice, and in which the best known, and the most natural affinities, are violated in every page. It is quite as unnecessary that the student of modern ornithology should trouble himself to become acquainted with all these, as that a foreigner, desirous of acquiring the English language, should begin with learning all the provincial dialects of the different counties. We can see no use, therefore, in bringing into notice a multiplicity of systems, which almost any one could have invented, and which nobody follows. Of those here mentioned the following is a list.

Illiger. Caroli Illigeri D. Prodromus Systematis Mammalium et Avium: additis terminis zoographicis utriusque classes, eorumque versione Germanica. Berolini, 1811. 1 vol. 8vo.

Cuvier. Le Règne Animal distribué d'après son organisation. Paris, 1817. 4 vol. 8vo.—Nouvelle édition. Paris, 1829. 5 vol. 8vo.*

Vieillot. Analyse d'une Nouvelle Ornithologie Elémentaire. Par L. P. Vieillot. Paris. 1816. Pamphlet of 70 pp.

Temminck. Manuel d'Ornithologie, ou Tableau Systématique des Oiseaux qui se trouvent en Europe; précédé d'une Analyse du Système général d'Ornithologie. Par C. J. Temminck. Second Edit. Paris. 1820. 2 vol. 8vo.

(172.) GENERAL SYSTEMATIC WORKS, wherein not only the divisions are defined, but the species are described, are much more useful to the practical ornithologist,

* The best English translation is that by Dr. M'Murtrie, in one thick octavo volume, the abridgement being confined to the descriptions of the species, which are meagre, and not at all necessary to a knowledge of the system. There are two others, much more expensive, but they are overloaded, either with badly executed plates, or verbose and ill digested additions.

whose primary object is to ascertain the name and history of a bird with which he is unacquainted. Before the great reform in the nomenclature of this science, commenced by the illustrious Illiger, and introduced into this country long afterwards, the *General Synopsis* of Dr. Latham was the universal text-book. The early volumes of the *General Zoology* of Dr. Shaw, are partly abridged from the *Synopsis*, and compilated from other authors. On the death of Dr. Shaw, the subsequent volumes were edited by Dr. Leach and Mr. Stevens: many of the modern genera were then introduced, particularly by the latter, who also incorporated the new birds figured in the more recent publications; thus rendering the work, upon the whole, far more useful for ordinary purposes of reference than either the *General Synopsis*, or the more recent *History of Birds*. It must be remembered, however, that all these compilations, however serviceable, partake more or less of the faults already alluded to (167.); and that, in all matters of doubt, recourse must be had to the original descriptions and figures contained in the authors from whom these general ornithologies have been compiled. The mere English reader must content himself with these: but, however poorly our own language is supplied with works of this class, that of France is much richer. The *Manuel* of M. Lesson, notwithstanding the defects in its arrangement that have been charged upon it, is certainly the best *Compendium* of modern ornithology the student can possess. Most of the genera there published are briefly characterised, and it is a most useful index to the new species figured in those expensive continental works which are above the purchase of the generality of students. In both these respects, we give the preference to the *Manuel* rather than to the *Traité de Ornithologie* of the same writer. The ornithological portion of the *Encyclopédie Méthodique* is a much more extensive and valuable work; it contains, in fact, descriptions of all the species then known, arranged under the genera of M. Vieillot, who is himself

the principal author. Very many of the descriptions are original, and all those species are incorporated which have been noted by Azara in Paraguay, and Le Vaillant in Africa. Notwithstanding this work is unavoidably deficient in the more recent discoveries, and defective in perpetuating species loosely described by former writers, and which are only nominal, it is unquestionably the best general system of ornithology at present existing. It may therefore be cited as a good authority; and it should be in the possession of every one who is desirous of investigating species. It may be as well to observe, that the fourth volume, which is sold separately, consists entirely of plates: but the figures are so extremely rude and inaccurate, that they deserve not to be consulted or quoted. In concluding this part of our subject, we must not pass over Buffon, whose Ornithology, with all its defects, must ever be regarded as a standard authority. He was the first to describe those numerous species which are figured in the *Planches Enluminées*, and which are copied into our English systems. The best edition we have seen of Buffon is that edited by Sonnini, on account of the notes and remarks upon the birds of Guiana, which the latter was able to insert from his original observations. The system of Brisson is now, like that of his more celebrated countryman, obsolete; but, as nearly all the descriptions are made from real specimens, and are remarkably accurate, the work is very useful as one of consultation. The following are the titles of the books here recommended.

Brisson. Ornithologia. Latin and French. Paris. 1760. 6 vol. 4to. Paris.

Brisson. Ornithologia sive Synopsis Methodica, sistens Avium divisionem in Ordines, Sectiones, Genera, Species, &c. Lugd. Bat. 1763. 2 vol. 8vo. (A Synopsis of the above, containing the essential characters in Latin).

Buffon. Histoire Naturelle des Oiseaux. Par Leclerc de Buffon. Redigé par C. S. Sonnini. Paris. An. xi. 28 vol. 8vo. (The figures are very rude.)

Latham. A general Synopsis of Birds. By Dr. J. Latham. London, 1792. &c. 3 vol. and 2 supplements. 4to. (The

coloured figures are sufficiently exact, in most instances, for determining the species.)

Latham. Index Ornithologicus. London, 1790. 2 vol. 4to. (A Latin Synopsis of the last, without plates.)

Latham. General History of Birds. Winchester, 1821—1824. 10 vol. 4to.*

Shaw. General Zoology, or Systematic Natural History. Commenced by Dr. Shaw, and continued by Mr. Stevens. London, 1809 — 1826, 8vo. (The birds occupy from vol. 7 to 14, each vol. being in two parts. The plates are plain and mostly copied from other works, but tolerably engraved.

Lesson. Manuel d' Ornithologie, ou Description des Genres et des principales Espèces d'Oiseaux. Par R. P. Lesson. Paris, 1828. 2 vol. 12mo.

Vieillot. Tableau Encyclopédique et Méthodique des Trois Regnes de la Nature. Ornithologie, par l'Abbé Bonnaterre, et continuée par L. P. Vieillot. Paris, 1823. 3 vol. 4to.

(173.) Under the head of PARTIAL SYSTEMS, we include monographs of particular groups, either published separately, or in the transactions of learned societies. 2. Miscellaneous descriptions, incorporated with other subjects; and, 3. Collections of figures and descriptions of select ornithological subjects. Many of the former, and some of the latter, equally belong to our fifth division; but they are here noticed that the student, upon merely looking over one of the lists, may not suppose they have been altogether omitted. The most valuable collection of monographs of certain genera is contained in the volume of Wagler before alluded to: it is rendered, however, defective by the absence of specific characters, after the manner of Linnæus and the best modern zoologists, while the unnecessary and injudicious changes that have been made in some of the best generic and specific names, and the artificial nature of nearly all the new divisions, shows that industry is the author's chief qualification; on the other hand, the descriptions of the species, although diffuse and laboured, are very accurate, and the work is not only valuable, but indispensable to every systematic ornithologist. M. Tem-

* The same plates are used for this work as were inserted in the *General Synopsis*; but several others are added.

minck's Monographs of the *Gallinaceous* Birds are clear and masterly, and should be taken as a pattern for all such dissertations. The description of the species, while they are free from the turgidity above alluded to, are scientific and accurate, while, in the *Synopsis*, each is technically characterised by a short specific diagnosis in Latin. The splendid folio volume, wherein all the species are figured, rather belongs to our iconographic division of ornithological works. A masterly Monograph of the Parrots, by the late M. Kuhl, will be found essentially necessary to every ornithologist who studies that beautiful, but very intricate family, since it not only contains many species not before characterised, but it serves as a systematic index to the two splendid volumes by Le Vaillant, subsequently noticed, upon the same group. The *Dendrocolapti*, or tree-creepers of tropical America, have been ably illustrated in a distinct essay by the celebrated traveller and zoologist, Lichtenstein; and there is a monograph of the genus *Larus*, by Mr. Macgillivrey, in the *Wernerian Transactions*. It would, however, be utterly impossible, in a work of this nature, to enumerate all the distinct essays and papers upon ornithology, scattered through the voluminous transactions and scientific records of all the learned societies in Europe and America, since half our volume might be filled with their titles. In the splendid folio plates of the zoological subjects discovered on the three scientific expeditions sent out by the French Government in the L'Uraine, the Coquille, and the Astrolobe, are many new and highly curious birds, particularly in the second of these volumes, which records the acquisitions of M.M. Garnot and Lesson: these latter descriptions, fortunately for the generality of ornithologists, are rendered accesible to all by being incorporated in the *Manuel* of the last mentioned naturalist. We may, perhaps, be permitted, in this place, to mention that, in the six volumes which compose our two series of Zoological Illustrations, there are 115 plates and descriptions of birds, nearly all of which are figured for the first time, and arranged under their

modern groups. A few original figures of birds are also in the two first volumes of Dr. Leach's *Zoological Miscellany:* but those in the *Naturalist's Miscellany* of Dr. Shaw are nearly all copied from other works, and are altogether too inaccurate to be quoted. M. Le Vaillant's splendid folios on the parrots, paradise birds, hornbills, bee-eaters, rollers, &c., will be noticed under the succeeding heads. The titles of the works above alluded to are as follows.

2. Partial Systematic Works.

Wagler. Systema Avium. Auctor Dr. Joannes Wagler. Pars prima. Stuttgartiæ. 1827.

Temminck. Histoire Naturelle Générale des Pigeons et des Gallinacés. Par C. J. Temminck. Amst. 1813. 3 vol. 8vo.

Quoy et Gaimard. Voyage autour du Monde, exécuté sur les Corvettes L'Uraine et la Physicienne, pendant les années 1817—1820, par Le Chevalier Louis de Freycinet. Paris, 1824. 1 vol. 4to. pp. 712, and 1 vol. folio of plates. (The latter contains twenty-seven of birds.)

Garnot and Lesson. Voyage autour du Monde, exécuté sur la Corvette la Coquille, pendant les années 1822—1825, par Capitaine Duperrey. Paris, 1826. 2 vol. 4to. and 1 vol. folio of plates. (The latter contains forty of birds.)

Astrolobe. Voyage de l'Astrolobe, pendant les années 1826—1829, sous le commandement de M. J. Dumont d'Urville. Zoologie, par M. M. Quoy et Gaimard. (This work, the plates of which are uniform with those of the two preceding, is now in course of publication at Paris. The descriptions are in royal 8vo.

Leach. The Zoological Miscellany: being descriptions of new or interesting animals. By W. E Leach. M. D. &c. London, 1814—1817. 3 vol. royal octavo. (The two first volumes contain together twenty-seven plates of birds.)

Swainson. Zoological Illustrations, or Original Figures and Descriptions of new, rare, or interesting Animals; selected chiefly from the classes of Ornithology, Entomology, and Conchology. Second Series. London, 1820—1823. 3 vol. royal 8vo; containing sixty-seven plates of birds.

Swainson. Zoological Illustrations. Second Series. London, 1832—1833. 3 vol. royal 8vo; containing forty-seven plates of birds.

(174.) Geographic Ornithology constitutes our

third division of works belonging to this science. These we shall arrange under the five zoological provinces of the world, as defined and illustrated in a former volume*; as, 1. Europe; 2. Asia; 3. Africa; 4. America; 5. Australia. In proportion as our knowledge of natural groups is increased, we find them, in very many instances, as much characterised by their geographic distribution, as by their external forms. Hence the locality of a genus is now become part of its essential character, and saves the student infinite trouble when investigating the birds of any particular country.

(175.) In regard to EUROPEAN ornithology, it is needless to enumerate the very many works that have been published, in one shape or other, on the birds of the different kingdoms. The most costly are those of Nozeman on the birds of the Low Countries, in four folio volumes; yet the figures, by Sepp, are poor and unnatural. Wolf and Meyers' *Almanach of German Birds*, in two octavo volumes, are valuable for many excellent observations, but we do not possess them. The substance, however, of all these will be found in M. Temminck's *Manuel of the Ornithology of Europe*; while the excellent coloured figures of Mr. Gould will supersede the necessity of possessing any of the other expensive works on the birds of Europe. Our object is not to give a general catalogue, but to enumerate such works only as are either absolutely essential to an ornithological student, or are eminently beautiful in their execution, and therefore entitled to the first place in a well selected library of natural history. In regard to the birds of our own country, we consider the excellent *Illustrations of British Ornithology*, by Mr. Selby, quite sufficient for all purposes of accurate description or pictorial illustration. It is not generally known, that the letter-press to this otherwise costly work, forms two separate volumes in octavo, the price of which renders them accessible to

* Geography and Classification of Animals. See also Murray's Encyclopædia of Geography, where we have treated the natural distribution of birds in more detail.

every one who can afford a few books on his favourite pursuit. The original edition of Montagu's *Ornithological Dictionary* is a standard authority, nor must Bewick's *British Birds* be forgotten, although the figures, however beautiful as works of art, are on too small a scale for the determination of doubtful species. Many other works on British ornithology, either original or compiled, have lately appeared, and more are announced. We fully concur with Mr. Selby, in considering that the "union of conciseness and perspicuity, with a plain didactic style, is that in which all works on scientific subjects should be written."

(176.) The ornithology of Asia has only of late received some portion of that attention it so greatly demands. Le Vaillant, indeed, has devoted a part of one of his volumes to the horn-bills, a family almost peculiar to this region; and the title of his work leads us to suppose he contemplated a much fuller account of the rare birds of India. Dr. Horsfield has added considerably to our knowledge of the animals of Java, particularly of its birds, in a paper inserted in the *Linnæan Transactions*, and in a separate work. Mr. Gould has published, in a costly volume, many new and magnificent birds from the Himalaya mountains. There are also a few birds in the published collection of General Hardwicke's Indian drawings, but as most of them are designed by native artists, no great degree of accuracy or of finish can be expected. There is still wanting a complete work on the general ornithology of this eastern hemisphere, worthy alike of the splendour of the subjects, of the present state of zoological painting, and of the munificence of that body of princely patrons under whose fostering care so much has been done to illustrate the civil and natural history of our oriental possessions. Whether, under the present adverse circumstances of the Honourable East India Company, they have now the means of patronising such a work, is very doubtful; but it certainly would be vain to attempt it, excepting under their auspices. The birds of Africa

are chiefly known by the admirable work of Le Vaillant, whose sole object in travelling the southern parts of this continent was to collect specimens for the French and Dutch cabinets. Only six volumes of this great undertaking have been published, so that the whole of the rasorial, grallatorial, and natatorial orders are omitted. In the volume of zoological plates, or atlas, to M. Rüppel's travels, there are a few birds of Northern Africa; while some interesting materials for the ornithology of the western coast, which we have long been collecting, will probably soon be put into the hands of the publisher.

(177). The state of our knowledge of the birds of America offers a singular contrast to that which we possess on the two last provinces. Those of the northern portions of this continent have been so admirably figured, and their habits so fully described, by the celebrated Wilson, that little has been left, comparatively, for those who have gone over the same ground. Many of the new species, said to be since discovered, are, in fact, either already named by Wilson, or are young birds, or females, of well known sorts. In the continuation of Wilson's noble work, by the prince of Musignano, the greatest care has been taken to avoid the above errors; and we believe all the species are really new. Professor Nuthall has also published, as we hear, an account of the birds of North America in a more popular form, but the work is not to be had in this country, and we cannot, therefore, speak of its contents or execution from personal knowledge. M. Audubon's two volumes of letter-press may be consulted with much advantage, but the scientific descriptions are destitute of that precision and detail which might have been expected in these days; and as the nomenclature is not that which is now in use*, it is impossible to make out the modern

* The author states in his preface (vol. ii. p. xxvii.), "that he has followed the nomenclature of C. Lucien Bonaparte, *i. e.* the prince of Musignano." M. Audubon, however, does not appear to be aware that the nomenclature he has used has been long ago repudiated by the prince himself, as altogether unsuited to the present state of ornithology: for, in

genera to which his supposed new species really belong, either by his descriptions or his figures, beautifully designed as the latter unquestionably are: in this latter respect, they will always be valuable as models of ornithological forms. Materials towards the ornithology of Mexico will be found in the description or enumeration of many new birds of that country inserted by us in the *Philosophical Magazine* and in Murray's *Encyclopædia of Geography*; but much more remains for future discovery. The birds of the West Indies, by some strange fatality, are as little known now as they were in the time of Sir Hans Sloane, and we have no accounts whatever of the ornithology of that part of tropical America laying between Guitamala and Cayenne, including the whole of Columbia; for the few species known to inhabit these countries are mixed up in our general works. Demerara, equally remarkable for the variety and beauty of its feathered inhabitants, has been often visited by amateurs, whose sole object seems to have been that of procuring perfect skins: as to the habits of the birds themselves, their structure, or their classic names, we know almost as little about them as if they never existed. This lamentable oversight in neglecting all that can be truly beneficial to science, we may confidently hope will be remedied, as far as concerns Demerara, by the exertions of an enterprising and scientific zoologist. M. Schombergh, who is now conducting the expedition into the interior of that little-known region, set on foot by the Royal Geographic Society, and who, with his assistants, intends to devote great attention to the ornithology of those inland tracts the expedition may explore. Among the numerous and important labours of Le Vaillant must be mentioned his monograph of the *Ampelidæ*, or typical fruit-eaters, a most splendid group of birds, peculiar to tropical America, and whose manners are recorded from his personal observation. Pro-

his *Sagio di una Distribuzione Methodica degli Animale Vertebrati*, printed in 1831, the learned and noble author casts aside his old nomenclature, which M. Audubon has taken up, and adopts all the modern genera.

ceeding towards the south we come to Brazil, an empire almost inexhaustable in the variety and beauty of its productions, among which birds form a prominent feature. With the exception, however, of the two valuable, but enormously expensive*, volumes by Dr. Spix, on the birds of Brazil, nothing has yet been done to illustrate, even by figures, the richest ornithological province in the world. Being one of those who have visited this region, with scientific objects alone in view, we have commenced the publication of that part of our acquisitions which regard ornithology, and hope to continue it to several volumes. We understand that a similar undertaking has been began by professor Schreiber of Vienna, but we have not yet been fortunate in meeting with the first part, which we believe is the only one yet published. The two volumes of M. Lesson upon the humming birds may properly come within this division of our subject; since this family is almost peculiar to the tropical regions of America, many new species are here, for the first time, made known; and the figures, although stiff and unnatural in their drawing, are yet engraved and coloured with great beauty. The student of this charming family must also consult the previous publication of M.M. Vieillot and Audebert, who have included all the species then known in their costly work, entitled, *Oiseaux Dorés*. In regard to the ornithology of Peru, nothing has been yet published in a collected form. The few remarks of Mollini on the birds of Chili are vague and unscientific; but we have just seen a paper, printed in German, by T. H. Von Kittlitz, containing an account of twelve new birds of this country, accompanied by a slight but expressive etching of each species, faithfully coloured, some of which are drawn with a spirit and grace quite opposed to that stiff and unnatural style so universal among the ornithological artists of the Continent. The celebrated Azara is the only authority we possess on the birds of

* The price of these two quarto volumes, in London, is about 50*l.*! an solute prohibition to their purchase.

Paraguay. Considering that this extraordinary man had never studied systematic ornithology (indeed, like Buffon, he affected to despise system), it is surprising to verify the accuracy of his descriptions and measurements; and yet, strange to say, from not having given any Latin names, either generic or specific to his birds, he has been, unintentionally, the cause of introducing into our systems a host of nominal species. This will be understood when it is explained that no less than three systematists have attempted to refer all the birds he has described, *without having seen them*, to the recorded genera; so that the very same species will be found not unfrequently in three different groups to which it has been referred by Sonnini, Vieillot, and Latham, each having no other guide than the original description of Azara, which is often silent upon those very points upon which correct judgment as to the true genus can be alone formed. We have been assured that Azara transmitted to Europe preserved specimens of every animal he described, and that they still exist in the royal museum of Madrid, "unnoticed and unknown" by all his commentators. We know not a more acceptable service that could be done to science than the personal examination of these specimens by a competent ornithologist, who could at once determine every species, and by referring each to its true genus, place a stamp upon the writings of Azara, which would render his admirable work as standard an authority as that of Wilson, or even of Buffon. Without such information we shall never be able correctly to locate upwards of 500 species, which Azara has actually described as natives of Paraguay; a country whose political state has prevented all our South American zoologists from visiting.

(178.) The ornithology of AUSTRALIA, the last zoological province, includes New Guinea, New Holland, and the Pacific Islands. There exists many valuable materials for this department, but they are widely scattered in detached fragments, and no attempt has yet been suc-

cessful in collecting them. The earliest account of the birds of New Holland will be found in the voyages of Collins, Phillips, and White. The plates of the two former are plain, but those of the latter are accurately coloured, and the drawings, in general, are very faithful. The volume of White is exceedingly valuable in every way, for it contains no less than twenty-nine plates of birds alone, independent of the quadrupeds, reptiles, and plants. A beautiful work on the zoology of New Holland was commenced by Dr. Shaw, but discontinued, for want of public support, after the first number.* Lewin, a zoological artist, settled in the country, published a thin volume, containing twenty-six plates, and descriptions of the native birds, drawn and etched by himself in a free and masterly style; yet this, too, shared the fate of the attempt made by Dr. Shaw, to the regret of every lover of ornithology. The Linnæan Society, with liberality and judgment, purchased a noble collection of the birds of this country, which now grace their museum. After many years, Messrs. Horsfield and Vigors undertook to describe them, and the first part of their labours, inserted in the Transactions, are, upon the whole, of considerable value; but, by the strange fatality which has attended the former attempts, ten years have elapsed without any thing having been done, so far as we can learn, to finish the undertaking: thus, nearly one half of the birds remained unnamed. Our attention has been for many years directed to this object, but so little are our public librarians and bibliopolists, disposed to encourage works of pure science, that, even if other circumstances were favourable, we question whether these materials will ever see the light. In regard to the ornithology of New Guinea, and the Pacific Islands, our information is very scanty, and, with the exception of the magnificent work of Le Vaillant on the Paradise Birds, is almost exclusively derived from the

* In this is figured the *Columba antarctica*, described many years after as a new species by M. Temminck, under the name of *Columba dilophus*. The latter name, however, is so appropriate that it may be allowed to remain.

French zoological navigators, particularly those of the Coquille, already noticed. Of the species discovered by Forster and sir Joseph Banks, inserted in Dr. Latham's *Synopsis*, very few can now be referred to their modern genera; so that in effect they become, like many hundreds of others in the same predicament, — nominal species.

List of the chief Geographic Ornithological Works, arranged under the Five Zoological Provinces.

1. Europe.

Temminck. Manuel d'Ornithologie, ou Tableau Systématique des Oiseaux qui se trouvent en Europe, &c. Par C. J. Temminck. Second Edition. Paris, 1820. 2 vol. 8vo.

Gould. J. The Birds of Europe. Royal folio. Now in course of publication.

Selby. Illustrations of British Ornithology. In two Series, viz. the Land and Water Birds. London, 1821–1824. Imperial folio. (Plates only.)

Selby. Illustrations of British Ornithology; containing the Descriptions of the Birds of Great Britain. London, 1825, &c. 2 vol. 8vo.

Montagu. Ornithological Dictionary; or Alphabetical Synopsis of British Birds, by Geo. Montagu, F. L. S. London, 1802. 2 vol. 8vo. Supplement to ditto. 1 vol. Exeter, 1813.

The pages of this work are, unfortunately, not numbered: the first volume contains one coloured plate; the supplement has twenty-four others uncoloured.

2. Asia.

Le Vaillant. Histoire Naturelle d'une partie d'Oiseaux nouveaux et rares de l'Amérique et des Indes. Par François Le Vaillant. Tom. 1. Paris, 1801. 4to. Forty-nine coloured plates.

This was the only volume published. It contains twenty-four plates and descriptions of hornbills, the last being the *Philedon corniculatus*, which is the Meliphagous representative of the *Buceridæ*. The remainder of the volume is devoted to the *Ampelidæ* or fruit-eaters of America.

Horsfield. Zoological Researches in Java and the neighbouring Islands. By Thos. Horsfield, M.D. &c London, 1824. 1 vol. 4to.

Neither the plates or the pages of this work are numbered; but there are thirty-two coloured plates of Javanese birds, with ample descriptions.

Horsfield. Systematic Arrangement and Description of Birds from the Island of Java. Inserted in the Linnæan Transactions, vol. xiii.

Gould. A Century of Birds, hitherto unfigured, from the Himalaya Mountains. By John Gould, A.L.S. London, 1832. 1 vol. folio.

The nomenclature and descriptions are stated to be by N. A. Vigors, Esq. M.P. There are eighty plates, some of them well drawn, and all very highly coloured.

Hardwicke and Gray. Illustrations of Indian Zoology. Folio. (The plates only have yet appeared.)

3. Africa.

Le Vaillant. Histoire Naturelle des Oiseaux de l'Afrique. Par François Le Vaillant. Paris, 1799–1808. 6 vol. 4to.

The number of plates in this valuable work are exactly 300. The figures are drawn, with a very few exceptions, by artists who had no scientific knowledge of a bird: they are, consequently, stiff, unnatural, and very inferior; nor should they be confounded with those executed for the other works of this author by the celebrated Barraband. The great merit of this work lies in the letter-press, in the observations on the natural groups, and in the account of the manners and habits of the different species. A few of these latter, however, in the two first volumes, are not natives of Africa, but have been introduced for the purpose of facilitating comparison.

Rüppell. Atlas zu der Reise im nnrdlichin Afrika. Von Eduard Rüppell. Vogel Bearbeitet von Dr. Med. Ph. J. Cretzschmar. Frankfurt am Main, 1826. Folio.

The ornithological portion is paged separately, and contains thirty-six plates and descriptions. The former are very respectable lithographs, and appear faithfully coloured. The letter-press is in German, but the specific characters in Latin.

4. America.

Wilson. American Ornithology; or, Natural History of the Birds of the United States. 9 vol. 4to. Philadelphia, 1803–1814. With 76 coloured plates.

Wilson. The American Ornithology of Alexander Wilson, with a Continuation by C. L. Bonaparte. The illustrative notes and life of Wilson by Sir William Jardine, Bart. London and Edinburgh, 1832. 3 vol. 8vo.

The order in which the birds were originally published is preserved in this edition; and the plates are copies, although much reduced, to bring them within the octavo size. The colouring is slight, but sufficient to identify the species.

Wilson. The American Ornithology of Alexander Wilson, with a Continuation by C. L. Bonaparte. Edited by professor Jameson. Edinburgh, 1831. 4 vol. 12mo.

This edition forms a part of *Constable's Miscellany*; and although the original text is given verbatim, there are no plates. The subjects have the advantage of being arranged in their family groups, as, for instance, the falcons, owls, &c., are placed together; but, unlike the edition above mentioned, all the species are left under their old, and now disused, generic names; while even the synonymes, by some strange oversight, are nearly altogether omitted. This is much to be regretted, after the masterly investigations of the prince of Musignano, in the two following works, had rectified all Wilson's errors of nomenclature.

Bonaparte, C. L. (Prince of Musignano). Observations on the Nomenclature of Wilson's Ornithology. Philadelphia, 1826. 1 vol. 8vo.

Bonaparte, C. L. The Genera of North American Birds, and a Synopsis of the species found within the territory of the United States. By Charles Lucien Bonaparte, Prince of Musignano. Extracted from the Annals of the Lyceum of Natural History of New York. New York, 1828. 1 vol. 8vo.

In these two admirable and exceedingly scarce volumes, which every one who writes on the birds of America ought to consult, the unavoidable errors of Wilson, in regard to nomenclature, are pointed out, many new species are added, and original observations interspersed. The contents of both will be found in a series of papers in the Transactions of the American Societies. A few copies only were then printed separately, made up into volumes, and distributed by the noble author to the chief ornithologists of Europe and to his scientific friends. Neither, we have reason to believe, were ever offered for sale.

Audubon. Ornithological Biography; or, an Account of the Habits of the Birds of the United States of America; accompanied by Descriptions of the Objects represented in the Work entitled the Birds of America, and interspersed with Delineations of American Scenery and Manners. By J. J. Audubon, F. R. S., &c. Edinburgh, 1832–1834. 2 vols. royal 8vo.

There are many isolated facts of much interest in these volumes; but they have not been made use of for general-

isation; and the nomenclature, as already remarked, is that which has gone out of use. The episodes, although not connected with the subject, are particularly amusing.

Audubon. The Birds of America; being the Atlas Collection of Plates described in the above work, and now in course of publication.

Richardson and Swainson. Fauna Boreali-Americana; or, the Zoology of the Northern Parts of British America, containing Descriptions of the Objects of Natural History the collected on late Northern Land Expeditions under the command of Captain Sir John Franklin, R.N. Part 2. The Birds by William Swainson and John Richardson, M.D. Published under the authority of the Right Hon. the Secretary of State for Colonial Affairs. London, 1831. 1 vol. in 2 parts.

This work is quoted throughout the CABINET CYCLOPÆDIA as *Northern Zoology*. It contains fifty coloured plates. The whole of the descriptions, and nearly all the synonymes, are entirely from the pen of Dr. Richardson; and we may, therefore, be permitted to express our opinion, in the words of another writer, that "they are models of perfection." Not only is the plumage described, but such a masterly definition of the form of each bird is added, that every experienced ornithologist would be able to determine the modern genus, even if the name had not been given. The classification is in unison with that which is more fully developed in this treatise.

Swainson. A Synopsis of the Birds of Mexico. By William Swainson. London, 1827.

This is a paper inserted in *Taylor's Philosophical Magazine* for June, 1827, and in which the specific characters of new species are given.

Swainson. A Monograph of the Tyrant Shrikes of America. Inserted in the *Journal of the Royal Institution*, No. xi. The subordinate groups of this family are here first defined and named, and the species described.

Le Vaillant. Histoire Naturelle d'une partie d'Oiseaux nouveaux et rares de l'Amérique et des Indes. Par F. Le Vaillant.

We have already noticed this work under the head of ASIA. It contains plates and descriptions of the tropical *Ampelidæ*, or fruit-eaters.

Spinx. Avium Species Novæ quas in Itinere Annis 1817-20. Per Braziliam collegit et descripsit. 2 vol. royal 4to. With 222 coloured plates. Genuæ, 1824-26.

The figures are accurate, and faithfully coloured, but stiff and unnatural.

Lesson. Histoire Naturelle des Oiseaux Mouches. In se-

venteen numbers, containing eighty-six plates. Paris, 1829. 1 vol. 8vo.

esson. Histoire Naturelle des Colibris, suivie d'un Supplément a l'Histoire Naturelle des Oiseaux Mouches. Thirteen numbers, containing sixty-six plates. Paris, 1831. 1 vol. 8vo.

sson. Les Trochilidées, ou les Colibris et les Oiseaux Mouches. Fourteen numbers, containing seventy plates. Paris, 1832–1834.

We have already alluded to these works, which we class under this head, as the whole of the humming birds are restricted in their geographic range to the continent of America.

Kittlitz. Uber Einige Vögel von Chili, beobachtet im März und Anfang, April, 1827. Von F. H. von Kittlitz, naturforscher der Expedition der Semavin.

The birds that are described and figured with so much spirit in this valuable and interesting paper (which we have only seen in a detached form) are as follows: —

Phitotoma silens.
Pleroptochos rubicula.
——————— albicollis.
——————— megapodius.*
Troglodytes paradoxus.
Synallaxis humicola.
Synallaxis Ægithaloïdes.
Opetiorynchos rupestris.
Muscicapa parulus.
——————— pyrope.
Fringilla diuca, *Mollini*.
Crypturus perdicarius.

Azara. Voyages dans l'Amérique Méridionale. Par Don Félix de Azara, Commissaire et Commandant des limites Espagnoles dans le Paraguay, depuis 1781 jusqu'en 1801. Publiés d'après les Manuscrits de l'Auteur, par C. A. Walckenaer. Suivis de l'Histoire Naturelle des Oiseaux du Paraguay et de La Plata, par le même auteur, traduite, d'après l'original Espagnol, et augmentée d'un grand nombre de Notes, par M. Sonnini. Paris, 1809. 4 vol. 8vo. (With an Atlas of Twenty-five Plates.)

This edition of the zoological researches of this extraordinary Spaniard is now become very rare. The two last volumes, that is, the third and fourth, are entirely devoted to ornithology, and contain full descriptions of no less than 448 species, collected by the author himself, chiefly in Paraguay. M. Sonnini, not having seen the birds, has been guided merely by the descriptions in referring them to the systematic genera; and MM. Vieillot and Latham have followed the same plan to a much more injurious extent. Azara is the Wilson of South American ornithology, and his name will

* This is the Leptonyx macropus of our Zoological Illustrations.

ever rank as the first describer of the birds of these little known regions.

5. Australia.

Collins. Account of the English Colony of New South Wales. London, 1798–1802. 2 vols. 4to. With many coloured Plates of Natural History. (A second edition was published in 1804.)

Phillips. Voyage to Botany Bay, London, 1789. 1 vol. 4to. (There is another edition in 8vo).

White. Journal of a Voyage to New South Wales; with Sixty-five Plates of nondescript Animals, Birds, Lizards, Serpents, curious Cones of Trees, and other Natural Productions. By John White, Esq., Surgeon-General to the Settlement. London, 1790. 1 vol. 4to.

The plates of birds, all coloured, amount to twenty-nine. They are designed by Miss Stone, the best zoological artist of that day; and the specimens were all deposited in the Leverian Museum, where we well remember seeing them.

Lewin. A Natural History of the Birds of New South Wales; collected, engraved, and faithfully painted after Nature. By John William Lewin, A.L.S., late of Paramatta, New South Wales. Illustrated with Twenty-six Plates. London, 1822. Thin folio.

Shaw. Zoology of New Holland. By George Shaw, M.D. The Figures by James Sowerby, F.L.S. London, 1793. 1 vol. thin 4to.

Of the twelve coloured plates which were published of this work, five are of birds.

Horsfield and Vigors. A Description of the Australian Birds in the Collection of the Linnæan Society, with an Attempt at arranging them according to their natural Affinities. By N. A. Vigors, Esq. M.A. &c., and Thomas Horsfield, M.D. &c. Part 2. London, 1826.

Inserted in the *Linnæan Transactions*, vol. xv. p. 170. Many new genera and species are here characterised; and the attempt at their natural arrangement, upon the whole, is highly creditable to the authors. The second part, however, has not yet appeared.

(179.) The foregoing are the chief works upon geographic ornithology that we are acquainted with. We believe the list includes all those of any importance that have been completed*; but there are no doubt many

* There have been two or three German publications commenced upon the zoology of Brazil, but which have been discontinued after the first or

other essays and papers that may come under this class, scattered in the Transactions of Societies both at home and abroad. We must again repeat, that to complete these lists by noticing all incorporated papers of this description would extend this part of our volume to a most disproportionate length.

(180.) Our fifth and last section contains such works as are more especially intended to illustrate the science by coloured plates: they are necessarily, on this account, of the most expensive description, and are therefore aptly termed by the French *Ouvrages de luxe*. Some few, being of the nature of monographs, have been already alluded to, and others, like the African birds of Le Vaillant, and those of India by Gould, would have been inserted, did they not decidedly belong to geographic ornithology. These are the works which should be in all public libraries whose funds are equal to their purchase; and they should be necessary accompaniments to public museums intended to advance zoological science. Unfortunately, however, such institutions in England are remarkably deficient in this respect; so that it has become almost impossible for the naturalist to prosecute his studies successfully, without incuring an expense so enormous that few private incomes can support. We have heard that the Zoological Society, the richest in this country, and that above all others which should possess a princely library in its own department of science, is yet deficient in some of the most ordinary works of consultation and of reference. On the other hand, the Ratcliffe Library at Oxford is proverbially the richest, in all the splendid zoological publications we are about to enumerate, of any in Britain. Its late lamented librarian, Dr. Williams, was more especially distinguished for his zeal and liberality in this respect, and to him the library is mainly indebted for the celebrity it has acquired in this

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second number, and we have been unsuccessful in procuring their exact titles.

particular branch. We shall begin with those works of the last century which still retain their value as standard books of reference, and, after enumerating those of a later date, proceed to make a selection of such as would constitute a magnificent and uniform series, worthy the library of a potentate.

List of Illustrative Works in Ornithology which are of standard excellence and authority.

Planches Enluminées. A Collection of one thousand and eight plates of Birds, generally known under this title, which are intended to accompany the original edition of Buffon's Histoire Naturelle des Oiseaux. Paris, 1770–1776. 10 vol. folio, or in imperial quarto.

This collection of figures owes its celebrity more to the absence of any other, equally extensive, than to any merit the figures themselves possess, either of accuracy or of execution: the greatest praise that can be given them is, that they are generally recognisable, and can be identified with the birds themselves; more, however from the colouring, than from the accuracy of the drawing. They are all referred to in the several editions of Buffon, and are printed both on a folio and on a quarto size; about nine represent insects, reptiles, and corals: the remainder are entirely of birds.

Temminck and Laugier. Nouveau Recueil de Planches Colorées d'Oiseaux, pour servir de suite et complément aux Planches Enluminées de Buffon, d'après les Desseins de Huet et Prêtre. Paris, 1820–1835.

In the mechanical parts of its execution this is a very beautiful work, the paper and printing are of the best description, and the plates are admirably engraved and coloured; but the drawing is not faithful, nor is the colouring generally natural: the figures are stiff and formal, and they are all put into nearly the same attitudes. The descriptions of the birds are meagre, and for the most part relate to the mere colour of the plumage. Occasionally, however, more extended remarks are introduced on certain genera, as that of *Buceros*, for instance, which are really valuable; but the total absence of synonyms, specific characters, and scientific descriptions of the form, structure, or habits of the birds themselves, renders this work far inferior to what it might have been, and what the scientific world expected, from the reputation of its authors. The publication is conducted so

irregularly, that we have never seen a complete set, even of those parts which are out.

Edwards. The Natural History of uncommon Birds, and of some other rare and undescribed Animals, exhibited in 362 copper plates. In seven parts (or volumes). By George Edwards, Library Keeper to the Royal College of Physicians. London, 1743–1764.

The seven volumes above mentioned includes the three volumes of *Gleanings of Natural History*, originally publish separately. Of this valuable and standard work in our ornithological libraries, we have already spoken.* Latham and Shaw have compiled largely from it; but Edwards should always be consulted in his own quaint but forcible and exact language.

Brown. New Illustrations of Zoology, containing Fifty coloured Plates of new, curious, and nondescript Birds, with a few Quadrupeds, Reptiles, and Insects, together with a short and Scientific Description of the same. By Peter Brown. London, 1776. 1 vol. 4to.

Brown seems to have been a zoological painter; his figures are superior to those of Edwards, but his descriptions short and unsatisfactory. The volume is, nevertheless, valuable, and may be looked on as a supplement to those of Edwards. In both there is a French translation.

Desmarest. Histoire Naturelle des Tanagers, des Manakins, et des Todiers. Par A. G. Desmarest, avec Figures d'après les Desseins de Mlle. Pauline de Corcelles. Paris, 1805. 1 vol. royal folio.

A noble volume. The fair artist who designed the plates was a pupil of Barrabaud, and, like her accomplished master, has succeeded in giving that *rotundity* to her subjects which relieves so much the sameness of position in which it was then the custom to paint birds. The author has not merely contented himself with describing the colour of the feathers: he has investigated and detailed all the synonyms, drawn up excellent specific characters, and executed his task with the hand of a master. The volume contains seventy-two coloured plates, and is a fit companion to those of Le Vaillant.

Vieillot. Histoire Naturelle des plus beaux Oiseaux Chanteurs de la Zone Torride. Par. L. P. Vieillot. Paris, 1805. royal folio.

This, like the preceding, contains seventy-two plates, but the execution is in every respect inferior: one small bird occupies a folio page, and the drawing and colouring are only of ordinary execution. We hazard the assertion that more

* Preliminary Discourse.

than one of the figures are made up from description alone; there are, nevertheless, many rare species represented, particularly of the tropical genera *Amadina* and *Estrelda* Sw.; but there are very many birds of Europe and North America introduced, in order, apparently to make up the volume. It is a pretty *show*-book, and may be consulted occasionally, with great advantage.

Vieillot. Histoire Naturelle des Oiseaux de l'Amérique Septentrionale, contenant un grand nombre d'Espèces décrites pour la première fois. Par. L. P. Vieillot.

The author describes many of these birds from personal observation in their native country; but he has likewise introduced those which he has not seen, upon the authority of Pennant and Latham. The work is useful as a book of reference, but can neither rank in merit with that of Wilson, or in execution with those of Le Vaillant.

Audibert and Vieillot. Histoire Naturelle et Générale des Oiseaux Dorés. 2 vol. folio. Paris, 1802.

There are two impressions of this work, one in folio, the other in quarto; in the first of which, the names upon the plates (180 in number) are printed in gold. The figures are accurate, without being well drawn; they represent the Humming birds, Jacamars, Promerops, Creepers, Sun birds, and Paradise birds.

Le Vaillant. Histoire Naturelle des Perroquets. Par François Le Vaillant. Paris, 1801–1805. 2 vol. royal folio (or quarto).

With the exception of a few of the plates at the commencement of the first volume, the whole are executed from drawings by the celebrated Barrabaud, the first artist who ventured to represent the varied attitudes of birds, at the same time preserving all that accuracy of detail so essential to their scientific characters. No painter of the present day can surpass, or perhaps equal, many of the exquisite designs contained in this and the subsequent volumes, enriched by the same pencil. The letter-press, although not scientific, is full of accurate detail and of valuable information. The number of plates are 139, printed in colours, and finished by the hand; in many of the copies, however, the tints are too rich, and "overstep the modesty of nature." The quarto edition is precisely similar to the folio, except in the size of the paper.

Le Vaillant. Histoire Naturelle des Oiseaux de Paradis. 1 vol. folio.

Equally splendid with the preceding. The size and extraordinary plumage of the Paradise birds requires a scale fully equal to the dimensions of this volume, which

exceeds any other of the author's in the beauty and splendour of its contents.

Le Vaillant. Histoire Naturelle des Toucans et des Barbus. 1 vol. folio.

This is generally considered as the second volume of the last; but the two works were published separately, and have distinct titles.

Le Vaillant. Histoire Naturelle des Promerops, Guëpiers, et des Couroucous. Paris, 1807. 1 vol. folio.

Fewer copies, we suspect, of this latter volume must have been printed than of the two preceding, for we have never been able to procure it, or to see it in any library, public or private: we cannot, therefore, speak of its execution from actual knowledge. Of its merits there can be no doubt, so far as the author is concerned, and if, as we have heard, the plates are executed from the drawings of Barrabaud, the volume will be equal to the preceding.

Lear. Illustrations of the family of Psittacidæ, or Parrots; the greater part of them species hitherto unfigured: containing forty-two lithographic plates, drawn from life and on stone. By E. Lear. A.L.S. 1 vol. royal folio.

This beautiful volume might be looked on as a supplement to the work of Le Vaillant upon the same family, had the plates been accompanied by descriptions, but unfortunately there is no letter-press beyond the title and the list of subscribers. Those drawings in the volume which have been taken from live birds are worthy of great praise, and all are beautifully and accurately coloured.

Gould. A Monograph of the family of Ramphastidæ, or Toucans. London, 1834. 2 Parts, royal folio.

Mr. Gould has ably investigated and beautifully delineated these singular birds, and has added several new species to those with which we were previously acquainted. A third part now in the press, is intended to complete the work, which deserves to be ranked with that upon the same group by Le Vaillant.

Gould. A Monograph of the Trogonidæ or Trogons. Part 1. royal folio.

Uniform with the preceding, and, from the superior beauty of the birds themselves, even more interesting.

(181.) This list comprises all the royal folio volumes of illustrative ornithology not mentioned in the preceding pages, with the exception, indeed, of some few of those on the European birds of the last century, whose execution is altogether inferior. They compose a series,

uniform in size, of about twenty volumes; for many of those of which the ordinary copies are in quarto, have been likewise printed in folio. They are all necessary for the consultation of ornithological writers, and for determining the names of birds; but their collective cost is so enormous, that few public libraries, or private individuals, would think of expending such a sum on books belonging only to one department of natural history. There are, nevertheless, not wanting, even in this country, individuals who enrich their libraries with a selection of the best works of this nature. It is, therefore, with a view to guide such patrons in their choice, that we shall now divide the last list into two classes; the first containing such works as are chiefly valuable for reference, but not, like those in the second, pre-eminently beautiful in the execution of their figures. To these we shall annex the current prices, where known, as marked in some of the catalogues of the London booksellers.

1. *List of Folio Works on Illustrative Ornithology, of the First Class, uniform in size, and chiefly valuable as Books of Reference.*

	Vols.	Selling Price. £ s.	Catal. of	Publication Price. £ s.
Planches Enluminées, Buffon	5	48 0	-	0 0
——— Coloriées, Temminck	3	(now publishing)		
Audibert and Vieillot, Oiseaux Dorés	2	12 12	- Bohn	0 0
Vieillot's Tropical Song Birds	1	10 0	- Bohn	18 0
——— American Birds	2	20 0	- Bohn	33 0
Gould's Himalayan Birds	1	10 0	- Bohn	14 0
Total	16	£100 12		

2. *List of Folio Works on Illustrative Ornithology, of the Second Class, printed uniform in size, and eminent for the Beauty of their Plates or the Value of their Descriptions.*

	Vols.	Selling Price. £ s.	Catal. of	Publication Price. £ s.
Le Vaillant's Parrakeets	2	20 0	- Bohn	31 10
——— Birds of Paradise	1			
——— Toucans and Barbuts	1	32 0	- Bohn	60 0
——— Bee-eaters, &c.	1			

List 2. — *continued.*

	Vols.	Selling Price. £ s.	Catal. of	Publication Price. £ s.
Brought forward	5	52 0		. .
Le Vaillant's Birds of India and America	1	7 7	Bohn	12 0
——— Africa	6	32 0	Bohn	0 0
Desmarest's Tanagers	1	9 9	Wood	18 0
Temminck's Pigeons	1	28 0	Bohn	0 0
Gould's Birds of Europe	0	(now publishing)		
——— Toucans	1	6 10		6 10
——— Trogons	1	2 10		2 10
Lear's Parrots	1	6 0		6 0
Total	17	£146 6		

3. *List of select Quarto Works entirely on Illustrative and Geographic Ornithology, of which Folio Editions were never printed.*

	Vols.	Selling Price. £ s.	Catal. of	Publication Price. £ s.
Edwards's Birds	7	14 14	Bohn	0 0
Brown's Illustrations of Zoology	1	2 10	Wood	0 0
Jardine and Selby's Birds	2	14 0		14 0
Wilson's American Ornithology	9	. .		. .
Bonaparte's Continuation of ditto	3	. .		. .
Richardson's Northern Zoology	1	3 0		3 0
Lewin's Birds of New Holland	1	3 0	Wood	0 0
Spix's Brazilian Birds	2	42 0	Bohn	50 0
Total	24	£79 4		

(182.) In concluding this part of our subject, we have felt it our duty to state our plain and candid opinion on the various works that have passed under our notice, "without favour or affection" even to those whom we class among esteemed acquaintance. If once the private feelings of regard or of esteem are made to influence the critic — as they unfortunately too often do — the confidence of the public will be entirely withdrawn; the critic becomes a false guide, and will be mistrusted on all other, and future, occasions.

CHAP. II.

ON THE NOMENCLATURE, AND DESCRIPTION OF BIRDS.

(183.) NOMENCLATURE, it has been well observed, is not strictly a part of the science of natural history; yet it is not only a convenient but an essential instrument for making that science more readily understood. Names convey definite ideas, as certain combinations of letters produce certain words, whose meaning is known to every one. Hence it is that a fixed standard for both is equally essential. An author who violates those rules of systematic nomenclature that are acted upon by the common consent of the greatest naturalists, is as inexcusable as one who chooses to use the orthography of Chaucer in the nineteenth century. The old naturalists paid little attention to this; and almost every one, particularly in botany, invented a new name for the object he described. As natural history treats of innumerable animals whose names have not been incorporated in vernacular language, and has to express ideas which are not to be met with in any other branch of human knowledge, it follows that its nomenclature should be expressive, and founded upon certain fixed principles. If no meaning is conveyed in the construction of the words used, the memory has nothing to lay hold of as a help to bring the object before the mind; and if every author is at liberty to change or reject the name of an object at his own will and pleasure, no stability can possibly be given to a language which is to enable two persons, placed at the opposite extremes of the globe, to converse upon the same object. The necessity of nomenclature being regulated by fixed laws, has been advocated by Linnæus, Fabricius, and all the best systematic writers, both in zoology and botany.

Willdenow*, in the latter department, has digested several excellent aphorisms on this head, nearly all of which we are bound to adopt as being equally applicable to ornithology. The advanced state of our science, however, requires several others. These rules will claim our first attention; and as the value of brevity and perspicuity in scientific descriptions is no less necessary to facilitate knowledge, we shall conclude this chapter with some hints and directions thereon.

(184.) Nomenclature divides itself into two branches; for all animals with which the bulk of mankind are familiar, have two names: one being the scientific, the other the vernacular. The first is derived from the learned languages, — that is, from the Greek or Latin, and is that by which the animal is called by naturalists: the second is used by the great bulk of mankind, or by the vulgar, and is the name belonging to the dialect of the country. With these latter names, science, of course, has nothing to do, because they are never used where accuracy of designation is required: we shall, nevertheless, offer some remarks upon them, after we have given our first attention to the former.

(185.) Scientific names are not only given to every object or species in nature, but also to the different ranks or divisions under which species are comprehended. But now that these names are so much multiplied, they would not be sufficient to convey all that was desirable to be known. If the name of a class was constructed like that of a family, how should we know what was the rank of the division or group to which it belonged? Modern zoologists, therefore, have fortunately hit upon an expedient by which we can designate, in the lesser divisions, not only the group, but the rank it holds in the scale of creation, by one and the same word. This is accomplished by making the last syllable uniformly the same in each of the fol-

* The Principles of Botany and of Vegetable Physiology, translated from the German of D. C. Willdenow. Edinburgh, 1805. 1 vol. 8vo.

lowing groups, which are those most numerous in nature, and of course require the clearest designation : —

Tribes	end in *es*	as	{ Fissirostres, Dentirostres, Pachydermes, Edentates.
Families	—— *idæ* or *adæ*	—	{ Laniadæ, Muscicapidæ, Lemuridæ, Cervidæ.
Sub-families	—— *inæ*	—	{ Thamnophilinæ, Ceblepyrinæ, Mustellinæ, Felinæ.

This plan of designating the groups in question has been so extensively employed, more especially in ornithology, that it will now be adhered to by all who desire to establish a fixed nomenclature. It is not so material that the names of the higher groups should have definite terminations, because they are comparatively so few, and are so well known, that the change would not be productive of any real advantage. The student will never be in danger, after his first lesson, of supposing that the *Fissirostres*, for instance, is a group equivalent to the *Insessores*, although both names terminate the same.

(186.) We now pass to the names of genera and species. A genus or sub-genus, indeed, comprehends many species ; but when we speak or write of an animal, we call it by both these designations, just as we use the Christian name of an individual to distinguish him from the rest of his family. We shall not here revive the long debated question, whether we should call a species by its generic or by its sub-generic name ; since so much may be said on both sides, that we think every one, on ordinary occasions or in parlance, may be at liberty to follow his own opinions upon this point. We certainly incline to the side of those who contend that the sub-generic name should be that which precedes the specific ; provided, however, that the validity of the sub-genus has been well ascertained. If we spoke, for instance, of the fork-tailed tyrant, it appears better to call it *Milvulus furcatus* (*Milvulus* being a sub-genus) than *Tyrannus furcatus* (*Tyrannus* being the genus). But when, as among the *Falconidæ*, ornithologists have made numerous and contradictory

sub-genera, resting upon no analysis or demonstration, our custom is to preserve the generic name only, not choosing to adopt sub-genera, which may possibly prove to be mere examples of aberrant species. With these preliminary remarks we may now proceed to notice the laws promulgated by our predecessors for the construction of generic or sub-generic names—for specific names—and the circumstances under which the latter they may be altered.

(187.) *Every group or species for which a new name is proposed, must be properly defined, otherwise it cannot be adopted or noticed.*—It is obvious, that if a new word is compounded, and applied to an object, or a group of objects, the meaning of the word, or, in other words, the characters of that to which it is given, must be fully explained, before it can be understood or adopted (if correct) by others. It has been a serious complaint among entomologists, that writers of catalogues introduce a multitude of new generic or specific names, without concerning themselves with the trouble of definitions, leaving their readers to make out their meaning, as best they can, but assuming to themselves the priority of nomenclature: such silly vanity is unworthy of any true naturalist, and has been discountenanced so effectually by those of a higher order, whose opinions have been looked up to*, that there is no danger of the few experiments of this sort that has been tried in ornithology, being often repeated. For our own part we have, upon a former occasion, distinctly stated that "all such names will be passed over as if they never had existed."†

(188.) *The character of a group or species must be so clear and definite, that it cannot be applied to any other.*—It has been well remarked, that a bad or imperfect description of an object is no description at all; its proposed name, therefore, cannot be adopted. Nevertheless, if we were strictly to act upon this rule, three

* Latrielle N. Dict. d'Hist. Nat. xxiii. 129.
† Macleay, *Annulosa Jav.* 19. note.

fourths of the species described by the naturalists of the last century, and a large proportion of those of the present, must be struck out of our systems, and rendered as obsolete as most of their genera. We must, therefore, in this instance, act with lenity; passing over the omission of many characters which are now found to be of importance, and endeavouring to preserve all such species of our predecessors, as we can make out by the aid of their descriptions, and the figures they quote. When, however, the former are inadequate to point out the modern genus, and no figure of the object described has been published, we have no other resource than to act upon the strict letter and spirit of this law. It is as clearly impossible to recognise the great majority of the shrikes, warblers, parrots,—nay, of four fifths of the birds described by Linnæan writers,—as it is for an entomologist to make out the unfigured species of the Linnæan *Carabidæ*, and refer them all to their modern groups.*

(189.) *Every new group or genus must have a new name.* — To call a genus in entomology by the same name as another in botany, would of course lead to the greatest confusion; we should not know, in fact, which was intended — a butterfly or a plant, a quadruped or a spider. The multiplicity of generic or patronymic names, however, renders it very difficult for a writer in one department to know what names have been used in another. When such repetitions are discovered, the name as first imposed or employed, is to be retained, and a new one given to the other group. Hence the following, among many others, have been changed: —

Mygale, in entomology, has been previously employed for a genus of quadrupeds; it is now, therefore, changed to *Therophosa*.

Zygæna, in entomology, is an old genus in ichthyology, now changed to *Anthrocera*.

* It has been truly said that there are hundreds of species in this group to which the description of "*carabus alatus ater nitidus, elytris striatis, antennis rufis*," will apply, although in their structure and economy they totally differ from each other. See *Annulosa Javanica*, 3.

Urania, in entomology, is an old genus in botany; it is therefore now changed to *Lelius*.

Lophyrus, in ornithology, is an old genus in entomology; it is now changed to *Ptilophyrus*.

(190.) *Names of genera or sub-genera must not be taken from foreign languages, but should be formed from the Latin or Greek.**—Names taken from living languages, even though they have a Latin termination, are generally barbarous, and always improper, and cannot be so classically compounded as if taken from the Greek. Even names formed from the Latin are often deficient in euphony, and still more so when they are compounded of Latin and Greek together. When it is possible, they should be made out of two Greek words with a Latin termination, the following are examples of faulty names in ornithology, whether used in a generic or specific sense:—

Ara, Aracari.
Cariama.
Gouan, Guiraca.
Piaya, Pitangus, Puffinaria.
Sula.
Lori.
Momotus.
Nengetus.
Tinamus, Taccocua.

(191.) *Names must not be received, that are borrowed from mythological, divine, historical, moral, puthological, or other terms.*†—"When we choose a name," observes Willdenow, "having a reference to religious or other matters, with which it cannot properly be compared, or which are not known to every one, *it is good for nothing.*" The following names, therefore, have been rejected:—

Catharractes, Cochlearius.
Fratercula, Fregetta, Montezuma.
Secretarius, Serpentarius, Stercorarius.

Some exceptions to this rule may be allowed, particularly in the instances of the *Ibis sacra*, the sacred ibis of the Egyptians; *Palæornis*, as the parrakeets known to the ancients, and *Gracula religiosa*, a bird held sacred in India.

* Willdenow, Illiger, &c. † Ibid.

(192.) *Names of genera must be framed according to resemblances or properties, which, however, must be found not in one species of the genus only, but in the majority of those which are known.* (Willd.) — When the name can be formed according to one of the essential characters of the genus or group, such names are undoubtedly the best. Hence, as nearly all rasorial types are remarkable for their crests or their tails, names indicating the peculiar formation of these parts are particularly good; for they not only indicate which of the primary types the group represents, but also the particular modification of one of the characteristics of that type. The following may be quoted as among the best of these names: —

Macrocircus.	Dicrurus.
Platycircus.	Rhipidura.
Oxyurus.	Seisura.

(193.) *Generic names ending in* oïdes, ella, ana, *must be carefully avoided.* (Willd.) — These terminations, which generally imply resemblances, often doubtful, cannot properly be used in a generic sense; as the names of such groups should be of a definite and positive nature. They may, however, be most usefully employed with regard to species, as indicating a similarity either of colour, form, or habit, to the bird with which it is compared. Thus, *Myiagra rubiculoïdes* is aptly so named, because it resembles in its habit a robin, and we are immediately reminded of its natural analogy to that bird.

(194.) *Names of groups should not be too long, although they may be classically compounded.* — All names are chiefly intended to assist the memory, which should not be burthened by words of great length. Hence the following names — although some, being strictly correct, may be tolerated — are not to be imitated either in their length or occasional harshness: —

Ateolepodes.	Macroramphus.
Coleoramphus.	Opetiorhynchus.

Campilorhynchus.
Ptilonorhynchus.
Tropidorhynchus.
Dermorhynchus.
Dendrocolaptes.
Phœnicophaus.
Phalacrocorax.
Phœnicopterus.
Pachycephalus.
Strobilophaga.
Teleopodes.
Opisthophus.

(195.) *Names of groups higher than genera should always be derived from the pre-eminent type of the group, or, if of a tribe or order, from the character which is most universal.* — The facility which this modern law of nomenclature gives to research is very great. It first originated among our own naturalists, about twenty years ago, and has since been universally acted upon in Britain, both in artificial and natural systems. It is clear, however, that before we impose a name upon a group which has never been characterised, we should carefully analyse it; without which we shall run no small risk of not discovering the typical character of the whole, and consequently apply a false name. Thus, if the rasorial order had been sufficiently inevstigated, it would have been discovered that the peacock was the pre-eminently typical bird, and, therefore, that the primary family would be the *Pavonidæ*. In like manner, *Muscicapa* being more typical than *Todus*, the family to which both belong should be called the *Muscicapidæ*. These changes, so far as the names are concerned, are comparatively trivial; but while the whole science is undergoing a revision and correction, it may be as well to make these and every other necessary change of nomenclature at the same time.

(196.) *The highest reward of a naturalist is to have a genus called after his name.*—"No monument," says the celebrated Willdenow, "of marble or brass is so lasting as this. It is the only way of perpetuating the memory of true botanists (or naturalists), or of those who have benefited the science." Linnæus, whose judgment was always sound and practical, confined the names of genera thus derived to botany alone, wherein, even in his days, such groups were so very numerous,

that it became frequently very difficult to invent a name expressive of actual peculiarities. His zoological genera, on the other hand, were few, and he was thus enabled, without difficulty, to frame his generic nomenclature upon other, and certainly better, principles; since there can be no doubt that a name derived from some actual property of the object it designates, is always more expressive than any other. But whatever were the motives that guided Linnæus in this restriction, there seems no valid reason—if we admit the principle that names may be so framed—why botanists alone are to be so honoured. We by no means wish to see a general departure from this rule, for the reason just stated, conceiving that all generic names should express the absolute qualities of the thing named; yet the same object can be gained in a different way. Perpetuity is as likely to attach to a specific as to a generic name; and thus the names of those who have earned the title of "true" zoologists may be as effectually preserved in the record of a species, as in the appellation of a genus. This, in fact, seems to be the general feeling among us, and so far all is well. But then comes the question, to whom, besides true zoologists, is this honour to be extended? A line of distinction must be drawn somewhere, or the designation ceases to be an honour. Now we conceive that private feelings on such a point ought not to be indulged at the expense of violating the spirit and obvious meaning of the law in question. There can be no doubt that naturalists who have brought home collections from distant countries for the object of benefiting science, and have so employed them, merit being associated with the great names that have enriched our science by their writings and recorded discoveries. But if every one who unknowingly happens to discover a new bird is entitled to have his name attached to it, we know not how widely this honour is to be distributed. The captain of a trading vessel may bring home a "curious bird," which may prove to be new, and thus may claim to have his name immortalised. Every per-

son, in short, who directly or indirectly assists an ornithologist by the donation or the loan of something new, will have an equal title to the only distinction we can bestow upon a Linnæus, a Cuvier, a Wilson, or a Temminck. Is there not some reason, therefore, to protest against this wholesale coinage of complimentary names which now begin to crowd every page of our catalogues, almost to the exclusion of those by which the species can in some degree be made known? Surely there are other ways of expressing our thanks or gratitude to those who assist our labours, than by this very cheap mode of cancelling the obligation,—this prostitution of what was once a scientific honour, but which is now within the reach of almost every one, however ignorant of science, or merely following it as a trade. But this is not all: not only will a gift of a new bird insure its donor "the highest reward" that a "true" naturalist can receive, but a quorum of the council of a scientific body may not despair of seeing all their names attached to the new birds in their own museum*,—names which are utterly unknown in the records of ornithology, and almost so in any other branch of science. Another instance may be mentioned, where the subscribers to a most expensive work are propitiated in the same manner, with as great a violation of scientific justice, and of all that is consistent and proper. Such names, however, will certainly not outlive their authors or their namesakes. They will share the fate of the *Phasianus Impeyanus*,—a name intended to consign to immortality an Indian governor who first sent the bird to England, but which M. Temminck has since called by the appropriate specific name of *refulgens*. Sanctioned, therefore, by an authority which stands so high in the scientific world, and fortified by the spirit of this law of nomenclature, we must be excused for not adopting very many of the complimentary names in-

* See some observations on this strange and unexampled proceeding in "Northern Zoology," ii. 457. and Jameson's edition of Wilson's "American Ornithology."

troduced of late years into our catalogues. We are ever desirous of bestowing honour where it is due; and we trust that no other motives than those we have here stated will be imputed to us on this occasion.

(197.) *A genus or species in one department of natural history should not be named after a naturalist eminent only in another; and such names, where practicable, should belong to those groups which have been more immediately benefited by the naturalist to whom the honour is given.* — The name of an ornithologist, however highly esteemed and honoured among zoologists, may be utterly unknown to the botanical world; it is, therefore, highly objectionable to record his name in the annals of a science wherein he has done nothing: equally objectionable is it when this position is reversed. Each branch of natural history, in fact, should perpetuate the names only of those by whom it has been advanced or signally benefited. Such appellations, therefore, as *Goodenovii, Bichenovii, Brownii, Baueri,* &c., all designating eminent botanists, should have no place in ornithological nomenclature; more especially as the high merits of the greater part have already procured for them the lasting honour of a generic distinction, and they are likely to put small account on seeing themselves introduced where they are not known. Even the true value of a mere compliment is in its being well timed, and happily appropriate to the individual; but the calling a bird after a botanist, or an insect after an ornithologist, destroys the association of ideas which should be between the name and the object. Linnæus and his school were not only, in general, very cautious in thus commemorating individuals, but peculiarly happy in their choice of appropriate occasions. "Thus," observes Linnæus, "the genus *Bauhinia,* as named after the two distinguished brothers, John and Caspar Bauhin, has a two-lobed or a twin leaf. *Dorstenia,* with its obsolete flowers, devoid of all beauty, alludes to the antiquated and uncouth book of Dorstinius. *Hernandia,* an American plant, the most beautiful of all

trees in its foliage, but furnished with trifling blossoms, bears the name of a botanist highly favoured by fortune, and allowed an ample salary for investigating the New World, but whose labours were trifling. *Magnolia*, with its beautiful blossoms and fruit, serves to immortalise two of the most meritorious botanists. *Linnæa*, a depressed, abject, Lapland plant, long overlooked, flowering at an early age, was named by Gronovius after its prototype, Linnæus." Many other poetic or elegant analogies might be drawn, showing the discriminating judgment of our predecessors in this respect. Thus, *Smithia*, growing in shady thickets, with its beautiful pinnated leaves, closing together on being rudely handled, commemorates the modest, yet learned Sir James Smith, whose amiable feelings were most expanded in the retreats of private life. The large and beautiful crimson flowers of *Brownea* will recall to mind the splendid talents of the first of living botanists, to whose honour every body will attribute the name.* *Goodenovia* will perpetuate the memory of a late eminent botanist and divine much better than the little bird injudiciously called after him: while *Banksia*, a most extensive group of plants peculiar to Australia, reminds us of that munificent patron of science who first investigated the shores of Botany Bay. In like manner, as specific names of this sort are, in ornithology, what generic are in botany, *Vaillanti*, *Kuhli*, and *Vigorsi* may justly be applied to some of the new and splendid parrots recently described; for by those names we should perpetuate the labours of the most eminent investigators who have especially written upon the family of *Psittacidæ*. As the name of *Barrabaud*, although but a zoological painter of these birds, cannot be refused admittance into such an honourable list, we trust to see that of *Lear* also added on some future occasion. It is obvious, however, that these two latter would be quite misapplied if given to other birds: however, they

* We believe this genus, in reality, was instituted to commemorate an old author who wrote on the plants of Jamaica.

might be tolerated from a desire to acknowledge the ability with which these excellent artists have illustrated this particular group. We may now pass to those rules which more particularly regard specific names.

(198.) *Specific names may be occasionally derived from the geographic range of the species, provided it is peculiar.* — Geographic names have been reprobated by some botanists; but we do not think, if they are judiciously used, that they are otherwise than excellent. Thus, when only one species of a group, as in *Troglodytes*, is found in Europe, what name would be more characteristic than *Europæus?* and to another, which is its prototype, but found beneath the tropics, *Æquinoctialis* is particularly appropriate. To the species of certain natural genera or groups, which are all inhabitants of one country, such names of course are never to be given; and when a species has been so designated by the old writers, we think its name should be cancelled. Thus, the whole of the *Meliphagidæ* being peculiar to Australia,—a fact not formerly known,—the old specific name of *Nova Hollandia*, applied to one of the species, independent of its faultiness in other respects, is quite inadmissible. These two instances of the opposite characters of geographic names will show the care necessary in their use.

(199.) *A specific name should be short, unlike the generic, and always an adjective, unless it commemorates* * *a naturalist.* — Those specific names are perhaps the best which denote some particular habit; but those are the most expressive which indicate a property that can be seen both in the live and the dead bird. Thus *Orpheus polyglottos* is excellent as applied to the American mock-thrush; but no one who saw the species for the first time in a museum could trace any connection between the bird and this name. And in the same way no person could imagine why a little bird, smaller

* Dr. Smith suggests two sorts of these names in botanical nomenclature: those terminating in *ana* may serve to commemorate the finder of a species, while the genitive case may be used for those who founded the genus.

than a thrush, should be called *Tyrannus intrepidus*. Names, on the other hand, derived from the general or partial colouring of the plumage, are appropriate at all times; and, together with such others as express the essential specific character, are perfectly unexceptionable. Names, also, which express the local haunts of different species, although not so good, as being less intelligible, are not to be rejected, as *Alauda pratensis*, *Anthus aquaticus*, &c.

(200.) A genus or sub-genus can never be admitted into a circle which has been demonstrated to be complete, without its rank and station has been analysed, and is made known; in other words, it must be proved, in the first place, to be natural. This rule is of course only applicable to such groups as have been completely analysed, and where the system followed is a natural one. We have said so much on this head in another volume, that recapitulation is here unnecessary. We have been inundated, particularly from France and Germany, with "new genera," as they are termed, which their inventors can give no other reason for making, than that they fancy them to be so. It is really time that we called for some better reason than this, more especially in ornithology; we must be pardoned, therefore, in future, for not giving currency to such divisions, unless they are first shown to be natural.

(201.) *A genus should possess at least three positive and discriminating characters, but a sub-genus usually possesses only one.* — It is totally impossible to lay down any positive rules by which either of these groups can be distinguished; for they vary in almost every family. The above conclusion, however, is the result of much study; and we must leave those who are disposed to verify its truth among some of the best known groups. It is quite obvious, however, that a sub-genus can never be known from an aberrant or osculent species, until the circle to which it belongs has been analysed; and therefore it becomes extremely desirable, at least in a natural classification, not to mix up imaginary divisions

with those that rest — apparently — upon demonstrative evidence. If the system is artificial, these "new genera" may be adopted, or not, at pleasure; but in every attempt at a natural arrangement, it would be better to place all supposed types of form or subgenera at the end, in an appendix, or as sections of the named group to which they seem to make the nearest approach.

(202.) Trivial or vernacular names cannot be said to come within the range of scientific nomenclature, because they are *not intended* for those who study natural history as a science, but merely for the mass of mankind. They frequently vary in different periods, and not only in every language, but in every province. To attempt, therefore, to have a uniform standard of the *English* names of birds, is as hopeless as we venture to think it would be useless. Nevertheless, as the question has been discussed in some recent periodicals, we may be expected to say something upon it. — It is contended by those who advocate this new system of vernacular nomenclature, first, that all birds should bear such names as will prevent them from being confounded with others with which they have no affinity, or which conveys, directly or indirectly, some erroneous impression; and, secondly, that every genus or subgenus, bearing a patronymic name, should also have a distinct English one. This, we believe, is the substance of the two reformations contended for. In theory, they appear very good; let us see, however, what they would become in practice.

(203.) First, there can be no doubt that vulgar errors in the naming of birds are very general. The goatsucker (*Caprimulgus*) does not suck goats: the hedge sparrow (*Accentor*) is not a real sparrow: the *tit-mouse* (*Parus*) is a bird, and no quadruped: the titlark is a warbler: the long-tailed *mag* (*Parus caudatus*) is no *mag*pie; and in this manner we might object, and reasonably, to one third of the English names now in use. Some few of these, in systematic works upon our native ornithology, where the most expressive English names

are inserted, may be altered. The goatsucker may be called the nightjar; the hedge-sparrow, *flitwing*, which will be rather better than shufflewing, and so on. But then the question arises, who can expect that this new nomenclature will be adopted by unscientific persons, — the great bulk of our population, — for whom this improvement of nomenclature is alone intended? They may answer, and very truly, "Make as many reforms in your classic names as you choose; but pray allow us to call a bird by the name that we and the people about us have known it from infancy. Your new name of *flitwing* may be very pretty and appropriate, but I care nothing about its being a finch or a warbler. We know it, about us, as the hedge-sparrow; with that name are associated early recollections, by that name I can make myself understood, and therefore by that name I shall continue to call it." Such will naturally be the reply of a country gentleman when asked to adopt our new scale of names, and teach them to his dependants. Again: admitting that appropriate English names should be used, who is to invent them? Once attempt to destroy the received nomenclature, and every field naturalist, every tyro of ornithology will contend for the name he likes best. The long-tailed titmouse, for instance, has the following names by which it is known in different counties: — Huckmuck, bottle-tom, longtail-mag, longtail-capon, and numruffin.* The yellow *wren*, which in fact is not a *wren*, but a *Sylvia* (*S. trochilus*, L.), is called also willow-wren, ground-wren, and ground huckmuck.† A choice must be made from these, and by whom? Whatever reforms, therefore, which experienced ornithologists, no less than intelligent amateurs will admit, must be few and judicious, giving in general the generic or family name to the species; calling, for instance, all the ordinary species of the *Sylviadæ*, warblers, except, in-

* Montagu, Ornithological Dictionary. We have heard it called, also, *bottle-tit*.
† Ibid.

deed, those few groups which are already distinguished by a separate vernacular name, as the redstarts, wagtails, robins, and stonechats. The *Sylvia regulus*, being at the head of this family, should more especially be termed a warbler *par excellence*; that is, if the same rule is to guide us both in scientific and in vernacular nomenclature. By this plan, some sort of connection will be pointed out between the modern subgenera; and we shall not have two birds, actually belonging to the same genus (like the yellow and the gold-crested warblers), known by two names, which have no apparent relation to each other.

(204.) In regard to the second proposition, that each genus and subgenus in general ornithology should have a distinct vernacular name, the difficulties are of a much more insuperable nature. It would require the coinage of between 300 and 400 English names, for birds of whose manners and habits we know little or nothing: and, after all, what possible use would this accomplish? Is it not sufficient, for instance, to designate the five primary groups of the parrots by their present well known names of maccaws, parrots, cockatoos, lories, and parrakeets, without breaking these up into twenty-five others*, which would make ordinary persons lose sight, in fact, of the groups themselves, in a multiplicity of small distinctions which they never could comprehend, and which would only perplex them. But what should we do with the woodpeckers (*Picus* L.), a group of the same value, and therefore containing as great a number of subgenera as the parrots? Five and twenty names, at this rate, must be devised for all the variations of a woodpecker! and they must be appropriate, for otherwise, what is their use? It is only when we come to follow a theory, whether in science or in common matters, down to its details, and see how it will *work*, that we can judge of its practicability or of its use. Some few vernacular names, indeed, may be occasionally added, but the con-

* This will be the exact number of the subgenera when the five types of each are characterised in our second volume.

struction of our language is not well adapted for this purpose. To attempt expunging a well known vulgar name, because it does not happen to express a scientific group, appears equally repugnant to common sense and sound judgment.

(205.) The observations of a late eminent naturalist on these proposed changes seem to us to be marked with so much sound sense, that we think they deserve the attention of us all. "It is generally agreed among mankind that names of countries, places, or things, sanctioned by general use, should be sacred; and the study of natural history is, from the multitude of objects with which it is conversant, necessarily so encumbered with names, that students require every possible assistance, to facilitate the attainment of those names, and they have a just right to complain of every needless impediment. The few great leaders, indeed, in natural knowledge must and will be allowed to ward off and to correct, from time to time, all that may tend to deform and enfeeble the prevailing system. They must choose between names of the same date, and even between good and bad ones of any date. A botanist (or zoologist) who, by the strength of his own superior knowledge and authority, reforms and elucidates a whole tribe, ought to be unshackled in every point in which he can be of service. His wisdom will be evinced by extreme caution and reserve in using his liberty with respect to new names; and, after all, he will be amenable to the general tribunal of botanists, and the judgment of those who come after him. *Few, indeed, are illustrious enough to claim such privileges as these.* Those who alter names, often for the worse, according to arbitary rules of their own, or in order to aim at consequence which they cannot otherwise attain, are but treated with silent neglect. The system should not be encumbered with such names, even as synonyms."*

(206.) The DEFINITION or character of a GENUS or subgenera should be strictly confined to such as are altogether peculiar. It is the prevalent error of ornitho-

* Smith's Introduction to Botany, second edition, p. 383.

logists who do not sufficiently understand their group, to bring into its definition all the characters, without discrimination, that it presents: hence they are led to use a number of comparative terms, such as *rostrum subrectum, subforte, sublongum,* &c.—indefinite words which perplex the reader before he reaches the truly essential character, and encumbers the definition with a multiplicity of unnecessary terms. In monographs, indeed, this verbosity can be allowed; but even there the essential characters should be kept separate, as a sort of table of contents to the more laboured general definition which followed. In all this the zoologists of the present day have lost sight of the admirable simplicity, and, more than all, the masterly perspicuity of Linnæus. The best and *neatest* generic definitions are those of Temminck's *Manuel:* the most verbose and over-laboured, those of the *Species Avium.* Even those of Illiger are too tedious. The same remarks are equally applicable to specific characters: by Linnæus they were made abridged descriptions of those peculiarities alone which distinguished the species, without noticing others; so that the eye might run over and get the substance of twenty of these in the same time that would be necessary to read two of those in the *Species Avium,* where, in point of fact, there are no true specific characters. We cannot too often insist on the daily increasing importance of condensing and simplifying the details of a science becoming necessarily every year more and more extensive, as we gain a greater acquaintance with the productions of nature.

(207.) On proceeding to the descriptions of species, however, we can scarcely be too minute; for the essential characters by which one may differ from another are often so slight, that however they may be perceived on comparing the birds together, it is only by minute details upon paper, that they can be definitely expressed. After the specific character, therefore, has been succinctly drawn up and elaborated, we should proceed to describe, if any, and what, deviation there is from the strictly typical form of the group in which we have

placed our bird. Here, comparative characters, from a well known species, are of the greatest value ; and here, every deviation, however slight, should be noticed. Then follows the description of the plumage, and, lastly, the measurements, which should be taken as follows : — 1. *Total length*, in inches and tenth parts. Specimens will always vary in this from the mode of preserving or mounting, and the greater or less extension of the skin. 2. The length of the *bill*, from the angle of the mouth and from the front base. 3. The *wings*, from the tip of the longest quill to the elbow joint. 4. The *tail*, from the base of the feathers, and how much it extends beyond the wings. 5. The *tarsus*, from the meeting of the thigh and shin bone (or the knee) to the *upper* base of the hind toe, or, if so expressed, to the sole of the foot. 6. The *toes*, positively and relatively, the claws being included therein. The specific descriptions by Dr. Richardson may be recommended as models in this respect, and we may be allowed to say, they are the best we have ever met with.

CHAP. III.

ON COLLECTING, PRESERVING, AND ARRANGING BIRDS.

(208.) A GENERAL introduction to ornithology would be incomplete if no notice was taken of the mechanical part of the subject; that is, of the methods by which the birds themselves are to be procured, preserved, and arranged. Those who study this science *must* possess specimens, if they wish either to understand thoroughly what has already been written upon it, or if they desire to prosecute any line of original research. We feel persuaded, therefore, that this chapter will conduce very

materially to one of the great objects by which ornithology is to be advanced; namely, the augmentation of specimens to our museums, by instructing those who are abroad in the most simple methods of preserving the birds found in the various regions in which so many of our intelligent countrymen are now, permanently or temporarily, located. Our remarks, from necessity, cannot be much extended, but the young naturalist or traveller will find fuller details on this subject in a little book expressly written for amateurs.*

(209.) The first question which appears most natural to be asked is this, What birds are worth collecting? The general answer to which, if such was sufficient, would be, *The most common*. We speak not now, or hereafter, of British birds, except in as far as the instructions and hints subsequently offered are applicable to them as well as to all others. But it is an extraordinary fact that, with few exceptions, the most common and plain coloured birds of foreign countries are precisely those of which we know the least, and of which specimens are rarely seen in our collections. The reason is obvious. Amateur naturalists, or mere collectors, generally are led away with the belief, that because a bird is so common — we will say in Jamaica — that it may be procured every day in the next field or wood,—it is therefore common in the collections here, and, consequently, not worth the trouble of preserving and sending home. Even professed naturalists and others who go abroad for the express purpose of collecting, contribute to produce the same effect. They find so many objects to engage their attention, that such as are within their daily reach are neglected until a season of more leisure. They think, as common birds can always be procured, they should first search after the scarce ones, and thus they very often leave the country without those species which might have been shot at every hour of the day. Several

* The Naturalist's Guide for collecting and preserving Subjects of Natural History and Botany. By William Swainson. Second edition. Baldwin and Cradock, 1833.

of the most common birds of Brazil are those which are most seldom sent to Europe, and the same remark is probably applicable to the ornithology of other regions. The collector would do well to remember this, and commence at once upon the ordinary birds that abound in the vicinity of his dwelling.

(210.) Neither are species to be passed over, because, in general aspect, they bear a resemblance either to those of Europe, or to others which have been previously collected. In regard to the first, the supposed identity is generally groundless, when the two specimens are placed together and compared. Not five land birds of temperate America are of the same species as those of Europe: and yet the wren, the gold crest, and the swallow of both countries are so nearly alike, that their difference can only be detected upon close comparison. It may be considered, therefore, as a rule admitting of but very few exceptions, that the land birds of one continent are specifically distinct from those of another, except, indeed, when the two regions join. Many of the birds, for instance, of Asia Minor and Turkey in Europe are the same. Yet, even in such cases, the collector should secure specimens; for, besides the interest attaching to examples of the same species from different localities, the geographic branch of the science is much improved, and our knowledge extended by a better acquaintance with the physical distribution of the different races. The redbreast of Britain is not found in India; and yet in that country there is a bird of a different genus, so exactly resembling ours that the difference is entirely confined to the shape of the bill, and cannot therefore be detected, unless by a very close comparison. Let us warn the collector, also, against another delusion of this sort, which, without experience, he could not anticipate; it is that of not killing or preserving a bird because it seems a slight variety, or perhaps even of the same species, as one that he has already. He will be chiefly influenced in this by colour and general appearance; for it is seldom that a travelling ornithologist can have im-

mediate access to all his specimens for the purpose of comparison, and he will therefore trust more to memory than to actual examination. Unless, therefore, he is a very nice and cautious observer, he will be frequently deceived. Colour, of course, is one of the best, or, at least, one of the most obvious distinctions of species; but it is by no means the only one; and, in some particular tribes, it is none at all. The whole of the drongo shrikes (*Edolinæ*) are entirely of a black colour, more or less glossy, with a tail more or less forked. At first sight the greater part appear to be the same, and yet we possess near fifteen species, from various parts of the old world, which are quite distinct. The tree-creepers, again, of tropical America, forming the entire genus *Dendrocolaptes*, have all precisely the same coloured plumage, and yet we already know of near twenty species, distinguished by their size, and the comparative length, shape, and curvature of their bills. The American flycatchers, both large and small, can only be discriminated when compared with each other after they are preserved, or by close attention to their different habits and notes when alive. We wish not to advocate indiscriminate slaughter, but whenever the sportsman observes any shade of difference in the manners of a bird from that species which he conceives it to be, he should secure the specimen, preserve it, and record its peculiarity in his note-book. We always made it a point of conscience never to throw away a bird after it had been killed; considering that its life would then have been taken wantonly, and without any benefit either to science or to useful information.

(211.) We may now proceed to notice the countries whose ornithology requires the most investigation, and where the collector will be most likely to meet with new or interesting species. For this purpose we shall take a rapid survey of the five zoological provinces of the world here characterised; viz. Europe, Asia, Africa, America, and Australia; introducing under each head such remarks as may serve to direct the attention of the

collector to the most useful subjects of investigation, and that he may employ his labours to the best advantage. In regard to EUROPE, indeed, there is not much to be said, as its general ornithology has been so well investigated and so accurately described: much, however, remains to be done in respect to the southern extremity of Spain, and the whole of Greece and European Turkey. No one has yet informed us of the proportion of Spanish birds found on the shores of the opposite continent of Africa; and what are the birds of the latter countries which do not pass the straits of Gibraltar? As to the birds of Greece, its numerous islands, and the wild and wooded provinces of Turkey, we know as little of them as if these countries were situated in the heart of Africa. The ornithology of the Caspian Sea, and the adjacent provinces, was, indeed, investigated by Pallas, but in those days we were not accustomed to examine very accurately; and we question much whether that celebrated traveller is correct in considering so many of the species he there met with (particularly among the land birds) as identically the same as those of northern Europe. The annual migration of land and water birds from Africa to the shores of the Mediterranean and its islands, would furnish a large collection to any ornithologist who made a spring trip to these countries in the months of April and May.

(212.) AFRICA, as being the least known continent, would seem to hold out a prospect where the greatest discoveries might be made, but this is very problematical. The arid, naked, dry nature of the soil is alike unsuited to insects and birds; and the obstacles which impede the ordinary traveller will be doubly felt by the naturalist who attempted to penetrate its central tracts, and who would be encumbered with his collections. These objections, however, do not apply so much to the more fertile provinces of Asia Minor and the shores of Red Sea, neither of which have been visited by any modern ornithologist. Mr. Salt, indeed, brought a tolerably good collection with him from Abyssinia, but the

smaller species have been so mixed up in the *General History of Birds* with the old genera, that they have rather tended to impede than to advance our knowledge of forms and of geographic distribution; and we know not where the original specimens are deposited. Ruppell has brought some few very interesting birds from Nubia and the adjacent provinces, but these, as well as the collection just mentioned, can only be looked on as the first fruits of what might be expected from the steady and undivided exertions of a professed practical ornithologist. It is to be hoped that the French colony at Algiers will tempt some of the young and intelligent naturalists of that enterprising nation to explore the ornithology of that province, with a special reference to the birds found on the opposite coast of the Mediterranean. We have long been receiving from Senegambia and Senegal beautifully prepared skins of the splendid birds of those two districts, one, if not both, of which will shortly be illustrated in one of the most popular natural histories of the day.* It would be curious to know by whom these specimens are prepared, for they are evidently done by one hand, and are the best which we have ever seen sent for sale to this country. From Sierra Leone, and all the richly wooded coast of western Africa, we have, as yet, had nothing peculiar; for the Sierra Leone goat-sucker is also found on the banks of the Gambia. Thus, while tracts containing thousands of miles in this vast continent are absolutely unknown, its southern extremity might be almost said to be exhausted of its ornithological novelties. Not to mention Le Vaillaut, who brought home hundreds of species, and has published the greatest portion, two other travellers have more recently traversed the country in different directions, although neither have yet given the public the results of their researches. Mr. Burchell's birds, collected twenty years ago, have never been published, and Dr. Smith is still prosecuting his arduous travels in districts never yet visited. The ornithological discoveries of the latter, we have

* The Naturalist's Library.

reason to know, are so very extensive as probably to equal those of Le Vaillant, and we believe that immediate steps will be taken, upon his return to England, to make them known to the world: many of the new species, indeed, have already been published. The collector, therefore, who goes to the Cape cannot expect to meet with many novelties, although he may procure a number of species. If, however, at some future time, the peaceful state of the Caffre country will enable him to explore the tracts beyond the Great Fish River towards Natal, he will enter upon new ground. It seems strange that we know so little of the ornithology of the immense island of Madagascar, at least collectively, seeing that it is proverbially rich in animals, and that intelligent individuals, both French and English, have long resided there. We should certainly recommend this country as one which promised many novelties, both among the land and sea birds. We have omitted to mention, that the birds of Egypt have been described and figured by Savigny in that splendid national work which records the French expedition into that country, but its enormous price renders its publication almost useless to science at large.

(213.) The regions of Asia have been very unequally explored. Those under the dominion of Russia were visited by Pallas, and many new and peculiar species were described by him; they cannot, however, be incorporated in our modern systems, for few of them are figured, and none described, with that minuteness which will enable us to refer them to their natural groups. The ornithology of Central Asia, and almost of China, is scarcely known, and there is no prospect of much additional information arising. The Chinese, however, are a clever and a thrifty people. They have made the collecting of insects for the European market a regular branch of trade,—why may they not be instructed and encouraged to do the same with birds? We think those English gentlemen, residents at Macao, who are attached to natural history, would do well to

make the experiment: teaching these ingenious collectors the art of taking off the skin, so as the bird itself may be eaten, would probably tend to further this object, seeing that the most splendid birds of China are the large pheasants and other rasorial species. Persia, again, offers an interesting, if not a very rich, country for the ornithological traveller, where his researches may be prosecuted without those dangers and impediments attending the investigation among hostile tribes. It is, we believe, through the instrumentality of Mr. Hodson, our accomplished scientific resident at the court of Nepal, that we have at length become acquainted with the productions of that most interesting portion of India, particularly its birds, which have been made the subject of a distinct publication.* General Hardwicke has done much to elucidate those of Hindostan; but his materials have only partially been published, and, from neglecting to bring home specimens of all the birds themselves, his drawings, now deposited in the British Museum, will not, in many cases, point out the natural genera to which they belong. Some other collections have been recently brought home, particularly by Colonel Sykes, who has added much to our list of authentic species by his excellent descriptions; those we saw collected by captain Smee were also numerous, but nothing, we believe, has yet been done to render them available to science. The farther we advance southward, the more interesting and beautiful are the ornithological forms. Sir Stamford Raffles, doctor Horsfield, and professor Reinwald, have all contributed, more or less, to enrich our museums with specimens, and our lists with descriptions of the birds of Sumatra and of Java; nor must we omit to do justice to the two French collectors, MM. Diard and Duvosel, who were patronised by Sir Stamford Raffles, and through whose liberality they were chiefly enabled to send so many objects to the Paris museum. Still, however, there is ample room for future discoveries, even in these

* Birds of the Himalaya Mountains. By J. Gould, A.L.S.

two islands, while all that we know of the others is from a few gleanings made by the French circumnavigating ships on their voyages of discovery. Borneo, New Guinea, and the adjacent islets, are unexplored mines of ornithological riches, where the most splendid of all birds, the *Paradisidæ*, are alone found, and where the zoology of India blends into that of Australia.

(214.) The AUSTRALIAN province, which may be said to commence with New Guinea, includes New Holland, New Zealand, and the whole of the numerous islands scattered in the Pacific Ocean. Considering that the chief seat of this range is an insular continent, under the British government, unusual facilities for its investigation present themselves, and we can only join in lamenting the apathy of our government in doing scarcely any thing towards prosecuting those scientific objects which would have claimed the first attention of any other European power.* The birds in the immediate vicinity of the chief towns have been industriously collected, and their skins are continually sent to this country, but we know little or nothing regarding their manners, habits, or internal structure. This is the more to be regretted in regard to the Australian birds, as their forms are altogether peculiar, and seem to present anomalies in nature of which there are no examples in other regions. There are parrots which are honey-suckers, crows that are shrikes, and vultures that are turkeys. The natural habits and economy, no less than the internal structure of these singular birds, require to be thoroughly investigated. The very general taste for natural history which has diffused itself of late years among us, has extended to these distant regions, and there are now several zealous lovers of our charming science settled in different parts of New Holland, who have already contributed valuable materials to illustrate its zoology. To those, more espe-

* A single naturalist has indeed been placed on the government establishment. This is well. But was the French scientific expedition to Egypt, or that sent by Austria to Brazil, composed of one individual?

cially, we should recommend the points of inquiry above alluded to. Let them read the pages of Wilson, now within the means of purchase of almost every one*, and in the same style, or at least with the same watchfulness and attention, *and the same regard to the most minute and apparently trivial circumstances*—let them become the biographers of the common birds around them;—if they will do this, science will be more benefited than by hundreds of stuffed skins sent over without any information of the living animals which they once covered. The natural history of the shrike crows (to which belong the genera *Barrita* and *Vanga*) would form one of the most interesting papers imaginable; for we feel persuaded they are truly *Corvidæ*, with many of the habits of the shrikes. The history of the turkey vulture†, the menura, and even of the common parakeets, would possess both novelty and interest; and the different groups of the honey-suckers (*Meliphagidæ*) must each possess peculiar manners. We feel so much interest in the elucidation of these subjects, that we take this opportunity of offering our assistance to any naturalist who may be disposed to investigate them on the spot, and we would take care that his observations should be published in this country, "with all honours," and elucidated by those scientific notes which require the use of a library and museum.‡ We can hardly expect that those who have so lately gone to the Swan River and other new districts, have yet become sufficiently *settled* for indulging in pursuits of this nature; but it may be as well to remind them that they are upon unexplored ground—that nearly every animal may probably be new to European naturalists, and that an early investigation, as leisure permits, will secure to them the honour of being the

* The edition in *Constable's Miscellany*, in four small volumes, costs only 16*s*.

† See Field's interesting volume, *Memoirs of New South Wales*.

‡ Communications addressed to the publishers will be regularly forwarded to the author. One or two specimens of each species should always accompany the description of its manners, which is all that is necessary to be written.

discoverers of many species. The land birds of New Zealand and of the Pacific Islands, appear to be few, but they are different, in regard to the species, from those of New Holland, although in general belonging to the same groups. The *Meliphagidæ*, or honeysuckers, are very prevalent through the whole range of this zoological province.

(215.) America, next to Europe, is the best known division of the zoological world. The ornithology of the northern regions has been so well explored by our arctic navigators, those two able collectors, and by Drummond and Douglass, that little has been left for those who came after; while the indefatigable Wilson secured to himself the first and highest honours of discovery in regard to the birds of the United States. Little, therefore, now remains to be done in the way of new discovery from Baffin's Bay to the shores of Louisiana. While the ornithologist may purchase specimens of the North American birds much cheaper in London than he could collect them upon the spot. The western coast, on the contrary, by some strange oversight, has been almost entirely neglected, and California still remains unexplored by modern naturalists. The first English adventurers to Mexico, upon its being opened to British commerce, were not unmindful of its natural productions; and we were enabled to determine the existence of near 150 species of Mexican birds, the greater part of which were altogether new. Continental collectors have since then visited many of the provinces, yet, when we consider the vast extent of this territory, and the peculiarly favourable nature of its surface for great diversity in its animals, we may yet believe that not more than half of its birds have been discovered. It is surprising that among so many intelligent persons connected with our unfortunate mining establishments, one instance alone has come before us of any of them paying attention to natural history. The late Mr. Morgan formed a valuable collection of birds round Real del Monte, but we have heard of no other English-

men following his example. The travels in Mexico that have yet been published are miserably deficient in any thing really valuable relative to its animals; so that the collector who should visit or take up his residence here has a wide and interesting field for prosecuting his labours and of enriching our collections with specimens. Texas, Honduras, and Guatamala are still more imperfectly known; and who can tell how many new and splendid birds inhabit the wide extending virgin forests of the coast on both sides the Isthmus? The whole of West India Islands are nearly in the same predicament. Cuba, indeed, is now, or was very lately, the residence of the celebrated author of the *Horæ Entomologicæ*, and several continental naturalists have visited the same island, so that we may hope soon for some certain information upon its productions; but in regard to Jamaica, and the whole of the remaining islands, we know scarcely any thing on their ornithology, and very little on their other animals. At Tortola there are persons who have long been in the practice of stuffing the more richly coloured humming-birds, &c., for sale, but those of ordinary plumage are neglected; and as these, even in tropical countries, constitute the majority, it follows that many species, even in that island, must remain unknown to us in Europe. The inhabitants of the Bahama islands must not, however, be confounded with the listless planters of the West Indies. A literary and scientific society has recently been established, and to the kindness of its active and intelligent secretary, Mr. Lees, we are indebted for several of the native birds; sufficiently interesting to show how highly desirable would be a further investigation of this portion of the local zoology. Beyond the Mexican Gulf lies the vast continent of South America, unquestionably the richest ornithological portion of the world, whether as regards variety of species or splendour of plumage. But before we introduce the collector to these regions, we desire to impress upon his attention the peculiar interest that attaches to the birds of the

West Indies and the adjoining Isthmus. It is here that nature forms the channel of communication, as it were, between the ornithology of the two great divisions of the American continent, not merely as regards species, but in the genera and types of form.* It is well known that the summer migratory birds of the northern states retire southward in the winter, as do those of Europe; and we suspect that the limits of their range in that direction are marked by the West India islands; but whether this is actually the case, or whether the greater part retire to the warm and fertile provinces of Texas, Honduras, and Guatamala, is altogether uncertain, and the question can only be determined by actual residents on the spot. We should recommend to every naturalist who may pass the winter in the West Indies, carefully to note the times of arrival and departure of such birds as are not constant residents, and more especially to collect those of the latter description. Such species as do not migrate northward are probably characteristic of the southern ornithology; and thus we might be able to trace the harmonious union of the two divisions of the continent, each connected by a slender, but well marked, passage in geographic configuration and zoological distribution. Among the humming-birds figured by Edwards, as inhabiting Jamaica, is a most beautiful one with a forked tail, quite unknown to modern collectors; and of this family we may in general remark that those only of Tortola are known to our collectors. All the water birds of these islands require investigation for the same reason as we have just alluded to when speaking of the migratory species. The peacock-turkey, a splendid bird†, is supposed to be confined to the forests of Honduras, and a few specimens would be

* More extended observations on this subject will be found in the Geography and Classification of Animals, p. 69.; and in Murray's Encyclopædia of Geography.

† The only specimen which, we believe, was ever in this country, was in Bullock's museum, and was purchased for the French government, at the sale of that collection, as near as we can recollect, for about 25*l*. *We were too poor* to secure it for the British Museum.

sufficient to repay the mere professional collector the expenses of his voyage in search of them.

(216.) Continuing our survey along the coast, we find much has been done in particular provinces, while immense tracts of country still remain unexplored. Thus the banks of the great river Marinham, or the Oronokoo, have been visited by Spix, Burchell, and Langsdorff, but of all the collections they formed, those of Spix alone have been rendered available to science. We have been informed that this naturalist was at length so overwhelmed with the new objects that crowded upon him in every department, that he was absolutely wearied to saticty, and determined on returning home to Europe: justly considering that, had he still continued to collect, he could never hope to make known even one entire portion of his discoveries.* Our own researches in Brazil were going on at the same time, but in a different direction; nearly a year was spent in the province of Pernambuco alone, and we subsequently traversed overland to Bahia, an immense province which had never before been visited by any European naturalist. The great harvest of the ornithology of these provinces, no less than those of Rio de Janeiro, St. Paul's, Minas Geraes, and some others, has consequently been already reaped, but abundant gleanings must yet remain. Of the extent to which M. Natterer, the German naturalist, who has been collecting in Brazil for the emperor of Austria the last seventeen years, has prosecuted his travels, we know not; but marvellous, not to say incredible, accounts of the number of species he has collected have been circulated in this country.† On the whole, therefore, the greater part of Brazil, large as it is, does not offer any expectations of much novelty in its feathered tribes, unless in such provinces as Goyaz,

* This suspicion was unfortunately verified; for this able and indefatigable zoologist was taken from us soon after he commenced publishing the zoological fruits of the expedition.

† Since the above was written we have had the pleasure of a personal visit from Dr. Natterer, whom we left in Brazil in 1817. He has only just returned to Europe, having procured the astonishing number of 1070 species of birds in that vast empire.

Matto Grosso, and on the confines of Peru and Chili. Little that is new can be expected in Paraguay, after the researches of Azara, even admitting the country was released from the tyrannic and excluding laws of the priestly despot who now rules it. Chili and Peru are too arid and naked to excite great expectations regarding their ornithology, although on the banks of the rivers, where woods are to be found, many new species are likely to be obtained. The birds of Cayenne are well known, although no distinct work upon them has ever been published. Surinam and Demerara are equally rich; but the first has never been well investigated, and although collectors have frequently gone to the latter, and brought away the more splendid birds, we are yet ignorant of the larger proportion of such whose plumage is not very attractive. The researches of M. Schomberg, however, now traversing the interior of Guiana, will doubtless supply this deficiency, and add numerous species to our systems passed over by the mere amateur. In conclusion, we may safely assert, that the most unexplored part of South America, so far as concerns its zoology, is that immense portion formerly called New Spain; for it is not generally known that Humboldt did little or nothing regarding the ornithology of these tracts, which are perhaps equal to Brazil in the variety and beauty of its natural productions.

(217.) We have now answered the questions with which we commenced this chapter;—what birds are worth collecting, and where are the best to be obtained. The young ornithologist, and the intelligent traveller, may now know in what parts of the world their attention to ornithology is most needed, and is most likely to turn to profitable account. We use this latter term, however, not in a commercial sense. It has been a grievous error with many persons to suppose that the collecting of subjects of natural history for sale in England would be a source of great profit, and that, because they hear of a bird or a shell being sold at an enormous price, more specimens of the same would be

equally valuable: they forget that the rarity of an object constitutes its current value, and that in proportion as more are brought into the market, so does their value diminish. At the sale of Bullock's museum, very many of the humming birds sold for as many guineas as they can now be purchased for shillings. It is our duty to guard individuals from incurring severe losses, although it is to the interests of science that these materials for our study should be cheap and abundant. We know of two instances where a whole museum of animals, &c. has been purchased at the Cape of Good Hope, under the idea that its sale in England would realise a large profit; when, after being exhibited in London, and subsequently sold, the proceeds have hardly covered one-half of the original purchase. There are persons again, in India, New Holland, Tortola, Rio de Janeiro, and other stations, who trade in these objects, and they are purchased by persons returning to England, under the supposition of their selling to advantage. Such speculators will generally be greatly deceived. Our supplies exceed the demand. There are, comparatively, few persons as yet who form regular collections of birds; for if they are fond of ornithology, they can see what specimens they desire at the public museums, now formed, or forming, in all the great towns of England. The directors or managers of these latter, again, depend chiefly on donations for adding new specimens to their collections; the funds devoted to this object, if any, being generally very trifling. Hence it happens that large collections, for which no purchasers can be found, are generally sacrificed at auctions, or sold to the dealers for about one-third their value. Desirous, therefore, as we must be to encourage the importation of ornithological specimens, for the greater diffusion of knowledge, we yet cannot hold out any other object that they will accomplish. Large collections of common American birds are now frequently sold at an average of two shillings a skin; a sum which is probably much less than their

original cost, setting aside the expenses of freight, &c. We have made it a practice, however, with such of our foreign correspondents who contribute specimens to our museum, to give the best advice we can on these occasions, considering it as the only return we can make for their voluntary donations, but we recommend no one to make pecuniary speculations in subjects of natural history, under the idea that the prices to be obtained will repay them for the cost or trouble of their original acquisition.

(218.) We now proceed to the practical part of our subject, commencing with the most simple, and proceeding to the more perfect methods of procuring and preserving birds. Those persons who have neither skill or time to shoot or preserve, may procure the small birds of any country from an ordinary sportsman, and put them at once into wide-mouthed bottles or jars, filled with weak spirits, in which state, after being well corked and rosined, they may be transmitted to England. This easy method will do very well among the generally indolent West Indians, where poor rum may be had almost for nothing, and pickle jars, originally from England, may be returned refilled. Those who could afford the time might attach a bit of stick, marked with notches, to such specimens, regarding which they are desirous to give, or receive, information. The most common species may be put up in this way, which is always the best where the internal structure is the chief object for subsequent investigation.

(219.) The ornithological sportsman, who intends preserving his game, should carry in his bag a small quantity of cotton or tow to put in the mouths, or over the bleeding wounds of each specimen as it is killed, to prevent one soiling the other; or those who are very particular may wrap each in a piece of paper. The best time for shooting, in all countries, is very early in the morning, when the notes of the different species are heard, and the best season, when there is a choice, is that which precedes the breeding, or the time of

pairing; birds are then in their finest plumage, and one good specimen, in its perfect plumage, is worth a dozen in a state of moulting. Small shot, and in small quantities, will kill without much injury; we never used higher than shot No. 8., even for thrushes, while dust shot is sufficient for humming-birds, and even small finches, or warblers. These, and the other requisites, including powder, had better be procured in England. If the collector is settled in a country where the peasantry are fond of shooting, a small premium above the ordinary price of birds used for food, will generally enlist one or two sportsmen into his service, and in this manner rare birds may be often procured. The South American Indians are admirable marksmen: they shoot birds with the blow-pipe and with blunt arrows, and specimens thus procured are generally free from blood upon their feathers. We shall here recommend a method of shooting particularly desirable in hot climates, and frequently much more productive of game than any other. This is to watch when the different wild trees successively come into fruit, and then to lie in wait for the birds which alight upon them to feed. This should be practised very early in the morning, and after the meridian heat is over: the sportsman, sheltered by the surrounding brushwood, or under an artificial hut made of boughs, may thus, without any exertion, wait the arrival of the different species, and single out such as he requires. This is the best method, also, to secure the small birds of the south of Europe, nearly all of which, although generally insectivorous, are passionately fond of figs. We have often killed the black-headed flycatcher (*Muscicapa atricapilla* L.) in these situations.

(220.) On proceeding to skin a bird, the following instruments should be at hand, viz. two or three penknives, of different sizes, a large and a small pair of scissars, the latter pointed, a blunt stick, like the handle of a camel's hair pencil, a pair of forceps, a piece of chalk, with cotton, wool, or tow, and a preserv-

ing composition called arsenic soap.* We can recommend this soap from long experience; the birds we preserved with it near twenty years ago in Brazil are as perfect now as they were the first day they were skinned. We cannot say so much of a different composition so strongly recommended by an amateur†, who seems to think it a modern discovery: spirits of wine and corosive sublimate, however, has been in use in this country, as a preservative against insects, time out of mind, and it is strongly recommended by sir James Smith;‡ it is probably a safeguard against some insects, but is unquestionably inferior to the arsenic soap, originally invented, we believe, by the French.

(221.) There are two ways in use of opening a bird; the first is by lifting up one of the wings and making an incision down the whole length of its side, from the shoulder joint to that of the thigh: the second is by parting the feathers in front and making the incision down the middle of the breast and belly, beginning at the top of the breast, and cutting in a straight line as far as the vent. The former is certainly the best, because the wing conceals the subsequent sewing up of the skin, and gives the bird, in front, an appearance of plumpness and smoothness which we can scarcely have by any other method; it is, however, the most difficult to inexperienced hands, and, therefore,

* Arsenici Oxydi ℥i.; Saponis ℥i.; Potassæ Carbonatis ℥vi.; Aqua Saturata ℥vi.; Camphoræ ℥ij.

† I made the following experiment with Mr. Waterton's compositinn when in Brazil:—The ants, which swarmed in a room I inhabited at Pernambuco, had committed great devastation among the prepared insects and birds. While preserving one of the latter, I cut off a piece of the flesh, and, after saturating it with the composition, laid it in the path which led to one of their holes. The little creatures seemed at first to be somewhat suspicious of its wholesomeness; but, after walking about and upon it, and examining it with their antennæ, they seemed to pronounce a favourable verdict, for one and all began dragging it away to the entrance of their nest, where it soon disappeared beneath the earthen floor. The experiment was repeated three times, and the same result followed. The mixture had been brought from England, and I had no reason to believe it was defective in the preparation. After this trial I determined on using the arsenic soap; naturally concluding that if ants would devour the soaked flesh of a bird, they would not scruple to attack its skin, which could only be washed with the liquor on the *inner* side.

‡ Introduction to Botany.

the second mode is that generally used. The incision should only be skin deep, to prevent the issue of blood or of the intestines; it may be made, to the end of the breast bone, by a penknife, but beyond, as the belly is soft, the scissars had better be used, passing the under point just below the outer skin, so as not to cut the inner; this being done, rub the skin gently away from the flesh on both sides with the forefinger, scraping some chalk upon the carcass, as it becomes exposed, that all moisture may be absorbed, and the feathers kept dry: so soon as a little of the skin has been loosened, lift it up with one hand, and with the other pass the stick between the skin and the flesh, in order to separate them: but this, and in fact all stages of the process, must be done very gently with small birds, and such others as have thin skins. Work with the stick in this manner until you come to the shoulder joint, from around which the skin must also he detached; when this is done, and your stick will pass between the loose skin and the joint, cut the latter through with a knife, or, if the bird is small, with the scissars. The clearing away of one wing greatly facilitates your future progress, which is prosecuted by continuing to detach the skin on the sides and back, using the thumb nail, or the scissars, to separate any muscles that impede your progress. Arriving at the leg, the knee joint is to be cut through, after the skin around it is removed. Having thus separated the skin from the flesh on one side, proceed to do the same on the other, and in precisely the same way: it will be as well, however, in this stage of the process, to separate the neck from the breast, by detaching the skin all round the base, and cutting the neck away, at its *lowest* part, with the strong scissars. By this operation the skin, being so much detached, may be separated from the other wing and leg with much more ease; and when this has been done, the carcass will only remain attached to the skin by the tail; draw away the skin, therefore, very gently all round the vent, until you come to the hard

root of the tail, where the skin cannot be separated any farther; here, therefore, you cut the body away with the scissars, taking care to avoid cutting the skin at the same time. The whole skin being now entirely taken off, the carcass will present, if neatly done, something the appearance of a trussed fowl. Spread out the skin so that you can sprinkle it with powdered chalk, for the purpose of absorping the blood and moisture, adjusting the feathers, and preventing any from adhering to the inner surface. If any of the feathers are bloody, absorb the blood with chalk, and press it upon them; so long as they retain any moisture, the chalk will thus form into flakes, which must be thrown off, and more applied until the feathers are quite dry.

(222.) The next stage consists in removing the fleshy parts of the wings and legs, together with the whole of the neck, and the inside of the skull. Let us speak of each of these separately. The feathers being adjusted, and all moisture absorbed from the skin by means of the chalk powder, take the stump of the shoulder bone, and with the thumb nail of the other hand, detach the skin from the fleshy muscles of the bone, working equally all round, so that the skin is not stretched or torn, but is forced gradually away; the slender muscles may be cut with the knife or scissars, but the parts where the quills adhere are to be separated by the force of the thumb nail: as soon as you reach the first joint of the wing, cut away all the fleshy muscles, which there seem as if they were united. If the bird is small you need not proceed farther, for the quantity of flesh on the bones of the next, or last joint, is but small. This done, and the bones made quite clean, anoint them and the skin with a little of the soap lather, worked up as ordinary soap is for shaving, by a camel's hair pencil, dipt in any sort of spirits, and then draw the skin over them *without* putting in any cotton or other stuffing. This latter practice is most detrimental, for it invariably discomposes the order and regularity of the feathers, and almost always swells out

the part to an unnatural thickness. The wing being restored to its natural shape, proceed to the *leg*, which is comparatively easy: the skin will readily slide off the flesh if the leg is gently forced upwards, and when the small or narrow part begins to appear, cut the muscles all round, tear off the flesh, and after anointing the bone with the soap, twist a little cotton or tow round it, so as to give it something of the appearance of the natural shape; gently pull out the leg again, and all will come right. There is one fault in adjusting the legs which all inexperienced persons fall into: they pull out the legs too far, and thus make them appear much longer than they are in nature. To obviate this, let it be remembered as a general rule, that the knee joint of nearly all birds is on a line with the vent; and in preserving a bird the leg should always be pushed upwards until the knee comes exactly in a line with, or rather above, the root of the tail. Again adjust the feathers, and proceed to the wing and foot on the other side, which of course are to be treated in the same manner.

(223.) The neck and inside of the skull is next to be removed. Take hold of the end of the neck, and pass the skin backwards; that is, draw it over the head in a contrary direction, until the hind part of the skull appears: here great care is necessary, for in some birds (the woodpeckers and ducks, for example) the neck is narrow and the head large; in ordinary birds, however, the skin, if gently pushed and worked by the finger and thumb (not pulled), will reach sufficiently far on the nape to admit of the angles of the lower jaw being pared down (if necessary) with the knife, the point of which is also used to scoop out the thin skin of the ears, which always lay in a little hollow, and should not be broken; a very little farther the sockets of the eyes will begin to appear, but still go on, gently passing the skin over the skull, detaching the former from the nerves which connect it to the eye by the knife. When about two thirds of the eye is thus exposed, cut through

the thin white skin which will then appear, with the scissars, so as not to injure the outer skin of the bird The eye being then exposed, cut round the margin o. the orbits, so that the eye is not broken, and then scoop it out entire with a strong goose quill cut in the shape of a pen, but without a slit: the other side of the head is to be done, of course, in the same manner. Before filling up the sockets of the eyes with cotton, a small portion of the back part of the skull is to be cut away, for the purpose of cleaning out the brains: this may be done with the quill just mentioned, or with a blunt-pointed pen-knife; then cut away all the flesh on the sides, and clean the bones with cotton. After having washed the whole with the arsenic soap, fill up the inside of the skull, if possible, with tow rather than with cotton; for if the bird is subsequently set up, or *mounted*, as it is termed, the wires, then to be used, will pass through tow, but seldom can be made to penetrate cotton or wool; so that, if no tow is at hand, it were better to leave the skull empty. Anoint the skin of the neck with the soap, and then proceed with great caution in returning the skin over the head, not by pulling, but by gentle pressure with the finger; this is, perhaps, the most difficult part of the process; and the young practitioner must make his account of tearing two or three of his first specimens; but a little experience will suggest improvements too minute and tedious to be expressed in writing. When once the skin is drawn back again over the skull, the difficulty, in fact, is over, and this should be done by the thumb-nail. It is only here that the skin appears tight; for when it has passed over the scalp, the rest of the neck comes out almost of its own accord.

(224.) The specimen being now free from all parts that are to be taken away, let the skin be again opened and spread out for the purpose of anointing all the inside, first removing any lumps of fat or flesh that may still adhere. We then proceed to the stuffing. A false neck should be made of tow or cotton, about

double the length of the natural one, since the lower half will be in the middle of the back, and supply the place of the vertebra, or back bone. Let this false neck be rolled round between the hands, and then insert it upwards to the roof of the mouth, by means of the forceps: if possible, push it so firmly into the skull at this part that it will take a slight hold, then draw down the neck to its natural length by means of the other end of the tow; this will obviate the great defect of specimens prepared by beginners where the neck is so much stretched that it becomes double the true length: this defect is caused by pushing the tow or cotton upwards, *in small bits* instead of one entire piece, the latter enabling the operator to shorten or lengthen the skin at his own pleasure, just as any one can shorten or lengthen a stocking upon his leg. This done, take a needle of moderate size, with some silk, and commence sewing up the skin in a zigzag direction, always passing the needle from the *inside* to the out, a mode by which all entanglement from the feathers will be prevented. From the point where the first incision of the skin was made, begin to put in more stuffing (cotton is perhaps the best), that the breast and body may have the plumpness of the natural size: care must be taken, however, not to fill it too much, for when once the skin is too much stretched, and becomes dry, it can never be reduced, whereas it may always be stretched hereafter by any subsequent process used for softening or relaxing the skin, if it is to be mounted: for this reason it is preferable to stuff the fresh skin rather below than above the natural bulk. After sewing up the skin, in the manner directed, to within an inch of the vent, there is no need to proceed farther. The opening then left will be sufficient for inserting the forceps, and either adding to or diminishing the quantity of stuffing. After adjusting the legs, according to the rule already mentioned, and bringing the wings to their natural position, your bird will be finished. If the two mandibles of the bill are not even, or gape, bring them together by passing a needle, with

thread, through the nostrils, and after binding them round, secure them by a knot. The tongue may be either left in the bill, or it may be taken out and fastened with a pin to the specimen when it is dry.

(225.) The last and finishing operation is putting your specimen into the mould or form in which it is to remain until the skin is thoroughly dry. This process gives it great neatness, compactness, and beauty, and it is accomplished with much ease. Make a sugar-loaf cap, or hood, of any sort of paper, provided it is smooth, and fit it to the bird so that it presses sufficiently close all round the head, neck, and breast, to press the feathers quite smooth; if the hood is too loose, contract it by folding it narrower or broader at one or both ends, as the case may be, leaving sufficient opening at the small end to admit the end of the bill, which may be pulled a little out to tighten the pressure of the cap round the feathers of the head. If, when the hood is on, the neck appears too long, push the whole body of the bird upwards, by grasping it all round the wings, legs, and body, so that all these parts are equally pressed upwards. This done, let the cap remain on the bird for twenty-four hours; then remove it, by pushing the end of the bill downwards, adjust any feathers that are out of place, and replace the specimen as it was before. The hood should be sufficiently long to confine the shoulders and the wing covers, and should fit close enough to press them on the sides of the breast. Writing paper or old newspapers are preferable to any other material for this purpose; and the edge which folds over, and makes the hood, had better be secured with two or three drops of sealing-wax, for if the small end is twisted, as is done for other purposes, there will be no aperture for the projection of the beak, which should be always attended to first, because the beak had better be *very slightly* bent forward rather than in a direct straight line with the body; and, secondly, because the cap will not fit so close to the feathers of the head if its margins do not press round the base of the bill. The

time necessary for the specimen to become quite dry, of course depends upon many local circumstances. In warm countries, two or three days' exposure to the air will be sufficient; but a week will be required in colder climates: if placed within the influence of a warm fire, the skin will become firm and dry much sooner. But even when the form of the specimen is thus fixed, the hood should not be removed, unless the bird is to be placed at once in the cabinet, for it keeps the feathers clean and smooth, and protects them from injury when the specimens are packed; indeed, all birds that are sent from abroad, or stowed in a package, should have their heads protected by these hoods, provided they have been preserved in the first instance in such a manner that they can be fitted on. A person not acquainted with this mode of finishing a bird-skin, can have no idea of the neatness which even an ill-stuffed specimen will acquire after undergoing this last process; and although it is not absolutely essential, no one, after witnessing its effects, will ever neglect it, if it was only for the gratification it gives to the eye of the operator. It may also be used much more generally with all birds, whatever the length of their necks may be, than might at first be imagined. No specimens are so troublesome to pack, and occupy so much room, whether upon a journey or in the cabinet, than the long-necked herons, waders, and ducks. Now, if we look to these birds in a state of nature, we see that the neck is very often brought down close to the breast, so that to preserve them in such a position is not only highly convenient, but even natural. This may be done (but in the first instance only) by firmly securing one end of the false neck of tow, either in the hollow of the skull or by bringing it out at the mouth, and then contracting the neck to as short a length as possible; the skin of a heron whose neck was extended to its full length in the first instance, may thus be brought to lay within two thirds of the space it would otherwise occupy, besides having a much better and neater appearance.

The same may be done with the dueks and the waders. Nor will this contraetion at all affect the subsequent proeess of mounting: if it is desired that the bird should be put in an attitude which required the neek to be lengthened, this extension ean be accomplished without diffieulty; but when the neek has been *dried* in an extended position, no art ean ever reduee it effectually to lesser dimensions.

(226.) Some few exceptions and general eautions may be here mentioned in addition to the foregoing instruetions. Some birds, particularly the pigeons and euckows, have their skin remarkably thin, and generally very fat; the greatest care must therefore be used in detaehing it from the flesh, and the operator must be very cautious in his efforts to remove the fat, otherwise he will repeatedly tear the skin; the best way for aecomplishing the latter object is by gently seraping it upwards with a blunt knife, and then applying powdered ehalk to absorb the oily substanee which exudes on the pressure of the finger. Most of the sea birds will require this proeess, and nearly the whole of the dueks. All rasorial birds, and their respeetive types, have thick skins*; in tenuirostral types, on the other hand, the skin is generally very thin. It is hardly necessary with the humming birds to clean out the inside of the skull, or the flesh from the wings and feet; but the body and neck should always be removed. In warm latitudes, where every thing that is dead is liable to be immediately attacked by ants, the eollector should take the preeaution of washing the bill and legs with a little of the arsenic soap; and only to expose his specimens for the purpose of drying, when he, or some one else, ean look at them every ten or fiftecn minutes. The colour of the eyes and feet, and the eontents of the stomach and crop, should be noted down; and the tongue of eaeh speeies either drawn, described, or preserved. The

* This is a very remarkable circumstance, and is one of the most beautiful of all those analogies which assimilate the *ungulated* quadrupeds as a whole, and the *Pachydermates* as a type, to the order *Rasores*, and the tribe of *Scansores*, among birds.

mounting of specimens, or setting them up in the attitudes of life, is a branch of Taxidermy not absolutely essential to our present purpose; since, if the student is acquainted with the art of preserving the skin of a bird, that will be sufficient to answer every scientific purpose. Our limits, indeed, for treating this part of our subject are so confined, that we deemed it preferable to treat one branch of the art of preserving thoroughly, than to say a little upon both.

(227.) We shall now pass on to the different modes of preserving birds in cabinets, or otherwise, after they have been prepared. It was formerly the custom among our collectors to have each species in a wooden case by itself, with a glass in front; the whole rendered air-tight: in this manner all the birds in the Leverian Museum were arranged, the cases being piled up so as to cover the sides of the apartments. The inconveniences of this mode are obvious, for the specimens could only be examined through the glass; and by having only one species in each case, a great deal of space was sacrificed. To this succeeded the fashion of grouping the birds upon branches, fastened into large cases, on the back and sides of which were painted landscapes, &c.: this was introduced, we believe, by Bullock, whose whole collection was displayed in this manner. This plan is certainly better adapted than the first for producing effect, by the contrast of colours and the variation of attitude; so that, for those persons who merely possess a few splendid specimens for show, this is, perhaps, the best way of displaying them to advantage. For all useful or scientific purposes, however, it is much worse than the last: the feet cannot be accurately seen, from the comparative obscurity in which very many of the birds must be thrown; and, as only the glass front of the case can be removed, all attempts either to accurately examine, or measure, or draw, or describe specimens thus disposed, will not only be imperfect, but in many instances impossible.* This bar-

* It is only doing justice to the authors of the "Descriptive Catalogue of Australian Birds in the Linnæan Society's Collection," to state that

baric taste, however, is now exploded, at least in all collections intended to be really useful and instructive. The admirable plan upon which the noble collection of birds in the Garden of Plants at Paris is arranged, has been adopted both at the British Museum, the Zoological Society, and the Liverpool Institution. Each specimen is mounted on a wooden stand, and then arranged on narrow shelves in ordinary glass cases, the whole interior of which is painted of a rose-coloured white, for the purpose of bringing out the birds in relief. These stands are made, of course, of different sizes and heights, to suit the different sized birds. The best we have seen are turned in France; and if a large quantity are wanted, it might be as well to procure them, if possible, from Paris, as the custom-house duty is not high. A more simple, and equally efficacious, plan, is to mount the bird upon a proper sized natural twig, and then insert the end into a slab or block of wood, sufficiently heavy to stand firm. For woodpeckers, a roundish block should be preferred, as more suited to the natural attitudes of these birds; and for such as walk only upon the ground, the stands should be made of slabs of wood of different sizes, and about an inch thick, neatly whitened: on a label in front may be printed the generic and specific name, the English name, and the country inhabited by the bird: the specimen is then fit to be placed in the case. The shelves should be as narrow as possible, in order to admit of as many rows of birds as the case will conveniently hold, and also to prevent the more backward ranges from being enveloped in shade: they should not be fixed as ordinary shelves, but moveable, like those in the generality of bookcases, so that their positions

nearly all the errors in that paper, in regard to matters of fact, may be fairly attributed to the miserable state in which this very collection is arranged. The birds are perched upon dark branches, one half obscuring the light from the other. The specimens cannot be taken out for examination, and they happen to be deposited in a particularly gloomy room. When will the Society expend about 20*l.* in making these specimens fit for scientific examination? We candidly confess we would not have undertaken to describe them in their present state.

may be changed, and they may be raised higher or lower, as circumstances require. The glass front should be easily taken off; or it may be hung on hinges, the sides being lined with felt or baize, so that as little air or dust can enter as possible. It is surprising how closely birds of a moderate size may be arranged on this plan without any appearance of confusion, each specimen being immediately accessible, and capable of being taken out singly in three minutes. Of two cases now before us, one, containing a large proportion of small birds, has seventy-five specimens; the other, chiefly filled with thrushes, starlings, and other middle-sized birds, contains fifty-two. The dimensions of each case are three feet eleven inches high, three feet one inch wide, and eleven inches deep.

(228.) But even the above method of arranging a large collection, admirable as it is, presents some serious obstacles to a private individual, no less than to societies whose funds are not very ample. It requires great space, and a large pecuniary expenditure. Rooms or galleries must be devoted to containing cases; and the cost of mounting, independent of the cases themselves, will generally be found, in a large collection, to average nearly two thirds the original cost of the specimens. The great and constant trouble, also, of opening glass fronts whenever a bird is to be examined, is no small hinderance to the scientific author, who often finds it necessary to be able to handle a specimen, turn it about, open its wings or tail, and discompose in some measure that exact arrangement of the feathers which constitutes the finishing of a mounted specimen. All these, as we before observed, are serious inconveniences to all but very wealthy individuals, who can build galleries and rooms, and to whom the expense of mounting is no object.

(229.) The last and best method of arranging birds is by leaving them, as it is technically called, "in their skins." It is now near twenty years since we began this plan, to the great surprise and disapprobation of

our scientific friends; but the practice has now become almost general. It is simply arranging the birds in drawers, as shells or minerals are kept; the specimens of each genus being placed together, and laid in rows upon carded cotton. The cabinets, of course, should be thoroughly well made, and the drawers of different depths. The large birds, indeed, or those of the size of a goose, are kept in chests; but all others, if preserved upon the hooded or contracted plan already alluded to (225.), may be contained in a cabinet by themselves, the drawers of which should be from three to one inch and three-quarters deep, the length about nineteen inches, and the breadth eighteen inches. That the collector may form an idea of the great advantage, merely as regards space, that attends this mode, we shall just mention the following fact. An oak cabinet is now before us, of the following dimensions:— four feet seven inches high, three feet three inches broad, and nineteen inches deep; it contains thirty-six drawers, in two tiers, each drawer measuring in the clear, two inches one-tenth in depth, eighteen inches in breadth, and sixteen and a quarter inches in length.* In this cabinet are contained no less than 614 specimens, few of which are small; the birds chiefly belonging to the woodpecker, parrot, toucan, cuckow, hawk, pigeon, and other middle-sized families. One, two, or even three such cabinets, may be arranged in our common-sized rooms as articles of furniture, the fronts of the drawers being protected by folding doors, with brass lattice work over purple silk. 1000 or 1500 birds will take the collector some time to acquire; and he may by this means have them compactly, and even beautifully, arranged in his library or drawing-room, without any risk of the plumage being injured by the light (a cir-

* This cabinet was originally made for minerals, and all the drawers are of equal depth. If a similar sized one was made expressly for birds, we should recommend that four of the drawers were two inches and a half deep in the clear, ten two and two-tenths of an inch, four two inches, twelve one inch and three-quarters, ten one inch and a half, total forty drawers, making the entire height much the same as that just mentioned.

cumstance which entirely takes off the freshness and brilliancy of birds in the London collections in three or four years), and ready, with a moment's trouble, to be handled and examined. To each specimen a strip of card is attached, with the name, &c., written thereon, and tucked beneath the wing. A regular inspection is made three or four times a year: if any injury by insects is observed, the specimen is taken out and placed in quarantine; a box strongly impregnated by camphor, or the oven, performs this office: and in this manner have birds, collected near twenty years ago, retained all the beauty and freshness they possessed on the day of their death.

PART III.

ON THE NATURAL HISTORY AND RELATIONS OF THE DIFFERENT ORDERS, TRIBES, AND FAMILIES OF BIRDS.

CHAPTER I.

ON THE RAPTORIAL ORDER, OR BIRDS OF PREY.

(230.) THE RAPACIOUS BIRDS, like the feline quadrupeds which they represent, form a distinct and primary order in their own class. In comparison to the *Insessores*, or perchers, their number is but few; for had it been otherwise, their sanguinary habits would have soon depopulated the feathered creation. For the same wise and conservative principles they propagate slowly. While the domestic fowl rears with facility a brood of ten or fifteen little ones, and the prolific sparrow, both feeding upon the seeds of the earth, lays from eight to ten eggs, the eagle seldom hatches more than two, and this but once a year. As if conscious that they were the known and detested enemies both of man and beast, they build only in wild and desert solitudes; shunning, and shunned by, their own class, except when they leave their retreats to seek and devour them.

(231.) Rapacious birds comprise some of the largest of the feathered creation, and they are notoriously the most muscular and powerful. The flight of the eagle has been the theme of poets, and there are few of that family which do not show great strength of wing. The male is considerably smaller than the female; a disproportion not found in other birds, and for which it is difficult to account, seeing that both sexes hunt the same description of game, and evince the same courage. It is a mistake among compilers to say that "the females are handsomer" than the males, for the very con-

trary is the fact. This inequality of size, and difference of colour, in the sexes, renders it very difficult to determine the species; and this difficulty is increased by the length of time required for the young birds to assume their adult plumage, which is often totally different from that which they at first put on. Rapacious birds are immediately recognised by their strong hooked bill, and formidably acute talons: by these instruments of rapine they are enabled to despatch and prey upon animals little inferior in size to themselves. In these attacks the victim is first struck by the talons, or by the feet, the muscles of which indicate extraordinary strength. The prey once secured, the bill is then used, as a knife, to separate or tear the parts asunder: for this purpose there is placed a strong and sharp tooth in one or both mandibles, which materially assists the operation. In such tribes as feed upon carrion, or small animals, this tooth, being no longer essential, is either obsolete or entirely wanting. It is thus that nature preserves, in this order, a strong analogy to the carnivorous quadrupeds. The slothful vulture and the cowardly hyena glut themselves upon carrion; the bold and majestic lions, like the noble falcons, feast upon no other prey than what their own courage has procured; while the owls and the stoats prowl during the night after the same feeble and ignoble game.

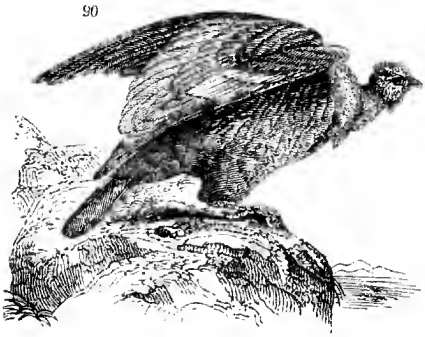
(232.) The order before us is composed of only three families that are now in existence, whose prominent features are, perhaps, more decided than those of any other groups in ornithology: the vultures, the falcons, and the owls are so strongly marked as to be familiar to every one. It has been customary with some systematists to divide this order into two groups, from the period of their feeding; the two former being diurnal, and the latter nocturnal: but this explains little. A much clearer, and certainly a more correct, idea will be formed of their true nature, by considering them with reference to their attributes, and their natural affinities.

(233.) Commencing with the VULTURIDÆ, or *Vul-*

tures, we shall briefly trace the affinities of the whole order. These, notwithstanding their great size, are cowardly birds: the filthiness of their food, which is principally carrion, imparts to their whole body a fetid odour, which nature has rendered a means of defence; for, if seized during the torpid inactivity which succeeds their meals, they immediately disgorge the nauseous contents of their crop over the luckless captor, who is thus, by a sudden impulse of loathing, obliged to relinquish his hold. But, that those parts of the bird which come in contact with its offensive food should not be soiled and matted together, the whole of the head (and frequently a great part of the neck), is entirely destitute of feathers; while those on the rest of the body have a certain elasticity and glossiness which enables the bird, by a few sudden shakes, to cleanse itself at once from any fragments that remain upon its plumage. The vultures are the great scavengers of nature in hot latitudes, where putrefaction is most rapid, and most injurious to health; and the disposition of their numbers is regulated, by an all-wise Creator, according to their usefulness. They are sparingly scattered over the south of Europe: in Egypt they are more numerous; but in tropical America, although the species are fewer, the individuals are much more plentiful. No sooner is an animal dead, than its carcass is surrounded by numbers of these birds, who suddenly appear, coming from all quarters, in situations where not one had just before been seen. The nakedness of the head, and frequently of the neck, is most apparent in those whose geographic range is limited to the new world, at the head of which division stands two remarkable species,— the celebrated condor of the Andes, *Sarcoramphus Condor** (*fig.* 90.), and the *Papa*, or king vulture of the Brazilian forests. The first is well known for the loftiness of its flight, and its amazing strength; while the latter is the only species whose colouring is

* So inaccurate is the figure of the head of this bird represented by Humboldt, that the nostrils have been altogether omitted! They are very conspicuously longitudinal and oval.

not dark or sombre: and both will be more particularly noticed in a future volume. The reader should bear in



mind, that our present object is directed to the characteristics of groups, not of individuals: our task is not that of the biographer, or the collector of anecdotes, but rather that of the general historian of this part of creation.

(234.) The genera composing this family may be here slightly mentioned, although our present state of knowledge will not allow so full an exposition of their affinities and relations as could be wished. The difficulty of procuring such large birds for minute examination, the rarity of most of them, and the few specimens that are in our museums, are all serious obstacles to attaining that acquaintance with the natural series of this family which can alone substantiate our present disposition of the genera. It has been stated, indeed, that, of the two typical groups, the first, or the restricted genus *Vultur*, has no caruncles or wattles either on the head or neck; while the possession of these appendages is stated to be the chief distinction of the vultures of the new world, forming the genus *Cathartes*. Our own observations, however, lead us to consider these as secondary, and not primary, characters; in proof of which

we may advert to the fact, that not one half of the new world vultures have either caruncles or wattles. The pre-eminent distinction of these two groups appears to be in the very opposite forms of their nostrils. In *Vultur*, the aperture is placed transversely across the bill, while in *Cathartes* it is long, linear, and situated parallel with the margin of the bill; in other words, the aperture is longitudinal. In the most aberrant species, there will, of course, be an interchange of characters, as in every other part of the animal kingdom. Of the typical vultures there are only two species found in Europe, — the *V. fulvus* and the *V. cinereus* (*fig.* 91.), the last of which we have occasionally found on the lofty mountains of Sicily. *Neophron* (Savigny), *Sarcoramphus* (Dumeril), and some others, seem to be minor variations, or subgenera. *Neophron* is obviously a tenuirostral type, for its lengthened and slender bill more resembles that of a wader than of a bird of prey; while the *Vultur aura* of South America seems to us to be the type of *Cathartes*. Both these great divisions have the head and neck more or less bare of feathers, while their feet and general aspect at once proclaim the typical characters of the family they represent. But there are some other birds, obviously allied to these, which cannot, however, be associated with them. One of these is the New Holland vulture, mentioned by my friend Chief Justice Field*, and which is so like a rasorial bird that some authors have hesitated (not having seen a specimen) as to what order it really belonged. So completely, indeed, has nature disguised this rare and extraordinary vulture in the semblance of that type which it is to represent in its own family, that it has even been classed by one writer with the *Menura* of the same continent;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* Géo. Mémoires of New South Wales.

and it must be confessed that if clear conceptions of the difference between analogy and affinity are not entertained, such a classification has some plausible reasons to recommend it. The feet, in fact, of the two birds, are formed nearly on the same principle; but, then, so are those of *Orthonyx*, a little scansorial bird not much bigger than a robin. All three genera, in short, are remarkable for their large disproportionate feet, long and slightly curved claws, and the equality of length, or nearly so, of the outer and the middle toe. It is by instances such as these that we perceive the full extent of those unnatural combinations which result from founding our notions of classification from one set of characters, and forgetting to look at the full consequences of carrying those notions into extended operation. Nor is this the only peculiarity of the New Holland vulture; for, unlike all others of its family, it possesses eighteen feathers in its tail. An examination of the bill (*fig.* 92.), which is decidedly raptorial, joined with many other considerations, shows that all these are but analogical relations to the *Rasores*, while the real affinities of the bird are in the circle of the *Vulturidæ*, of which it forms the rasorial type. A perfect specimen of this very rare vulture, now before us (procured by Mr. Allan Cunningham in the forests adjoining Van Diemen's Land), enables us to speak of its structure from personal examination.

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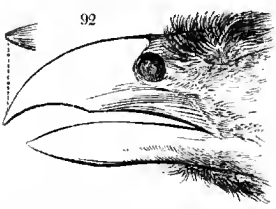
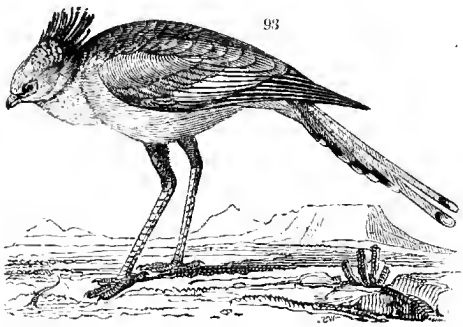


(235.) The fissirostral type is no less strongly marked than is the rasorial. This is exhibited in the bearded vulture of the Alps, forming the genus *Grypœtus* of Storr, the only example yet discovered of this particular form. It has the lengthened bill of the vulture, but the boldness and rapacity of the falcon family. The fissirostral type or form is clearly manifested in its

short legs, bristled gape, and long pointed wings; while the singular tuft of stiff feathers surrounding the bill, makes it a perfect representation of *Dasycephala*, its corresponding type in the circle of the thrushes (*Merulidæ**). This vulture, in fact, is the most cruel and rapacious of all the European birds of prey; and all our best ornithologists have placed it close to the eagles.

(236.) The third and last type of this family appears to us to be the secretary vulture of Africa, forming the



genus *Gypogeranus* (*fig.* 93.). At least we cannot assign it to any other known division of the *Raptores*, without separating it much more widely from its congeners than our present state of knowledge will sanction. It has been thought, indeed, that this remarkable bird represented one of the primary divisions of the whole order; in which case it would stand between the owls and the dodo: but its similarity to the vultures and the falcons, in our opinion, is too great to favour this supposition; while, on the other hand, it will subsequently appear that the circle of the *Falconidæ* is sufficiently complete to show that it does not enter into that family. We have no other alternative, then, but to place it as the most aberrant — in other words, as the grallatorial type of the vultures; a station to which

* See the demonstration of this circle in Northern Zoology.

it has some claim by the uncommon length of its legs and its perfectly terrestrial habits. We confess, however, that until a proper analysis of this family has been made, we shall by no means be satisfied that this is the true station of *Gypogeranus*. Its conspicuous and very remarkable crest, which rises from the back of the head, and can be spread out like a fan, and its aptness for domestication, are all in favour of its being a rasorial type; more particularly as crests are absolutely unknown in that of the grallatorial. It is barely possible that this perplexing form may prove to be the rasorial subgenus either of *Cathartes* or *Vultur;* in which case the grallatorial genus of the *Vulturidæ* will be unknown, unless *Neophron* fills that station. Difficulties of this sort will always attend the determination of those comparatively few groups in zoology, where the links in the chain are wide apart; and these difficulties are increased where the requisite analysis has not been gone into. *Gypogeranus* is evidently a compound, both in structure and habits, of the vulture and the falcon; and we can incur no risk in placing it as the most aberrant of the former, seeing that, without any reference to our theoretical views of the subject, such an intervening station has been assigned to it by all the most eminent writers. It must be remembered, also, that the very same objections occur against placing this bird between the *Strigidæ* and the *Dididæ*, as those we have intimated against considering it as the grallatorial type of the *Vulturidæ*.

(237.) The FALCONIDÆ, or falcons, exhibit the perfection of the order; they are distinguished by a much shorter and sharper bill, more or less toothed, and by very acute and strongly curved talons. Their form, in general, is lighter, their flight more graceful, and their courage much greater, than what we see in the vultures: unlike these latter, also, they live almost exclusively upon animals which they themselves have killed, resorting only to carrion or dead game when pressed by extreme hunger. The geographic range of this family, as a whole, is universal; for wherever other animals

exist, there also these deadly enemies are to be found. From the arctic regions to the most southern limits of Australia, and from the western shores of Africa to the vast forests of Brazil, different races of the falcons abound; and yet there are very few species which inhabit widely remote countries. Some of those whose chief metropolis is in Europe, extend their range to the most northern parts of the new world, and even spread in the contrary direction to the more temperate latitudes of Asia; but the species of tropical America are totally different from those of western Africa, although many of these latter extend their range to the Cape of Good Hope, and some few appear, also, to be inhabitants of India. We are by no means satisfied of the truth of the assertion, that certain species, inhabiting New Holland, are specifically the same as their counterparts in Europe; but this much is certain, that Australia, no less than southern Africa, possesses species peculiar to their respective regions. From the first of these countries we have a hawk of a pure white colour, and a noble eagle, feathered to the toes, possessing the unusual peculiarity of a wedge-shaped or cuneated tail. It is observed that falcons are invariably much more numerous on continents than on islands: they love a wide extent of country, which is not only congenial to their habits, but absolutely essential to a fitting supply of daily food. The plumage of these birds, although destitute of a bright or gay assemblage of colours, is, in many instances, particularly elegant. The upper parts are generally of different shades of brown or slate colour; sometimes, as in the lesser American falcons, of a bright rufous, variegated with spots: the under plumage has generally a white ground, often beautifully marked with pear-shaped spots, or transversely banded with narrow parallel lines of grey. The eye is deep sunk in the head; and the bone which supports the eyebrows, both in this and in the owl family, is unusually prominent.

(238.) Such are the chief distinctions of the family before us;—a family whose natural arrangement has

excited more attention among modern naturalists, and has given rise to more controversy than any group in the whole circle of ornithology. In the present advanced state of science it is quite unnecessary to advocate the imposition of classical names to the different groups it contains, since they have been long distinguished by the vernacular ones of eagle, hawk, buzzard, &c. The real difficulty lies in determining the natural series, and in separating those modifications which are typical of natural genera, or subgenera, from those which merely belong to aberrant or annectant species. It is quite clear that neither of these important objects can ever be accomplished by consulting figures, which are often incorrect, not only in their details, but in giving a false character to the bird *, or the ordinary descriptions found in systems, where it generally happens that those points of structure which chiefly point out the relations of the bird are entirely omitted; while minute particulars as to colour, &c., of no essential importance to the main question, are prominently brought forward. It may be urged, indeed, that such classifications are provisional, and are merely proposed until the group is better understood; but we question much whether any real advantage to the cause of science, and more especially to the establishment of the circular system, is eventually gained by such premature attempts to prove its truth, particularly in those groups which, from their intricacy, more especially require rigid analysis. On the other hand, it must be confessed that such analysis, in the present instance, is attended with peculiar difficulty. Most of the exotic raptorial birds, or at least several of the most remarkable forms, are rare; and there are no collections in this country, public or private, which contain more than a very insignificant portion of the existing species. These considerations, which carry with them the impossibility of determining the rank of the numerous divisions proposed by Savigny, Cuvier,

* This is particularly the case in the figures of falcons contained in the *Planches Colorées*.

and many others of lesser note, deterred us, some years ago, from attempting any classification of the *Falconidæ*, when treating of the North American species discovered on the Arctic expeditions: rather choosing to prosecute further inquiries, and collect additional materials by slow degrees, than to adopt a circular arrangement of the family; which arrangement, although we may know it to be erroneous, we may be unable to rectify in a satisfactory manner. With this decision, which was then thought to be somewhat fastidious, we have now reason to be satisfied. In the following distribution of the family, we trust to have placed the primary types upon that sure basis which reposes both upon affinity and analogy; so that some advance, at least, will be made towards a more natural disposition of the family, and, by indicating what appears to us the true station of some of the minor groups, a clue will be furnished by which the validity of the genera and subgenera not here adopted may be more correctly ascertained.

(239.) The three primary divisions of the FALCONIDÆ are characterised by the following peculiarities. The first contains the true falcons, having a deep and sharply angulated tooth (which is often divided into two) near the tip of the upper mandible: these compose the restricted genus *Falco*. The second is composed of the hawks, wherein the tooth just mentioned is not apparent, or rather it assumes a form of a rounded projecting lobe, or festoon, towards the middle of the margin: the shape of the bill, however, in other respects, is the same; that is to say, it is short, high, and curved from the base: the wings are also more rounded than those of the true falcons, but both groups agree in having the tarsus fully developed. To these birds we retain the generic name of *Accipiter*, originally given exclusively to them by our great countryman, Willughby. The third, which is the aberrant division, is characterised, as a whole, rather by negative than positive characters. The bill is weaker, less curved, and more straight at its base; it is never toothed, and seldom

festooned or sinuated on the margin; while the wings, although rounded like those of the hawks, are considerably longer. Greater precision, however, will result from characterising each division of this aberrant circle separately. The eagles form the genus *Aquila* (*fig.* 94.), and are known by having the longest bills of the whole family. Their form is heavy, their size large, their feet short and thick, and their wings only of very moderate length. Following these are the buzzards — the genus *Buteo* — where the body and legs are slender, the ears large, the bill short and weak, and the wings uncommonly long. To the birds of the third and last division of the aberrant groups we shall retain the English name of *Kites*. They differ very little from the buzzards, excepting in one very remarkable particular — the extreme shortness of their tarsi, — a character, however, so obvious, that it renders the birds of this genus more easy of determination than almost any of the entire family. The type of this group, now first characterised, is the genus *Cymindis;* for the common European kite, *Milvus ictinus* (Savigny), does not, according to our views, strictly belong to the group, but merely forms a passage to it from the buzzards. This error, as we conceive, in overlooking the true distinction of one of the great divisions of this family, has, in all probability, resulted from examining prints and descriptions instead of actual specimens.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(240.) We shall not, in this stage of our exposition, attempt to prove that the above divisions form a circular series, because this could not be done without anticipating those details which will be stated in their proper place. Nor is this altogether necessary. All ornithologists agree in placing the hawks next in rank to the owls,

and we have elsewhere * stated our reasons for considering that the three aberrant groups, namely, the eagles, the kites, and the buzzards, form a distinct circle of their own. We may, therefore, consider the circular succession of these three, or five, divisions as substantiated by the following details, and we may at once proceed to the analogical verification of the group. Our first test will be to compare it with the tribes of the *Insessores*, or perchers, because its analogies will come more home to the student than if he had to trace them through the medium of the orders of birds.

FAMILY FALCONIDÆ. — *The Falcons.*

Genus.		
FALCO.	The most perfectly organised in their respective circles.	CONIROSTRES.
ACCIPITER.	The most conspicuously toothed; wings rounded, rather short.	DENTIROSTRES.
BUTEO.	Wings very long; hunt upon the wing.	FISSIROSTRES.
CYMINDIS.	Feet remarkably short; wings long; the upper mandible considerably projecting.	TENUIROSTRES.
AQUILA.	Size large; body heavy; feet very thick and strong; head frequently crested.	RASORES.

So fully is the theory of variation exemplified by this tabular comparison, that the professed ornithologist requires no additional evidence that these analogies are founded in nature. A few observations, however, tending to elucidate them to the student, may not be misplaced. The noble falcons, like the conirostral birds, are well known as the most perfectly or highly organised of any part of their family; and we should not be at all surprised to find, when their history becomes better known, that they are, like the *conirostres* among birds, and the *quadrumana* among the quadrupeds, pre-eminently distinguished in their powers of grasping. Indeed, this fact may be safely assumed, since it has been well ascertained that the Peregrine and one or two other typical falcons, when darting into the middle of a flock of ducks or a covey of partridges, will strike down with its talons many other individuals besides that which it

* Northern Zoology, vol. ii. pp. 9, 10.

first pursued. Here, then, is that great superiority of grasping, though manifested in a different way, which we find in the typical perchers and the four-handed quadrupeds: for this perfection, which belongs to some of the most perfect falcons, must be, without doubt, a typical characteristic; the more so, as there is no evidence to show that it is possessed by any birds of the other divisions of the family. This fact so materially strengthens the other evidences in favour of the genus *Falco* being the representative of the conirostral birds, that we may consider the analogy as established: it consequently follows that the hawks represent the *Dentirostres*, because the succession of affinity in their own circles of these groups with those two we have just compared have long ago been established. In other words, no one can doubt that the hawks do not follow the falcons, or that the *Dentirostres* do not follow the *Conirostres*. Yet it must be confessed, — if these facts were not established, so little do we know of the habits and instincts of the greater proportion of the *Falconidæ*, —that this analogy would not, at first, appear so perfect as the last. It deserves attention, however, that, as the shrikes (which stand at the head of the *Dentirostres*) have the largest tooth among the *Insessores*, so is the

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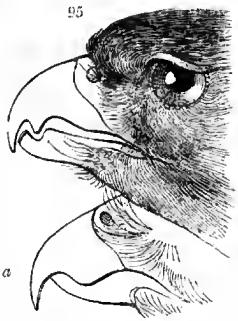


tooth or festoon of the hawks (*fig.* 95. *a*) much larger than that of the falcons (*b*), although not so formidable in its use. All the typical shrikes, that is, the *Laniadæ* and the *Thamnophelinæ*, have rounded wings like the hawks; and the prevalent colours, both in *Accipiter* and *Lanius*, are grey, transversely banded beneath with narrow lines: these latter, in the *Laniadæ*, disappearing with age. The *Dentirostres* is obviously the subtypical group of the perchers; and the hawks are as obviously

the subtypical group of the *Falconidæ*. Their mutual analogy, therefore, would be substantiated upon this ground only, setting aside the considerations we have just stated as corroborating their juxtaposition in the above table. We have expressly stated, in our development of the theory of variation, that, in all natural groups, it is much more difficult to discover the analogies of the typical and subtypical divisions than those of the three aberrant ones: the simple reason for which is this, that where two or more circles are brought into comparison, the two typical divisions of each, from being the most dissimilar and widest apart, will, of course, be the most difficult to assimilate by characters or habits common to each. But let us now proceed to the aberrant division, including the buzzards, the kites, and the eagles. These will verify the above opinion, for their analogies lie open to every well-informed ornithologist, although they have never yet been stated. The chief distinction, then, of the buzzards (*Buteo*) is their great extent of wing, which enables them to skim along just above the surface of the ground, in search of their food, instead of watching for its appearance, like other hawks, when resting. But, as the establishment of this fact is of the first importance to our present purpose, let us hear the account which Dr. Richardson has given of the American henharrier, a typical bird of this genus: — "This bird takes its prey from the ground, hunts long and diligently for it on the wing, and quarters the district regularly, so as to survey every spot, wheeling backwards and forwards in easy graceful circles, with little seeming effort or flapping of the wings. It is wary, but not timid; avoiding the sportsman, but not easily driven away from its hunting grounds. It is a common species on the plains of the Saskatchewan, seldom less than five or six being in sight at a time, but each keeping to a particular beat until it has completely examined it." Wilson, again, observes of another species of this group, the *Buteo lagopus*, or rough-legged buzzard, that it has the habit of coursing over

the meadows long after the sun has set; and Dr. Richardson mentions that, although it often sits for a long time on the boughs of a tree, it is frequently seen skimming over swampy pieces of ground, and hunting for its prey by the subdued daylight, which illumines even the midnight hours in the high parallels of latitude. These two forms we consider as typical of the buzzards; and so perfectly does the first, which belongs to the subgenus *Circus*, represent the *Fissirostres*, that Dr. Richardson's account of its manners is precisely applicable, as every one must perceive, to the common swallow. Fissirostral types either hunt for their prey upon the wing, like the swallow family, or watch for it from a fixed station, like the tyrant fly-catchers and the ordinary buzzards; while, to show that these opposite modes of feeding are quite consistent with the same primary type, we find them actually united in the *Buteo lagopus*, which thus intervenes between *Circus* and the common buzzard, and represents at once both the typical and the aberrant *Fissirostres:* for all these, in fact, capture or seize their prey upon the wing.

(241.) The relations of the two next groups, the kites and the *Tenuirostres*, from our comparative ignorance of the habits of both groups, cannot be traced in their economy; but this need not be much regretted, since they possess, in common, certain peculiarities of structure which are not to be found in any other birds of their respective circles. The humming-birds have wings fully as long as the swallows, joined to a peculiar elongation of the upper mandible, which they, or any other perching family of slender-billed birds, do not possess. Their feet, moreover, are the shortest of all the *Insessores;* so short, indeed, that the tarsus is frequently shorter than the hinder toe, while the middle toe scarcely exceeds the lateral ones. Now, upon looking to the true kites, comprehending the subgenera *Cymindis*, *Nauclerus*, and probably *Elanus**, we ob-

* We have not an example of this genus before us, but the published figures give an idea that the tarsi are remarkably short.

serve that they are distinguished from all the rest of their family by those very characters of the *Trochilidæ* which we have just enumerated. In *Cymindis* and *Nauclerus* the bill is small, but the upper mandible is remarkably long in the curve it takes over the lower: the wings equal those of the buzzards, but the feet are formed upon a totally different model: the tarsus is not so long as the hind toe and its claw: the two lateral fore toes are of equal length, and the middle one is scarcely a quarter of an inch longer. Compare a foot, thus constructed, with that of an ordinary raptorial bird, and the difference will appear so very striking, that the analogy of the kites to the *Trochilidæ* will immediately be admitted. Two other groups now only remain for comparison, the eagles and the gallinaceous birds. What, it may be asked, are the chief distinctions of these two groups, when viewed in reference to those of their respective allies? They are obviously these:— great bulk of body; comparative shortness of wings, accompanied by an incapacity for *rapid* flight, or swift evolutions; very thick legs; and ornamental crests upon the heads of many species. All these peculiarities more or less belong to the eagles, and they are some of the chief distinctions of the rasorial birds. It is only among the *Aquilæ*, or their representatives, that we find any crested birds of prey, or any which partake of vegetables as a part of their diet. The lofty flight, indeed, of some of the species has become proverbial; but it is equally notorious that they chiefly live upon animals which are seized upon the ground, their wings not being calculated for that celerity of flight and quickness of evolution which enable so many other rapacious birds to pursue and capture their prey while it is flying. Hence the greater part of the eagles feed upon quadrupeds, which they can easily overtake, and which their great superiority of strength enables them to conquer. To expatiate farther upon this subject will now be needless. We may consider the group as now proved

to be natural; and it therefore follows, as a legitimate deduction, that as the insessorial order is circular, so also is the raptorial.

(242.) In regard to the *external* affinities of the family, little need be said, since its situation between the vultures and the owls has been universally admitted since the days of Linnæus. The bearded vulture of the Alps, as already remarked (235.), is an eagle in its habits, food, and many parts of its structure: while several of the *Aquilæ* evince their affinity to the *Vulturidæ* by their partially naked heads, and by feeding occasionally upon carrion. Some of the buzzards, on the other side of the falconine circle, show the strongest possible affinity to the owls, by their large ears, often surrounded, as in *Circus*, by a ruff of stiff feathers—their hunting, like the rough-legged buzzards, by twilight—and by the soft lax plumage, seen more particularly in the last-mentioned species. These external affinities, indeed, have been so long known to naturalists, that they would not have been here repeated, did not their admission confirm the analogical demonstration we have just given of the family; for if this is correct, if follows, that, as the primary divisions of the *Falconidæ* represent the primary divisions of the perchers, they consequently represent those of all the circular groups in the class of *Aves*.

(243.) Upon entering more into the details of the five leading generic groups, we shall experience more difficulty, from the causes we have already mentioned, than with almost any other group in the whole circle of ornithology. We have, for several years, assiduously collected, where procurable, all such specimens as were adapted, from their size, to a private museum, and have taken an extensive series of notes regarding such as were only to be seen in other collections; but these materials are still insufficient to allow of that complete exposition of all the newly proposed genera which it would have been so desirable in this place to furnish. Several of these, indeed, we know only from figures or

descriptions in books; and others, from not being in our own possession, cannot be re-examined, or laid upon our study table, while this inquiry is going on. We have found, in short, that notes taken in public museums, rarely, if ever, completely answer the ultimate purpose for which they are intended. Something of importance, not known to be such at the time, is generally overlooked; while other details, *then* thought of importance, sometimes turn out of very secondary consequence. Several reasons induce us to make these observations on the present occasion. In the first place, the reader will be informed what facts repose upon personal observation, and what are taken upon trust. He will further see the importance of collecting, as far as possible, *under his own eye,* the subjects upon which he intends to write; and he will learn to appreciate the value of those very few descriptive works which minutely describe the *structure* of every species, and all its deviations from its acknowledged type.

(244.) Commencing with the genus *Falco,* as the most typical of the whole family, we observe in them the highest development of that structure which is best adapted for rapine. Their wings, although not so long as in some of the kites and buzzards, are yet more pointed, the second and third quill being the longest; and although the character is applicable only to the typical species, it never is so far lost but that the student can at once discriminate a falcon from a hawk. The most prevalent distinction, however, of the group lies in the bill, which is always short, and the tooth near the tip invariably angulated. The subgenus *Falco,* to which we are now more especially alluding, has only a single tooth in the upper mandible, behind which there is an incipient festoon or sinuated projection, analogous to that which is so much more developed in the next generic group (*fig.*95.*b*). These birds present among themselves some very slight variations, not, however, of any material consequence. In some, as in the small rufous-backed species, allied to

Falco sparverius, the inner toe, with its claw, is scarcely shorter than the outer; while in others, from the very same quarter of the globe, the disproportion is much more striking: some of the large species, again, as the *Falco peregrinus?* of New Holland, have the tarsi proportionably much shorter; while in the *Falco unicolor* of Senegal, the two lateral toes, when measured with their claws, are of precisely the same length: we cannot, however, view this latter bird in any other light than as an aberrant species; for although its different locality might suggest the propriety of detaching it as the type of a geographic group, yet this idea must be altogether abandoned upon finding that the *Falco graciles* (Sw.) of Brazil, (hitherto considered the same as *sparverius*), actually possesses the same character, although the toes, divested of their claws, are slightly unequal. We have been much surprised, in fact, in discovering the great diversity in the proportionate length of the lateral toes in the typical falcons, — a variation which we do not remember to have met with in any other subgenus of ornithology, and which, therefore, requires particular attention. The general character of the majority of the species, as before remarked, is that of having the inner toe decidedly shorter than the outer, although with a much larger claw: of this the well-known *sparverius*, a bird in almost every collection, is a good example. But this deficiency in the length of the inner toe is often made up by its claw; which thus brings it equal to the other, if both are measured in their full length: such is the case in *Falco unicolor*, and in some of the supposed varieties of *sparverius*. In others, however, from tropical America, the outer toe of the claw is by far the longest: while, in an undescribed kestrel from Western Africa, this proportion is actually reversed, — the two lateral *toes* only are perfectly equal; but as the claw of the inner one is much longer than that of the outer, it gives to this claw the appearance of being longer than the other. The same structure we observe in a kestrel-like species from Java, which is probably the *F. tin-*

nunculus of Dr. Horsfield. For the present, however, we shall consider all these variations from the typical structure as sectional groups; the more so, because deviations, equally marked, exist among the *Thamnophelinæ*, or bush shrikes, another group of predatory birds, although belonging to the *Dentirostres*. Now, as these modifications occur in closely connected species, and of the same countries, it is quite clear that they do not characterise either natural or geographic groups; in other words, that they are aberrant species, and not subgeneric.

(245.) The next principal type of *Falco* appears to be that of *Bidens* of Spix (which we discovered in Brazil previous to that traveller), but which name has been properly changed for *Harpagus*. In this the wings are less pointed than in *Falco*, but not so rounded as in the hawks; the bill has a peculiar thickness, and instead of one very strong tooth in the upper mandible, there are two smaller ones; the structure of the feet accords with that of the generality of true falcons, but the scutellation of the tarsi are very different: instead of numerous small scales, disposed in a reticulated or net-like manner, those in front of the tarsus are large, broad, and transverse. The passage between *Harpagus* and *Falco* is marked by a well known and beautiful little bird, the *Falco cærulescens* of Linnæus, which we class as an aberrant *Harpagus*, with which it agrees in having a doubly toothed bill, united with the more pointed wings of the subgenus *Falco*. This species, not now before us, does not appear to be otherwise different from *Harpagus;* for, by the description we quote from *, the tarsi appear to be similar to those of the typical species, all of which inhabit Brazil. The third subgenus is represented by a most beautiful crested falcon from India, the *Falco lophotes*†, of which only one specimen, now in the Paris Museum, is known. Like the latter, the bill of this also is bidentate; but the feet

* Zoological Journal, vol. i. p. 328.
† Temminck, Planches Coloriées, pl. 10.

are described as particularly short, and the nails small and but slightly curved: these characters, joined with its elegant pendent crest, places it at once as an aberrant type in this group; while the latter characteristic leads us strongly to suspect it is the representative of the crested eagles and the gallinaceous birds. We saw this remarkable bird when in Paris; but, from the case which contained it not being made to open at pleasure, we were disappointed in giving it a critical examination. The same obstacle was probably experienced by M. Temminck, which may account for the imperfection of his description: the bird, however, is of too remarkable a type to be confounded with any other, except, perhaps, with one we have received from Western Africa, and to which we have given the name of *Aviceda*. This subgenus, for as such we consider it, appears to follow that of *Lophotes:* both have the bills bidentate; both have remarkably long wings, and short tarsi: but the bill of *Aviceda* is much more powerful, while the feet are stout, and the claws strong and well curved. In the structure of its feet it differs from all the falcons we have yet examined. The tarsus is not longer than the hind toe and claw, and, from being feathered for more than half its length, it appears even shorter: the sole of the foot is remarkably broad, and is entirely destitute of those prominent callous pads which belong to *Falco, Harpagus,* and most of the hawks. Unlike all these genera, the inner toe is decidedly longer than the outer; so that the bird, in fact, may be said to have the feet and wings of *Cyminidis,* with the bill of *Harpagus* and *Lophotes:* it is a falcon in the disguise of a kite,—as such, at least, we view it; and, by placing it next *Lophotes,* its station in the circle actually confirms this analogy. The fifth type alone remains undetermined; for we have not, as yet, met with any bird whose structure appears sufficiently marked to make us feel any degree of confidence in its holding this station. Judging by theory, and presuming that *Lophotes* is the rasorial type, this, which we now require, would be the fissi-

rostral, and lead immediately to *Buteo*. It should, therefore, possess some of the characters of the buzzards proper, joined with others that would unite it to *Falco*. This type may be thought by some to be the Iceland falcon, made into a subgenus by M. Cuvier; but we have not a specimen of this rare bird now before us, and we can add nothing to what we have already said on this subject.* But there is another singular form in the *Gampsonyx Swainsonii* (Vig.)†, discovered during our researches in Brazil, which exhibits the union of characters above mentioned, and which may therefore very properly be placed within the circle of *Falco*. The identical specimen, from which the description we have quoted was taken, is now upon our table. Its bill is rather small, and is formed very much like that of the common buzzard; for the upper mandible is entirely destitute of the lobed tooth, common to all the sparrowhawks, with which it has been so confidently associated ‡: to compensate, apparently for the want of this tooth, the tip of the mandible is prolonged into an unusually long and sharp hook. The wings, instead of being "short," are nearly as long as those of *Falco sparverius* §, and are completely typical of a true falcon: the feet, although rather short, are very strong and robust for the size of the bird; they have the breadth and scutellation of *Aviceda*, with the same proportioned toes as the generality of falcons, that is, both the outer toe and its claw are longer than the inner. The whole aspect of the bird, notwithstanding its small size, gives it the appearance of a most bold and muscular little creature. It deserves to be added, also, that

* Northern Zoology, vol. ii. p. 30.

† Zoological Journal, vol. ii. p. 65.

‡ "This bird decidedly belongs to the accipitrine sub-family of the *Falconidæ*; but it is placed at that remote extremity of it, where the species, gradually approaching the falcons, partially assume some of their leading characters. It possesses the bill of the hawks, and also the shortness of wing which so strongly characterises them." — *Zoological Journal*, vol.ii. p. 68.

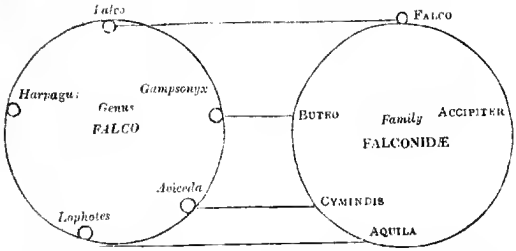
§ The wing of a specimen of *Falco sparverius*, now before us, measures six inches nine-tenths; that of *Gampsonyx* six inches three-tenths: so that, considering the relative size of the two birds, the proportionate length of their wings is perfectly equal.

some of the buzzards have the smallest heads among the *Falconidæ*, and that this peculiarity is very remarkable in *Gampsonyx*. Upon the whole, therefore, we are disposed, for the present, to place this singular bird as representing the fifth subgenus of *Falco;* since it seems to unite some of the characters of *Buteo* with those of the typical falcons, and has a singular relation to *Aviceda* by its broad foot and robust tarsus, half feathered from the knee. Our doubts, indeed, upon this point, are more drawn from theoretic considerations, than from any thing in *Gampsonyx* which decidedly militates against its being the fissirostral type. We should have looked for a larger bird, with longer wings and *some* indication of the falcon's tooth, as in *Ictinea;* but not one of these are characters absolutely essential, and the objections may be entirely removed by the discovery of a larger species of *Gampsonyx*, or of one which, as in the instance of the aberrant *Harpagus cærulescens*, possessed more of the falcon characters than the solitary species we as yet know.

(246.) Concentrating the essence of the preceding remarks, we shall find that the circle of the subgenera of *Falco*, when compared with that of the entire family, will represent them in the following manner:—

Subgenera of Falco.		Genera of the Falconidæ.
	1. Typical group.	
Falco.	Pre-eminently typical; bill acutely toothed; wings pointed, rather long.	FALCO.
	2. Sub-typical group.	
Harpagus.	Wings shorter, rounded; tarsi with entire transverse scales.	ACCIPITER.
	3. Aberrant group.	
Lophotes.	Feet short; head crested.	AQUILA.
Aviceda.	Feet small, very short; soles broad and flattened; outer toe and claw shortest.	CYMINDIS.
Gampsonyx.	Bill neither notched or festooned; head small; feet strong.	BUTEO.

By throwing each of these columns into their respective circles, and then bringing them into juxtaposition, the same results will follow.



(247.) The genus *Accipiter* comprehends the hawks, of which our common sparrowhawk (*fig.* 96.) offers a familiar type. In this, and in a considerable number of other species, from different parts of the world, the festoon or rounded tooth is placed, not near the tip, but in the middle of the cutting margin of the bill; so that not only its form, but its situation, is essentially different from that of the last genus. The wings are not only short, but rounded; they seldom reach beyond the middle of the tail; the first quill is very short, and although the second and third are progressively longer, the full length is only attained by the fifth. The feet, like those of the falcons, are long and slender: the tarsi are so smooth as to appear covered with only one scale: the relative proportion of the lateral toes is also more uniform; the external one is considerably longer than that which is internal, and it has the smallest claw; whereas the claws of the internal and hinder toes are remarkably large, and nearly of the same size: the callous pads on the soles are very prominent; and the tail is either rounded or even. Such are the prominent distinctions of the genus before us; but as it contains, like that of *Falco*, many subordinate types, the student

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must not suppose that a bird wherein two, or perhaps only one, of these marks can be traced, is therefore not an *Accipiter*. On the contrary, he must expect to find birds which blend the characters of the two groups so equally, that he will be compelled to consult the subgenera before he can determine the name of his specimen: nay, it frequently happens that an aberrant form will retain but one of those distinctions of the group with which it is naturally associated. This, in fact, we have seen in *Gampsonyx Swainsonii*, and it is equally apparent in the subgenus, which appears to represent that bird in the circle of *Accipiter*, named by M. Vicillot *Ictinea*. The best known species, *Ictinea plumbea**, from its very long wings and short even tail, is obviously a fissirostral type; but whether it belongs to this genus, or naturally fills the station we have for the present given to *Gampsonyx*, must be left for future determination. Such questions, indeed,—where those types which have been personally examined are few and far between—should always be left open for future discovery. The bird of which we are now speaking is unquestionably an aberrant form, either actually entering the circle of *Falco*, or the means by which that circle is united on one side to *Accipiter*, or on the other to *Buteo*. It is a buzzard in its wings, an *Aster* in its feet, and as much of a hawk as of a falcon in its bill. (*fig.* 97.) This latter character, in short, decides its intimate connection to *Falco*: the half festooned tooth and its feet lead us to consider it as an aberrant *Accipiter*, while, in its very long wings, it may be said to have an affinity to *Lophotes*. On these considerations we place *Ictinea*, provisionally, as the first subgenus of *Accipiter*, as a medium of connecting *Lophotes* with the accipitrine falcons. On the typical subgenus *Accipiter*, whose characteristics have been

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* *Falco plumbeus* Lath. *Milvus Cenchrus* Vieil.

already enumerated, little more requires to be stated: it is clearly analogous to that of *Falco*, and the birds belonging to it are as readily distinguished from the subgenus *Aster* by their long, smooth, and very slender

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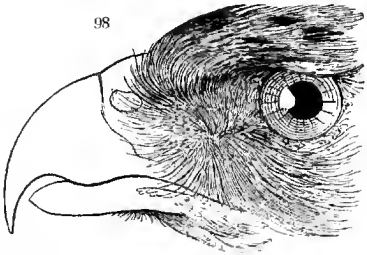

legs. This latter is composed of the goshawks, of which only one species, the *Falco palumbarius* (*fig.* 98.), is a native of Europe, although several others are found both in the New and the Old World. The European goshawk, from its size and strength, might be very easily mistaken, by an ordinary observer, for an eagle; and the same may be said of the white goshawk of Australia. The form of these birds, in comparison with the sparrowhawks, is thick and somewhat heavy; and, although there is little or no difference between their bills, except in size, the slender and delicate tarsi of *Accipiter* offers a remarkable contrast to the thick, powerful, and eagle-like structure which belongs to the feet of the goshawks. The scales of the tarsi, in both, are smooth; but their divisions in *Accipiter* can scarcely be perceived, while in *Aster* the front and back of the leg are protected by many broad but short plates, disposed transversely; and in the two species above named the greater part of the upper half of the tarsi is clothed in front with feathers. Several modifications of this form, like that of *Aster monogrammicus**, &c., have come before us; but they do not appear sufficiently marked to favour the idea of viewing them as distinct types.

* Birds of Western Africa, plate 4.

The genus *Dædalion* has been placed with the hawks by M. Cuvier; but, as we have not met with either of the two species of which it is said to be composed, we do not admit it in the circle. Far better evidence, however, exists for considering the *Haliætus pondicerianus* of India (*fig.* 99.) as one of the leading types of this group, since it unites some of the characters of *Accipiter* and *Aquila;* and as we have now traced this generic circle to where, from theory, it should touch that of the eagles, this is the very form which will enable us to pass from one to the other without any abrupt transition. Upon what ground this bird, even by the promoters of new falconine genera, has been placed in the same group with the osprey, does not appear, seeing that its affinity to *Aster* is much more apparent than to *Pandion*. Anxious, however, to avoid, where it is possible, the creation of more names in this already overburthened family than is necessary, we shall retain that of *Haliætus* to the bird in question, and to such as resemble it, leaving the ospreys or fishing eagles alone in the genus *Pandion*. The feet of *Haliætus pondicerianus* very much resemble those of an *Aster*, but they are proportionably rather smaller in their details, although quite the same in general structure: both the anterior and the posterior scales are smooth; but the first are broader, and the latter appear to be composed of a single piece. We suspect this bird, although nothing is known of its manners, to be a fisher; for the soles of its feet are particularly rough, like those of the osprey, or at least are formed upon the same principle: all the nails, however, are grooved underneath, and the wings are so long that they reach to the end of the tail. Notwithstanding these latter differences, the bird before us may possibly be an aberrant species of *Pandion;* but, for the present, we cannot but consider it

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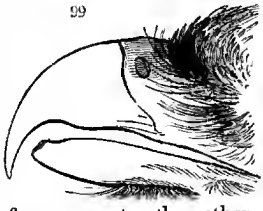

as a distinct type. The above four subgenera are all that we can admit into the accipitrine circle; and it consequently follows that there still remains another to be determined by future observation or discovery: this, according to our theory, will be the tenuirostral type, which in the present instance must alike represent *Aviceda* and *Cymindis*; in other words, it must be a kite among the hawks. Several of the birds arranged among the smaller eagles and the larger buzzards will probably be found, upon actual examination, more naturally allied to the aberrant hawks, especially such as *Buteo borealis*, *pterocles*, &c.

(248.) The genus *Aquila* is the first of those composing the aberrant division of the family wherein the upper mandible of the bill shows little or no indication either of the acute tooth of the falcons, or the prominent but rounded lobe of the hawks. We have a perfect example of this shaped bill in the white-headed hawk, forming the type of the restricted subgenus *Haliætus*, and the bill of the osprey is nearly the same; but as we approach the more typical eagles, the length of the bill is greater, the size of the body is augmented, and all indications of the accipitrine structure are lost. These circumstances deserve attention, because they afford a strong ground for considering the true fishing eagles (*Pandion*) as a prominent, although an aberrant, type in the aquiline circle; a station which still further confirms that which we have given to *Haliætus*. The typical eagles appear to arrange themselves, as M. Cuvier has intimated, under two leading groups or subgenera, chiefly distinguished by the structure of their wings. To those whose wings, like the golden eagle, are more or less lengthened, we restrict the subgenus *Aquila*, more for the sake of not creating a change of nomenclature among the best known species, than from any belief that they are the pre-eminent types of the aquiline group. The legs of these birds are all more or less plumed; and in one species, the wedge-tailed eagle of New Holland (*A. fuecosa*, Cuv.,

fig. 100.), the feathers closely and completely cover the entire length of the tarsus. The other group of typical eagles we arrange under Cuvier's genus *Harpyia*, including in it not only the *Harpyia destructor* as the type, but all those arranged under his genus *Morphnus*. Of the two remaining genera placed by M. Cuvier in the aquiline group, *Cymindis*, as we shall presently show, has no connection with it, even if its organisation alone is to be considered; while, if the *Asturina* of M. Vieillot, which we have not personally examined, is really an eagle, it must be a very aberrant one, *possibly* representing *Cymindis* and *Aviceda*.

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(249.) Following *Harpyia*, we place the subgenus *Ibycter* of Vieillot, of which the *Daptrius ater* of the same author, in our opinion, is but an aberrant species. The form and general appearance of *Ibycter* is altogether so peculiar that the genus cannot be mistaken. It is remarkable for three characters: 1. The very slight curvature of its bill (*fig.* 101.), which more resembles that of a gallinaceous bird than of an eagle; 2. The nakedness of the face, chin, and part of the throat; and, 3dly, the uncommon breadth of its large fan-shaped tail. The feet are only of moderate length; and there is no great strength in the toes and claws, at least in comparison with what we see in the more typical eagles. M. Vieillot, in fact, classes this bird provisionally with the vultures, merely because it presents "some analogy"

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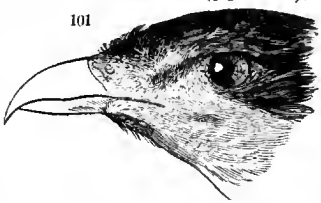
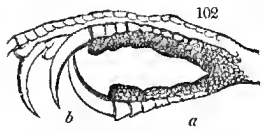


(*quelque analogie*) with those birds on account of the nakedness of its face and throat; thus investing analogy with the same meaning as affinity. . Its whole structure, indeed, shows that it has very few of the raptorial characters; and we accordingly find, by the relation of travellers, that it feeds as much upon fruits and seeds, as upon insects and small reptiles.

(250.) The types we have now retained in the Aquiline circle are four; viz. *Pandion, Harpyia, Aquila,* and *Ibycter*. Of these we consider the first to represent the aquatic, or fissirostral, type; the second and third are the typical and sub-typical; while every ornithologist must perceive in the relation we have just given of *Ibycter,* that it is the representative of the gallinaceous order,—in other words, the rasorial type; while *Asturina,* as before hinted, may possibly occupy the tenuirostral station.

(251.) We enter the genus *Cymindis,* or the milvine division, by means of *Polyborus,* a South American group, so closely allied to *Ibycter* that, until we had personally examined and studied both, we were led to believe they were only modifications of the same subgenus.* There is a remarkable part of the structure in *Ibycter,* which neither M. Vieillot, who first proposed the genus, nor those who have followed him, have taken any notice of. In all the preceding types of this family we have examined, the hinder toe (with its claw) is equal in length to that which is the interior, or the difference is so very slight as scarcely to deserve mention; but in *Ibycter* this structure is not seen: the hallux, or hind toe (*fig.* 102. *a*), is considerably shorter than the other (*b*) — a further proof of this genus being the rasorial type of the aquiline circle; for every ornithologist knows that this disproportion is eminently conspicuous throughout the whole of the gal-



* Zoological Illustrations, ii. pl. i.

linaceous genera. Now this structure is carried on also to *Polyborus*, and, amid the great diversity of the species, in point of size and general appearance, although not of structure, it becomes one of its most characteristic marks. *Polyborus* is further distinguished from *Ibycter* by the curvature of the upper mandible being much the same as in the aberrant rapacious birds, by a much greater length of wing, and by the smallness of the *external* when compared with the *internal* claw: in other respects there is such a marked affinity between the two, that no link of the chain is wanting: the largest species is *Polyborus vulgaris*, which is equal in size to the goshawk. *P. ochrocephalus* (*fig.* 103.) is considerably smaller; and an apparently undescribed species from Cayenne, now before us, is scarcely larger than the kestrel. Hitherto no species of this group have been found beyond the warm latitudes of America; and probably several others are confounded among the buzzards and eagles. The typical species was long known to the older ornithologists by the name of Brazilian kite — an association which was founded in some truth; for it is by this group and *Ibycter* that the kites, generally so called, are united to the eagles. The type, however, of the milvine circle, in our opinion, is the genus *Cymindis* of Cuvier, a group of birds entirely restricted to tropical America, and of which four species are already known. A very erroneous character has been assigned to *Cymindis*, which is neither possessed by this genus or by any other in the raptorial circle with which we are acquainted: the "*tarsi*" have been termed semipalmated *, a misprint, probably, for *toes*; but in either case the

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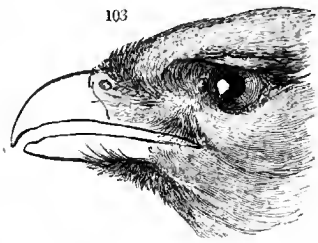

* Cymindis — Tarsi breves semipalmati. — *Zoological Journal*, vol. i. p. 337.

assertion is not correct. Of course there is no such thing as a "*semipalmated tarsus*;" but the toes of *Cymindis*, so far from possessing this character, are even destitute of that slight connecting membrane at the base of the outer toe which exists in the typical falcons, and in so many other rapacious genera. The true characters of the group are to be found in its excessively hooked bill, long wings, rounded tail, and very short feet, the structure of which, although more like to *Polyborus*, is yet so peculiar as at once to distinguish *Cymindis*, as a genus, from all others of the family. In *C. cuculoïdes* Sw. (*fig.* 104.) the tarsus is only a very little longer than the hind toe*, which is almost equal to the outer toe in total length; the inner toe is slightly longer than the hinder, and the two lateral toes, excluding their claws, are of the same length; the middle toe is shorter than in any falconine bird we have yet seen; while all the claws, except the external one, which is small, appear of the same size and breadth when viewed on their inner side. Prolix as these details may be, they are rendered necessary, since no writer has noticed them; and it is highly important to show that the genus before us has a construction of foot totally unlike any other in the entire circle of the *Falconidæ*. The semiplumed tarsus of the species just mentioned makes its legs appear still shorter; and this circumstance, with its grey and white barred plumage, gives it so much the appearance of a large cuckoo, or of a *æblepyris*, that even a professed ornithologist, upon the first glance, might easily mistake it for one of those birds if its bill was concealed. Whatever uncertainty

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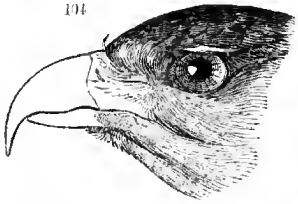

* To avoid repetition, the ornithologist will understand that when the length of any particular toe is mentioned, its claw is included; but that when the toe *only* is mentioned, it will be so expressed.

hangs, therefore, over other divisions of this family, we feel fully persuaded that *Cymindis* is the tenuirostral genus of the *Falconidæ*, a further confirmation of which, by the way, will be found in its closed nostrils, opening only by an oblique slit — a universal character among all the humming birds, no less than in the order of Waders. The affinity of *Cymindis* to *Polyborus* may be traced in the thickened bill, long wings, and short hind toe; and we shall now proceed to establish its connection with *Nauclerus*, a form justly separated by Mr. Vigors* from the other kites, and represented by that beautiful and graceful bird, the swallow or fork-tailed kite of America (*fig.* 105.) In this type many

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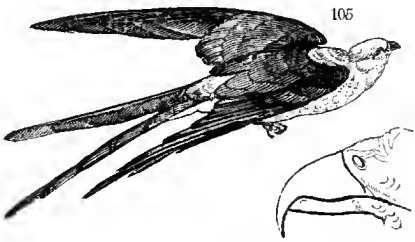

of the characters of *Cymindis* are retained; but they are combined with others very dissimilar. The bill (*fig.*106.)

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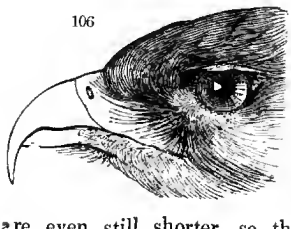


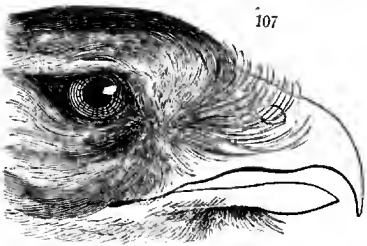
is equally hooked; but it is smaller, and there is a small half-angulated festoon in the middle of the upper mandible: the feet, and the proportionate length of the toes and of their claws, are all the same; but the legs are even still shorter, so that the hinder toe, when measured from its base, is exactly the length of the tarsus: its exclusive characters, therefore, are almost

* Zoological Journal, ii. p. 386. 28.

confined to the wings and tail: the former are of most unusual extent, having the third quill the longest, the first and second being lobed, or emarginated, on their inner margin in precisely the same manner as those of the typical falcons; while in *Cymindis*, and all the other genera excluded from the typical group, this lobe is situated at the *base*, instead of towards the point of the quills. the great powers of flight manifested by this structure are further increased by a very long and deeply forked tail. All these peculiarities, while they establish the affinity of *Nauclerus* to *Cymindis*, clearly point out the bird to be the fissirostral type of the milvine circle, and places it in immediate junction with the common fork-tailed kite of Europe. The genus *Elanus*, which clearly belongs to this generic group, is only known to us from description and a hasty inspection; we cannot, therefore, offer any opinion worth depending upon regarding its precise station: it probably, however, intervenes between the subgenera *Cymindis* and *Nauclerus;* while the very short toes of Vieillot's genus *Circætus* makes it not improbable that it is the grallatorial type. If our suspicions regarding the two last-named forms are correct, the subgenera *Polyborus, Cymindis, Elanus, Nauclerus*, and *Circætus* will then describe the milvine circle, and will fully exemplify the theory of representation: the analogies, indeed, of the first, second, and fourth are placed beyond doubt; so that, whatever modifications in the circle a more intimate knowledge of the group may occasion, we look upon these three as certain landmarks, by which the location of all other forms of the milvine group will be regulated.

(252.) We have now arrived at the BUZZARDS, the last division of the falconine family, and that which, by the series we have chosen, brings us back again to the genuine or typical falcons. If the vernacular name of this group was taken from those birds which in our opinion are typical of it, we might denominate them the Harriers, inasmuch as it is *Circus*, and not *Buteo*,

which exhibits all those distinctions by which nature has marked this group as the fissirostral type of the whole family. We shall not, however, alter a designation so well known as that of Buzzard, particularly as it does not affect the scientific nomenclature, and as the henharriers are sometimes called also by that general appellation common to the whole division. Of all the leading divisions we have now gone through, this is one of the most strongly marked in its typical characters, and the least understood in its aberrant forms. The genus *Circus* is unquestionably the pre-eminent type of the whole, while the *Buteo lagopus* appears to stand next in rank. To these, therefore, we shall first direct our attention. The peculiar habits of the henharriers forming the subgenus *Circus*, have been already sufficiently noticed, and we shall now see that their structure is no less peculiar. Independent of their slender body and very long members, under which we include both wings, feet, and tail, they may be readily known to an ordinary observer by their large ears, partially surrounded by a ruff of short and rather stiff feathers, which form a semicircle round the outer portion of the head on each side, and which meet under the chin. The bill is comparatively small, unusually elevated at the base (*fig.* 107.),



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but very narrow and feeble towards its outer half. Now these two characters, unknown in any other falconine group, are precisely those which are prevalent among the owls; and they establish the important fact, that the

buzzards not only represent those nocturnal birds, but actually unite them with the true falcons. In conformity with these double affinities we find that the tip of the bill of the harriers is lengthened and very acute, while the festoon of the upper mandible is either entirely wanting, or is so faintly indicated that it can hardly be perceived. The legs of these birds are remarkably long, and more resemble those of the sparrow-hawks than of any other group; but they have that remarkable character, so prevalent among the aberrant *Falconidæ*, of a very short hind toe, of which the claw occupies one half of the total length. The hind toe, consequently, is not slightly, but very conspicuously, shorter than either of the two lateral ones. Such is, likewise, the case in the rough-legged buzzard (*Buteo lagopus**) (*fig.* 108.), which agrees with *Circus* in its short feeble bill, in its slender body, long wings, and lengthened tail, but differs in being without the semicircular ruff round the ear, and in having the legs feathered down to the toes. Such are the most prominent characters which we view as typical of the genus before us. The common buzzard, usually taken as the type of this division, has some of the leading peculiarities of *B. lagopus*, joined with others of a more ambiguous character. Its feet, for instance, although somewhat short, are remarkably robust, and but for the shortness of the hind toe, might be taken for those of an *Aster*. The wings, however, are very long, and the tarsi, although not booted, are feathered nearly half way; so that, in the present state of our acquaintance with this group, we may leave this and one or two similarly formed species in the same subgenus as *Buteo lagopus*. In regard,

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* Northern Zoology, ii. pl. 28.

however, to several of the birds that have been placed in this particular group, we apprehend very few really belong to it. We have seen the errors that have resulted from classing these birds from mere descriptions and figures, and even from describing them before their distinguishing characters have been rightly understood; and we shall not, therefore, give a fictitious degree of perfection to our arrangement of this family by attempting to refer such little-known species to those groups to which, as we conjecture, they more naturally belong. There is one, however, the *Buteo borealis*, whose affinity to the subgenus *Aster* has already been intimated*, and which we now venture to remove from the buzzards. There is, it is true, a very strong general similarity between this bird and the *Buteo vulgaris* (*fig.* 109.);

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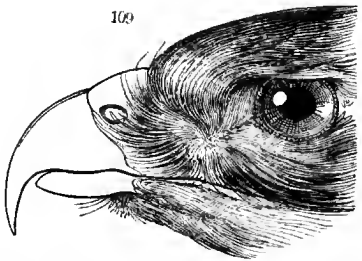

but the bill of *borealis* (*fig.* 110. *b*) is higher, more abruptly curved, and altogether partakes of the general structure of the accipitrine circle, while the well defined lobe in the middle of the upper mandible brings it, in our opinion, close to the *Aster palumbarius*. If such a bird, in short, is admitted into the genus *Buteo*, we really are totally at a loss in what manner to define either that group or *Aster*. *B. borealis*, moreover, like the majority of the asturine group, has the hinder toe and claw of nearly equal length with the inner; whereas the most universal character of the buzzards is to have the hinder toe decidedly the shortest. That most beautiful species, the

* Northern Zoology, ii. 9.

Buteo pterocles of Temminck* (*fig.* 110. *a*), has so much the character of an eagle in its lengthened and entire bill, that it probably forms the most aberrant type of either *Aquila* or *Buteo*. We have drawings and notes made from specimens sent from Mexico, but they are not sufficient to determine this, although a glance at the contour of the bill will strengthen our suspicions on the accuracy of its present location. The same uncertainty prevents us from offering any original remarks upon the honey-buzzards, made into the subgenus *Pernis* by M. Cuvier, and of which one of the two described species is found in Europe. Although the probable course of the buteonine circle cannot be traced, we place the common kite (*fig.* 111.) as the fissirostral type, for the following reasons: — It is clearly and confessedly allied to *Nauclerus* by its short feet, long wings, and forked tail; and as the equally close affinity of *Nauclerus* to *Elanus* has been justly insisted upon, the legitimate inference follows that *Nauclerus* stands at the confines

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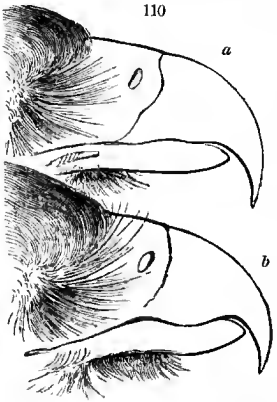


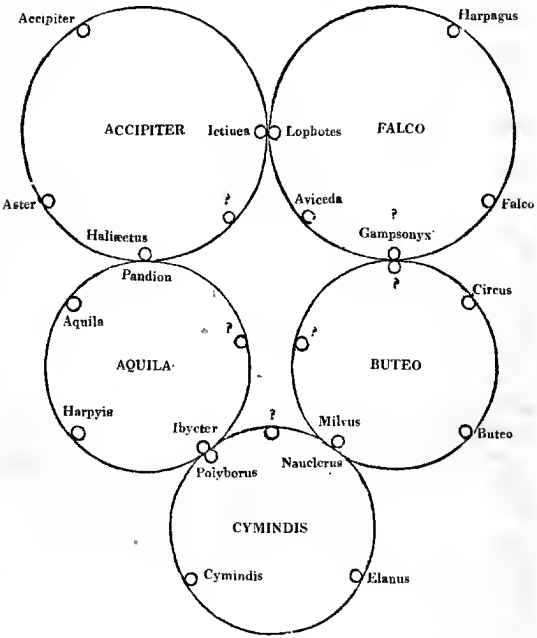
111

* It is impossible to justify this epithet upon looking to the figures intended for this species given in the *Planches Coloriées*, where it seems thick, heavy, and short-tailed, instead of slender, elegant, and long-tailed.

of the milvine circle, equally connected on one side to *Milvus*, and on the other to *Elanus*.

(253.) Collecting all we have now said upon the FALCONIDÆ into a narrow compass, we have inserted, in the following diagram, the *supposed* situation of *all* the subgenera, whose characters have been more particularly dwelt upon in the foregoing pages.

FALCONIDÆ. — *The Falcons.*



(254.) It is somewhat remarkable that of all the five types which are in every *complete* circle, that which represents the *Tenuirostres* should be the most defective, or rather the least known, in the family before us. It

will be remembered that the distinguishing character of this type, in the *Falconidæ*, is an extreme shortness of foot; and the discovery of *Aviceda*, in all other respects a perfect falcon, and its most remarkable similarity in other respects to *Cymindis*, has led us to believe that the other tenuirostral types in the genera *Accipiter*, *Aquila*, *Cymindis*, and *Buteo*, would also exhibit the same peculiarity. Hitherto, however, we have failed in meeting with any forms sufficiently approaching this structure, to authorise their insertion in these particular stations. Among those genera already proposed which we have not personally examined, our suspicions point to *Asturina* and *Circætus* of M. Vieillot, and to the *Buteo pterocles*, as likely to fill up some of these stations.

(255.) The primary object, however, which we have had in view, and which has alone tempted us, in this stage of our researches, to lay the foregoing exposition before the ornithologist, has been that of determining the types of the five great divisions of the *Falconidæ*, and of establishing their analogies with all other circular groups (through the medium of the *Insessores*) in such a way that nothing yet known should invalidate the correctness of the series. We therefore wish it to be understood that almost every thing beyond this requires additional verification. Nothing is more difficult in natural groups like this than to determine the *precise location* of any particular type; although we may have little or no doubt as to the *nature* of that type. To illustrate this remark more fully, — for it deserves the greatest attention from ornithologists, — we may instance the common kite. Now it is quite clear that this bird is of the fissirostral structure*; but whether it belongs to the circle of *Buteo* or to that of *Cymindis*, would have been a matter of very great doubt but for *Nauclerus*, a subgenus which is evidently more closely related to *Cymindis* and *Elanus* than is *Milvus*. *Nauclerus*, consequently, must be considered the fissirostral type of

* See Classification of Animals.

Cymindis. Now the only way that all these affinities can be reconciled is by supposing *Milvus* to belong to the circle of the buzzards, where it still remains, as before, a representation of the *Fissirostres, although in a different circle.*

(256.) On the location of particular types, or, in other words, of subgenera, in every department of zoology, we shall take this opportunity of stating the opinion we have formed, after many years' consideration of the subject; and, in so doing, we trust not to be called upon again for the same explanation. True it is that zoological science has certainly not reached that point which will enable us to distinguish at once a subgenus from an aberrant species. This discrimination must be the result of a much more refined analysis than naturalists of this age are accustomed to institute; but this we maintain — and we appeal for its truth to the many instances we have already cited, and the many more that yet remain to be pointed out — that every subgenus and every aberrant species exhibits sufficiently strong indications of one or other of those forms we have already defined as the PRIMARY TYPES OF THE WHOLE ANIMAL KINGDOM. We care not how strongly this theory may be combated by the weight of great names, or by the opposition of mere asserters of their own opinions. We appeal to facts; not solitary, but innumerable: and so long as these facts remain unemployed in the construction of any other natural system, so long must they remain unanswerable evidences in our favour. Whatever may be thought of our theory by the present race of zoologists, to whom it will naturally appear strange and startling, and however it may expose its author "to the obloquy and censure which are the usual portions of an original discoverer," we are well content to abide the decisions of another generation. Thus much for the theory of representation. As to the rank of all circular groups *above* genera, we think that in ornithology by far the largest portion have been fully and completely determined, while time

and research are alone necessary to give the same stability to the minor divisions. In the mean time we shall *endeavour* to make some approximation to this object by exercising our own judgment as to the rank of the subordinate types, that is, all such as exhibit those representations above alluded to; without presuming, however, to attach to our opinion that weight which further knowledge and analysis can alone impart.

(257.) The STRIGIDÆ, or OWLS, exhibit the full development of that singular ruff of close-set feathers round the head, the first indications of which are seen in the henharriers (*Circus C.*). Their nocturnal habits, their large eyes, singularly shaped ears, and soft downy plumage, are well known. This structure is admirably adapted to their peculiar economy. Great powers of sight and hearing are absolutely essential to these birds, whose habits are nocturnal, more particularly as they hunt after many small quadrupeds which only venture from their retreats after sunset. No sound in the air should tell the approach of the owls: their flight, by the peculiar construction of the wing feathers, is, therefore, rendered noiseless, and they come upon their prey silently and surely. The wings of the goatsuckers (*Caprimulgidæ*) alone, of all other birds, exhibit a similar conformation. In both these, the tips of the external bars of the outermost quill feathers, instead of lying flat upon each other, in the ordinary way, are detached and curved outwards, so as to resemble the teeth of a fine saw; hence it follows that when the air is beaten by wings so formed, there is no reverberation. The opposite extreme of this structure is seen in the gallinaceous birds, where the external barbs are very stiff, and pressed close upon each other: this formation of wing causes the air to be suddenly and abruptly expelled from beneath it, and occasions that loud whirling noise, often startling to the unprepared pedestrian, with which the partridge ascends from the ground and seeks refuge in flight. The whole structure, in fact, of the wings of the owl is evidently intended to promote a

noiseless flight: the quills themselves are unusually broad, while the barbs, no less than the general plumage, is remarkably soft and lax, in order to permit a free escape of the air in all directions. That these circumstances, however, should not diminish the powers of flight too much, the wings are generally rather long, and the four outer quills have that abrupt sinuosity on their inner webs which is so universal among the swift-flying falcons.

(258.) An exquisite sense of hearing is another peculiarity of these birds — a faculty which is essential to the discovery of their prey in the dusky hours of twilight. The great size of the head is well known, and its apparent disproportion to that of the body is rendered necessary, on account of its containing several large cavities, which communicate internally with the ears, and thus tend to the unusual development of those organs. The external orifice is, in general, enormously large, and, even in the aberrant species, generally exceeds that of ordinary birds. In the typical examples, the external opening is protected by a fleshy operculum, or lid, thickly covered on the outside with feathers, and as freely moveable as is a door on its hinges. But if the faculty of hearing is so essential to an owl, how much more so is that of sight, when it has to pursue its prey in the dark. Yet here again we trace, in a beautiful and wonderful instance, "the wisdom of God in the creation." The eyes, in the first place, are of an enormous size; but as if this were not sufficient, they are surrounded with two large concave disks — generally composed of white and shining feathers, — for the purpose of concentrating a greater extent of light to be reflected upon the eye, which is placed in the centre. There can be little doubt on this being the true use of the facial disk in owls, although the circumstance appears never yet to have been touched upon. We all know the effect upon our own sight, when, by looking through the hand, as we would a telescope, we contract the light, and are enabled to see further and much

better. It may also be remarked, that in those owls which are partly diurnal in their habits, the facial disk is small or imperfect; while in such as hunt during the day, like the snowy owl, the disk is hardly perceptible. Independent of the retractile claws which the owls possess in common with the falcons, they have the faculty, unpossessed by the latter, of bringing their external toe either backwards or forwards, in the same manner as is seen in the plantain eaters and a few of the cuckows. Their enormous head and large eyes give them a most grotesque appearance, particularly when disturbed during the day: on such occasions they bob their head up and down, and turn it about in all directions, as if they were half blind, and were endeavouring to get a clear sight of the object which annoyed them. We have frequently endeavoured to rear and tame young owls from the nest, but no efforts to accomplish the latter object were ever successful. One of the typical groups has the head ornamented with tufts of feathers, longer than the others, and which are placed above the ears. These egrets have been improperly termed horns — a term, no doubt, originating in their analogy to those processes in quadrupeds. The use, however, of these singular appendages is totally unknown. Owls, no less than hawks, are feared and hated by all the smaller birds, who shun the latter, but fear not to attack the former during the day when their retreat is discovered, as if conscious they can do so with impunity.

(259.) The natural arrangement of this group has been attempted by several of our best writers; but the task, difficult in itself, has been rendered still more so by the manner in which it has been conducted. When so much stress has been laid, in the *Règne Animal*, upon the importance of making anatomical organisation the basis of systematic divisions, we are led, from the high reputation of the author, to place implicit confidence, if not in the mode in which he combines his facts, at least in the facts themselves, more especially

when they regard points of comparative anatomy. We candidly own, that, from placing implicit reliance upon the statements of M. Cuvier, in regard to many forms in this family which we had not personally examined, and the impossibility of reconciling them to our own views, we were induced, at the time, to abandon, in utter despair, all attempts to work out the groups of this family in *Northern Zoology;* and we felt more disheartened at this failure, from perceiving that those very points of structure which we had conceived were to lay the foundation of their natural arrangement, were precisely those upon which the divisions in the *Règne Animal* were professedly grounded, namely, the form and structure of the ears, and the modifications of the facial disk. Since our former notice, however, of this family was published, we have had the means of examining very many of the forms in question, and the result has tended to show that very little reliance can be placed upon the anatomical facts relative to this family in the *Règne Animal.* To justify this opinion we shall merely state one instance out of several. The great American horned owl is placed in the genus *Otis,* all the species of which are stated to have a membranaceous operculum to the ear. On closely examining this bird, however, no such structure, as Dr. Richardson has also asserted, will be discovered; and thus we find the European and the American horned owls in two widely parted divisions. It is absolutely necessary to advert to these facts; for if errors in comparative anatomy, made by so high an authority, are passed over in silence, they will still be received as truths, unless pointedly adverted to by those who may detect them. Having stated thus much, we shall not enumerate other objections which may be urged against the existing arrangements of the family, but proceed at once to lay our own before the reader.

(260.) We have already shown that the formation of the ear, the eye, and the facial disk, are the peculiar distinctions of this family; and it follows that the

different primary groups will repose upon the greater or less development and modification of these organs. Upon this principle we find that the divisions of the *Strigidæ*, made by modern ornithologists, can all be referred to one or other of the following groups: — 1. Typical *Owls*, having the facial disk very large and complete, with large ears and (in general) an ample operculum; 2. *Horned Owls*, furnished with egrets, and a large facial disk, but having only small or moderate sized ears; and 3. *Diurnal* or *Hawk Owls*, where the conch of the ear is comparatively small, and is destitute of an operculum: the head has no egrets, and the facial disk is imperfect or obsolete. The reader will be at no loss to perceive in the first the characters of the typical group; in the second, the sub-typical; and in the third the aberrant. Let us now consider each of these separately.

(261.) The STRIGINÆ, or typical owls, are well represented by the common white species of this island. The head is uncommonly large, and the facial disk of great circumference; the extent of the latter is marked by a dense semicircle of rigid narrow feathers, forming a sort of collar, and of which the ends are turned, lying close upon each other in the manner of scales. The aperture of the ear, which is within this collar, is large, measuring in the brown owl more than an inch in length. This is protected by an operculum, which is sometimes much larger (as in *Strix flammea*) than the aperture, and sometimes nearly of the same size. These differences, however, will not be regarded at present as *generic*. Owls of this group are eminently nocturnal, and their geographic distribution, as is usual in all pre-eminent types, is very wide; the white owl, under slight variations of colour, having been found over all the temperate parts of America, in the sultry groves of India, and even in Australia. Without attempting, for the present, to arrange the sub-genera of this group in their natural order of succession *, we

* This is a task of very peculiar difficulty, for it is frequently impossible

shall, nevertheless, enumerate such of the subordinate forms as appear either to lead to, or represent, the other genera. We make it the primary distinction of the birds of this group, that two out of the three primary characters, viz. the facial disk, the operculum, and the great development of the ear, should be found in all; hence we include in it the common long and short-eared owls of Britain, as aberrant forms or subgenera, representing the rasorial or crested type of the genus. The crest, or egrets, of these two birds, indeed, would place them in an arbitrary system with the genuine horned owls; but as there *must* be a passage from one to the other, we consider that the two birds in question constitute that passage: they retain the first and strongest character of their own genus, yet they are furnished with egrets, in order that they may connect the operculated with the horned division. Leaving this, we have a third type in the *Strix Tengmalmi* of the *Northern Zoology*, to which, in all probability, we should refer the various small species of Europe (still but imperfectly known under the common name of *S. passerina*), together with those of temperate America. These latter owls are known by their small size; short feet, thickly covered with feathers to the root of the claws; and by the operculum being long and narrow, the conch forming almost a semicircle.* This, for reasons which will appear hereafter, is doubtless the tenuirostral division of the present genus, and it forms our subgenus *Scotophilus*. Hitherto we have had owls only with short, and almost even, tails; but in the gigantic *Strix cinereia*† the tail is long, cuneated, and the feathers pointed: the facial disk, as in all the pre-

to examine the ears of preserved specimens of the foreign species in museums; and, even when they are in skins, what with the carelessness of the original preserver, and the shrinking of the neighbouring parts, the investigation will always be imperfect, and sometimes faulty.

* Such is the description of *S. Tengmalmi* by Dr. Richardson in *Northern Zoology*, vol. ii., which we subsequently verified; and yet we find this very bird arranged by Cuvier in the same genus with the great snowy owl, which has hardly any disk, no operculum, and a very small conch!

† Northern Zoology, ii. pl. 31.

ceding, is full and complete, and the operculum large; but the eyes, comparatively, are very small. Looking merely to the birds we have already instanced, it would seem that *S. cinerea* holds an intermediate station between *S. Tengmalmi* and *S. stridula:* there may naturally be supposed many others intervening, but they seem all to be referable to one or other of these modifications. *S. cinerea* will therefore form the type of our subgenus *Scotiaptex:* the length and graduated shape of the tail separate it both from *Scotophilas* and *Strix;* and its station in this genus, as will presently appear, is in exact accordance with the series in which the primary divisions follow each other.

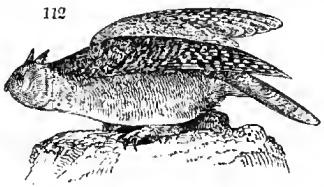
(262.) We shall retain the name of Asio to the second genus, as it is sanctioned by antiquity, and is not open to any valid objection.* Here we have the true horned owls, furnished with conspicuous egrets above the eyes, and with large disks and ears. If the assertion is true† that the great European horned owl has no operculum to the ear, this bird will stand next to that found in America (*Asio Virginiana*), and long considered as of the same species; for we know, by personal examination, that the latter is destitute of such an appendage. The facial disk is still large, but it is more or less imperfect, especially above the eyes. The grand character, however, of this division is the possession of egrets; and we therefore see this structure, in several foreign species, excessively developed. These latter birds, however, have been so loosely described, that we shall hazard no opinion on their precise situation in this circle; but there can be little doubt, judging from their published figures, that all the subgeneric types of this group exist. Two of these only, which have been personally examined, will here be noticed. The great white horned owl (*Heliaptex arcticus*‡, *fig.* 112.)

* *Noctua* has been employed by some writers to designate these owls; but this name has been already appropriated by Linnæus to an extensive group of noctural lepidopterous insects.

† Règne Animal, i. p. 343.

‡ Northern Zoology, ii. plate 32. under the name of *Bubo artica.*

evidently intervenes between the *A. Virginiana* and the *Nyctia candida*. It is, in fact, so closely connected to the latter, that, but for its egrets, both would stand in the same genus: the facial disk has now almost disappeared; the head is not much bigger, in proportion, than that of a falcon of the same dimensions; and the ears are very small. Like the great cinereous owl, which it seems to represent, its tail, although not much graduated, is longer than usual. Last of all come the little *Scops* owls, a diminutive group in point of size, but of which there are many species. We are disposed to believe that these may form a subgenus of themselves; although we cannot at present detect any very prominent character by which they are separated from their congeners. They seem to differ, indeed, from the great-horned owls above mentioned by the superior length of their legs, and by the nakedness of their toes. From the hornless passerine owls of Europe (*S. Tengmalmi*, &c.), which they seem to represent, they are at once known by the diminished size of their ears, and by their egrets; while, from the corresponding group in South America (*Nyctipetes*), they are immediately recognised by the last of these characters. For the present, therefore, we may retain the group until the whole genus is properly analysed. Several species, apparently belonging to the subgenus *Scops*, are found in South America, and one in Western Africa. For the other horned owls we can only refer the reader to their published figures. One of the most remarkably horned species is the *Asio superciliosa*; and there are several from India which have the *tarsi* or legs nearly naked.



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(263.) We now come to the aberrant group, composed, as usual, of three divisions, which we shall view as genera. Hitherto the owls of which we have spoken,

however imperfect may have been their facial disk, have nevertheless had its circumference indicated by a line of stiff scale-like feathers, more or less distinct, according to the degree in which the conch of their ears was developed. But in those which follow, even this remnant of the typical character is lost, together with all appearance of egrets, and even much of the nocturnal habits of the typical owls. Many of those, indeed, which follow, hunt as much during the day—perhaps more than they do in the night; and from this circumstance, no less than from their general physiology, they have been called hawk owls. We have already intimated that but for the egrets of the *Heliaptex arcticus* it would be a *Nyctia*, the genus to which belongs the great white owl—that "northern hunter" of the poetic Wilson. This magnificent owl at present stands alone as the representative of this type, which is distinguished by the ears being hardly larger than those of an ordinary bird, and totally unprovided with the series of stiff feathers; the feet, also, are short, and clothed with thick feathers nearly to the claws. Unlike any of the preceding, the eyebrows project like those of the true falcons; the head is small, and the habits of the bird are diurnal. These peculiarities, when combined, are quite sufficient to justify us, for the present, in placing *Nyctia* as a distinct genus. We are loath, however, to associate with this large and majestic bird a little group of South American owls, remarkable, on the other hand, for their diminutive size, but yet possessing a much closer affinity to *Nyctia* than to any other group. Among these tropical passerine owls there exists, at present, so much confusion in regard to the names of the species, that we can hardly venture to cite one, by its correct name, as an example. M. Temminck has increased this confusion so much, that, although the group is almost exclusively American, we may quote the *Nyctipetes perlatus* Sw.* of Western Africa as a type. The reader will at once perceive that

* Le Chevechette Perlé, Ois. d'Afrique, vi. 284.

the first is the typical, the second the sub-typical, and the third the aberrant group of the whole family.

(264.) The genus NYCTIPETES is placed between *Nyctia* and *Surnia*. Of these little owls we possess four species from tropical America, and are acquainted with three more: they bear such an external resemblance to the European race, represented by *S. Tengmalmi*, that all writers have failed in perceiving how truly they differ, by having very small ears, no operculum, and no indication of the marginal ruff of feathers. The want of egrets, on the other hand, separates them at once from the *Scop* owls. Their general structure, in short, is certainly very like that of the great white owl, but the legs are only feathered to the base of the toes; and these latter, except in being thinly clothed with white shining hairs, might be termed naked: the wings are also short, and reach only to the base of the tail, which is moderately long and slighted rounded. It is clear, therefore, that these birds cannot possibly be arranged with the true nocturnal, or with the horned, owls; and we are therefore led to decide that they form part of a genus, of which the burrowing owl of America (*S. cuniculata*, Mollini) is probably the type. This latter bird differs from the structure just described in having the legs much longer, more naked, and the claws less hooked; the tail is shorter and quite even. But in the more essential characters, drawn from the ears, bill, and head, it quite agrees with the little birds just mentioned; so that one species, with legs of an intermediate length, would be sufficient to complete the link of connection, and such a bird will probably be soon discovered.

(265.) The genus *Surnia* of Dumeril designates the hawk owls, represented by that of America.* These differ from the other two aberrant types in having a long wedge-shaped tail, which, with their small head and obsolete facial disk, gives them more the appearance of being hawks than any others of this family. Dr.

* *Strix funerea.* Northern Zoology, ii. p. 92., and vignette, p. 94.

Richardson, an eye-witness of the habits of the species just mentioned, remarks that in the bleak territory of Hudson's Bay, where it is very common, it is more frequently killed by the hunters than any other, from its boldness, and its habit of flying about by day. When the hunters are shooting grouse, this bird is occasionally attracted by the report of the gun, and is often bold enough, on a bird being killed, to pounce down upon it, though it may be unable, from its size, to carry it off. It is also known to hover round the fires made by the natives at night.* The African hawk owl, *Surnia Africana*, is probably another species, for it has all the aspect of the last. But the great ural owl, if truly represented in Temminck's figure (Pl. Col. 27.), has a very large facial disk and long cuneated tail, precisely agreeing with the sub-genus *Scotiaptex*: so that the very error of its classification with the two former is a collateral proof that the series we have now traced is natural.

(266.) Upon condensing the foregoing remarks, and divesting them of scientific technicalities, we find a gradual progression from the great-eared to the horned owls, by such birds as *S. bracheotus* and *otus*, which unite in themselves the characters of the two genera *Strix* and *Asio*. The diurnal flight of the *Heliaptex articus*, and its whole appearance, show that the great white owl follows next. The little passerine owls of the tropics, with the burrowing species of America, which is probably the grallatorial type, form the genus *Nyctipetes*, and are obviously intermediate between the white or eagle and the hawk owls. These latter, it will be remembered, have unusually long tails, but no facial disk; and *Scotiuptex* possesses the first, but not the second, of these characters. The long-tailed owls are thus brought together; at the same time that no affinity in the series is deranged or interrupted. M. Cuvier, by not following up his own theory on the structure of the ear, places the ural and the hawk owl in the same genus; thus confessing their similarity, and showing

* Northern Zoology, ii. p. 92.

that at least they follow each other. The circular series cannot be closed more perfectly; and thus we have an additional proof that the very errors of such men, if rightly used, will often afford instruction.

(267.) In now attempting to trace the natural series of this group, the most difficult, and certainly one of the most confused, in the whole range of ornithology, we wish to be understood as confining our exposition to the primary divisions and genera only, without at all attempting to designate other types of form than those already enumerated. We have been constrained to show how little dependence the ornithologist engaged in this task can place in books; so that nothing but a personal examination of a large number of the foreign species will enable him to fill up those blanks he will still perceive in the series. We have been obliged, also, even in this preparatory arrangement, to reject the genera *Noctua*, *Bubo*, and *Ulula*; and we still hesitate in admitting *Syrnium*, uncertain at present whether the brown owl of Britain is really one of the types of the genus *Strix*. On the other hand, it has been absolutely necessary to designate the groups here named *Scotiaptex*, *Scotophilus*, *Heliaptex*, and *Nyctipetes*; the characters of which, moreover, have this advantage, that they are drawn both from internal organisation and external aspect. The characters of the five genera will now be concentrated in the following table of the entire family.

STRIGIDÆ — *The Owls.*

		Genera.
1. *Typical Group.*	Ears large, operculated; no egrets.	STRIX.
2. *Sub-typical.*	Ears smaller, no operculum; egrets.	ASIO.
3. *Aberrant.*	Ears small; no egrets or operculum; disk imperfect.	
	Head small; claws feathered; tail short.	NYCTEA.
	Head large; claws naked; tail moderate.	NYCTIPETES.
	Head small; claws feathered; tail wedged.	SURNIA.

(268.) We know too little, both of the scientific and of the natural history of the birds composing these groups, to admit of their analogies being traced among other families, at least with that precision which is desirable. Nevertheless there are not wanting indications sufficiently

strong to show that such analogies really do exist, and that they follow in a uniform and natural series. Thus the lengthened and more conic bill of the barn owl reminds us of the *Conirostres;* on the other hand, the bill of *Asio Virginia* is described by Dr. Richardson as "very strong, curved from the base, and with its cutting margin very obtusely lobed in the middle," a structure peculiarly belonging to dentirostral types. The short tail and the piscatorial habits of the *Nyctea candida* sufficiently designate the aquatic type. The long-legged burrowing owl obviously represents the grallatorial order of birds, and the gliriform quadrupeds; but whether it is the type of *Nyctipetes,* or one of its subgenera, we know not: while in the long-tailed hawk owls of the genus *Surnia,* we trace that great development of tail so conspicuous in rasorial types. This, it will be remembered, is precisely the order of the primary types in the class of birds; so that if such an accordance can be made out from the very few species that have yet been thoroughly examined, how much more perfect, may we suppose, will these analogies become, when the whole are better understood, both as to structure and manners, than they are at present.

(269) It will be observed that the only one of the genera whose subordinate types we have ventured to designate, is that of *Strix.* Let us now look to this more closely; first, as to its circular nature, and then to its subgenera. The *Strix flammea* (*fig.* 113.) is unquestionably the type of this group, for the circumference of its head is greater than that of the body, while the facial disk, with the ear and its operculum, are all proportionably large. It must not be forgotten, also, that as this bird represents the insessorial or

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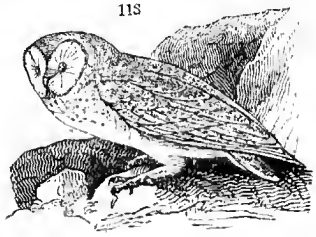

perching order, its powers of grasping ought to be more than ordinary; we consequently find that one of the claws is serrated, to give the bird a firmer grasp than it otherwise would have. But this is not all: as the consequence of its analogy to the *Insessores*, and through them to the *Conirostres*, we get at the true value of a remark of M. Cuvier, that in this bird, and its allies, the "elongated beak bends only towards the end, while in all the other subgenera it is arched from the point."* Now this is precisely the character which separates the conirostral birds from the dentirostral. We have before expressed our hesitation in admitting the brown or wood owl of Britain, forming the genus *Syrnium* of Savigny, to be a distinct type. It certainly differs in its ears from the barn owl; but it has not sufficient of the dentirostral form to make us feel sure of its representing that type: the question must therefore, for the present, be left undecided. Less doubt hangs over the subgenus *Otis*, where the egrets first begin to show themselves in the short-eared, and are fully developed in the long-eared owls of Britain; both, however, by their ears, preserve the typical character. There is a remarkable trait in the natural history of *Otis brachyotos*, which deserves attention; for although *nocturnal*, it seems to be also *diurnal*, and hunts during the middle of the day †, like the *Nyctia candida*, just as well as it does in the night. The superior length of its wings, more pointed than any in this genus, would seem to indicate that it is, probably, like *Nyctia*, a fissirostral type. Next to this group we have the little passerine owls of Europe, forming the new subgenus *Scotophilus*; they are strictly nocturnal, and are known at once by their short, thick, well-covered tarsi and toes, and their small yet complete facial disk. Lastly, come the great species of *Scotiaptex*, conspicuous by their long cuneated tails and large size. Some of these, as *S. cinerea* ‡, are nocturnal; but — as they pass

* Griffith's Cuvier, i. p. 74.
† Bewick.
‡ Northern Zoology, ii. plate 31.

into the hawk owls — others, like the *S. uralensis*, are diurnal. Both, however, have the large facial disk which gives such a peculiar character to the genus before us. Disposing these types in the order we have noticed them, we shall find they represent the contents of the whole family in the following manner :—

GENUS STRIX.

1. Subgenera.	*Analogical Characters.*	2. Genera of the Family.	3. Orders of Birds.
Strix.	Facial disk very large; great power of grasping.	*Strix.*	INSESSORES.
——?	——	*Asio.*	RAPTORES.
Otis.	Nocturnal and diurnal; wings long.	*Nyctia.*	NATATORES.
Scotophilus.	Size small; nostrils tumid.	*Nyctipetes.*	GRALLATORES.
Scotiaptex.	Size very large; tail long.	*Surnia.*	RASORES.

(270.) The *direct* analogies of the subgenera to the *orders* of birds are too obscure, in our present state of knowledge, to claim distinct consideration; and yet, when viewed through the medium of the *genera* of the family, there is nothing to militate against the above comparison. We have already seen how well the two last columns represent each other, and that the first and the second have likewise a close analogy, notwithstanding the uncertainty that hangs over one of the subgenera. The truth, however, of the above arrangement of the restricted genus *Strix* mainly, if not exclusively, reposes on the different structures possessed by the minor divisions, and by their close affinity to each other. Until greater experience and more profound study force conviction upon the minds of certain zoologists on the subject of analogical resemblances, we would wish them to look upon this, and all other of our groups, without any reference whatever to their analogies, real or supposed. We will relinquish — to fall in with their humour — all the importance which we consider belongs to such relations, and *rest our arrangement on the mere fact of close affinity :* nay, more, we will even admit that a truly natural circle of affinity can be demonstrated, without the aid of calling

in its analogies; for this *may* be done by simply showing that no animal yet known that is excluded *from* the group has an affinity with the type equal to any of those that are brought *within* the group. Our doctrine of analogies may thus, to use a colloquial expression, be thrown overboard, and yet our group will remain just as natural as it was, if the chain of affinity has been truly and strictly followed.

CHAP. II.

GENERAL REMARKS ON THE INSESSORIAL OR PERCHING ORDER. — PRIMARY DIVISIONS. — CHARACTERS AND ANALOGIES OF THE DENTIROSTRAL TRIBE.

(271.) THE order INSESSORES, composed of the PERCHING BIRDS, is the most numerous, and the most varied, in the whole circle of ornithology. It comprises, as before stated, all those tribes and families which (without being rapacious) live habitually among trees, or at least have nothing in their structure to show they are in the least degree aquatic. Their foot, in short, as the name denotes, is especially formed for grasping or perching; a peculiarity evinced by the situation of the hinder toe, which is invariably placed upon the same level, or plane, as those in front. Their number is generally four; either placed, as in ordinary birds, three forwards and one backwards, or, as in the scansorial tribe, two in front and two behind. The length of the tarsus or shank is always moderate, and generally very short in comparison to what is seen in the other orders; and, as these birds never seize their prey by the claws, these weapons are never retractile. The perchers are thus distinguished from the birds of prey, properly so called; while the situation of the hind toe separates them

at once from the gallinaceous, the wading, and the swimming orders.

(272.) The most absolute peculiarities of the order before us are those we have just stated; but there are some others to be mentioned of a secondary nature, inasmuch as they are not without several exceptions. Thus a few of them, like the shrikes, possess a strong tooth in the upper mandible, similar to that of the hawks; while many more, as in the finch family, have not the slightest vestige of this process. The most prevalent construction of the bill is, nevertheless, to have this member more or less notched, a structure which enables these birds to take a firm hold of their food, although without the power of tearing it in pieces by their bill. They are likewise the most highly organised in other respects, whether we view them as the most melodious songsters, the most expert architects, or the most resplendent in their colours, of the whole feathered creation.

(273.) The LEADING DIVISIONS of this order are so obvious that every ornithologist, unprejudiced by the authority of artificial systems, cannot fail to perceive them. The *Dentirostres*, *Conirostres*, *Scansores*, *Tenuirostres*, and *Fissirostres*, are so many prominent groups, which have long been known and recognised by all the moderns; and they have accordingly been cited, with justice, to illustrate the circular disposition of the entire order.* So far, therefore, as regards the admission of these groups, nothing more need be urged, since they are now universally adopted. This unanimity, however, amongst ornithologists merely extends to the typical forms: all agree, for instance, in classing the woodpeckers and parrots as climbing birds; but, because the scansorial structure is exhibited under a different form in the *Grimpereaux* of M. Cuvier, or the tree-creepers, we find these birds occupying a station in the *Règne Animal* with the *Tenuirostres*. Even this latter tribe, by some authors, is made to embrace every bird sus-

* See Linnæan Transactions, vol. xiv. p. 346.

pected of having a suctorial tongue, however strongly it may be allied, in all other parts of its organisation, with groups far differently situated. When, therefore, it is said that the five tribes above mentioned have been universally admitted, it is necessary to premise that no two writers have yet agreed on their definite nature. Hence it becomes advisable, before proceeding further, to state our views of their prominent or typical distinctions.

(274.) The PRIMARY CIRCLES of the order before us appear to be three. The first composed of those families where the bill is very conspicuously notched, and the food almost exclusively derived from insects; these are the DENTIROSTRES. The second includes such as have the notch much slighter, and who feed almost indiscriminately both upon animal and vegetable substances; these are the CONIROSTRES, the bill being more conic than the latter: but in both tribes the feet are the same; that is, the tarsus is not uniformly short, and there are three toes before and one behind. The third circle is composed of the CURTIPEDES; differing materially from the two former in having the tarsus much shorter, the notch of the bill either obsolete or altogether wanting, and the position of the toes variable. Under this last group, which is the aberrant division, we include the three tribes of *Scansores*, *Tenuirostres*, and *Fissirostres*. Preliminary remarks will be given upon each of the foregoing tribes as they come successively under our elucidation; but, that the student may have a general idea of their nature, we shall here designate their chief peculiarities, and the different families of birds they respectively contain.

(275.) The DENTIROSTRES, as the name implies, is distinguished by a distinctly notched bill, and by being the greatest destroyers of insects among the perchers: with very few exceptions, they either live entirely upon insects, or only resort to fruit when deprived of their favourite nourishment. In accordance with these habits, the mouth, or *rictus*, is defended on each side by bristles,

the feet are generally adapted more for perching than for walking, and the notch of the upper mandible is very rarely obsolete. At the head of this tribe stand the family of shrikes (*Laniadæ*), which is followed by those of the thrushes (*Merulidæ*), and the warblers (*Sylviadæ*): these latter pass into the chatterers (*Ampelidæ*), which, from their frugivorous diet and general structure, are the farthest removed from the type of their circle. In the last family, however, composed of the flycatchers (*Muscicapidæ*), the insectivorous habits and structure are again resumed; and these birds finally blend into the shrikes, by means of the tyrant flycatchers of America. It need hardly be observed that this is the subtypical tribe of the order before us; it is analogous to the true rapacious birds, and represents them in the circle of *Insessores*.

(276.) The CONIROSTRES are pre-eminently the typical assemblage of the whole order: their organisation is more perfect, or, rather, their faculties are more varied. They feed indiscriminately both upon insects and vegetables, and are therefore termed omnivorous. Their feet are so constructed that they can walk upon the ground with nearly the same facility as they perch upon branches — a double faculty which is rarely found in the last tribe, where the outer and middle toes are often connected at their base. The bill is thicker, more conic, and the notch of the upper mandible very slight: the tip, also, is still more rarely hooked; the mouth is not defended by rigid bristles, as none of these birds, like so many of the *Dentirostres*, seize their food upon the wing. Finally, they include the largest and the most powerful birds of the whole order. The families included in this tribe are the crows (*Corvidæ*), the starlings (*Sturnidæ*), the finches (*Fringillidæ*), the plantain-eaters (*Musophagidæ*), and the hornbills (*Buceridæ*). These, collectively, form a circular group, representing, by the great and varied powers of their foot, the order *Quadrumana* among quadrupeds, at the

same time that they represent the perfection of the class of Birds.

(277.) The Curtipedes, as their name expresses, are an assemblage of short-footed families, much diversified in general structure; but having the toes so arranged as not to admit of their being habitually employed in walking. The situation of the toes is either similar to those of the ordinary perchers, or in pairs; in some few there are only three, and there are not wanting instances (as in the colies and swifts) where all the four toes are placed forward. These minor differences, joined to others which will be subsequently mentioned, serve to characterise the three aberrant tribes composing the primary group; namely, 1. The *Scansores*; 2. The *Tenuirostres*; and 3. The *Fissirostres*.

(278.) The Scansores are composed entirely of those families which habitually and invariably climb among trees; and, in consequence of this habit, have their feet peculiarly constructed for the purpose. Sometimes the toes are placed in pairs; that is, two before and two behind: sometimes one of the outer toes is nearly versatile, so that it can be almost brought forward, while in others the three anterior toes are in the ordinary direction; but in all these variations the hinder toe is remarkably developed, as in the nuthatch and creeper, for the obvious purpose of giving support to the body: the tarsus is always very short, and none of these birds possess either the conic bill or the terrestrial habits of the last tribe. The woodpeckers (*Picidæ*), the parrots (*Psittacidæ*), the toucans (*Ramphastidæ*), the cuckows (*Cuculidæ*), and the creepers (*Certhiadæ*), are the several families under which the whole of the scansorial, or climbing birds, are naturally arranged.

(279.) The Tenuirostres, or suctorial tribe, includes the smallest and the most brilliant birds in creation. Unlike all others, they possess a long retractile tongue, divided into slender filaments, with which they lick the nectar of flowers. Many of them still retain something of the scansorial structure of the last tribe, particularly

the honeysuckers of New Holland, and the paradise birds, both of which have the hind toe considerably developed; and all of them, at certain seasons, have recourse to an insectivorous diet. The humming birds lick up the minute and tender insects found in blossoms; and the honeysuckers (*Meliphagidæ*) devour both fruits and insects. The bill of the tenuirostral families is generally very long and slender, while the nostrils resemble a lengthened slit: they consist of the humming birds (*Trochilidæ*), the sun birds (*Cinnyridæ*), the honeysuckers (*Meliphagidæ*), the paradise birds (*Paradisidæ*), and the hoopoes (*Promeropidæ*).

(280.) The Fissirostres, or swallow tribe, like those birds which constitute the type of the whole, are eminently distinguished by great breadth of bill, an enormous gape, small and weak feet, and the incapacity of habitually walking, or wandering among trees. They live entirely upon insects, or other small animals, which are seized during the flight of the bird; so that the feet are mere instruments for resting and supporting the body. The representations of this type in other tribes have all the foregoing characters *except the last:* great weakness of foot being the grand characteristic of this group. The goatsuckers, or nightjars (*Caprimulgidæ*), the swallows (*Hirundinidæ*), the bee-eaters (*Meropidæ*), the kingfishers (*Halcyonidæ*), and the trogons (*Trogonidæ*), exhibit all these characters, although under different modifications; and, by uniting with the flycatchers among the *Dentirostres* — the first tribe with which we commenced this rapid survey — complete the circle of the whole order.

(281.) Having now enabled the reader to form a comprehensive idea of the different tribes composing the insessorial or perching order, we shall condense their chief distinctions into a tabular form; for the purpose of showing in what manner they represent the primary divisions of this class of animals, no less than those of the quadruped class.

CIRCLE OF THE ORDER INSESSORES, *or Perchers.*

1. *Typical Circle.*	Bill more or less conic, strong, slightly, or not at all notched; mouth without bristles; feet robust, formed both for perching and walking. Omnivorous.		Conirostres.
2. *Subtypical Circle.*	Bill shorter and more compressed, with a distinct tooth-like notch; mouth generally defended by bristles. Insectivorous.		Dentirostres.
3. *Aberrant Circle.*	Bill entire; feet very short, not adapted for walking; position of the toes various.		Curtipedes.
	1. Feet formed for climbing.	*Scansores.*	
	2. Bill long; tongue extensile. Sub-torial.	*Tenuirostres.*	
	3. Bill broad at the base. Feed upon the wing.	*Fissirostres.*	

This table is drawn up in conformity with our second proposition — already so fully explained * — that the primary divisions of every circular group are five, *apparently;* but three, *actually.* In the present instance, more than perhaps in any other, this union of the three aberrant groups is demonstrated by the genus *Prionites* in the *Fissirostres*, and the *Ramphastidæ* in the *Scansores;* the details of which will be given in their proper place.

(282.) The leading groups of the *Insessores* have been so repeatedly and so fully demonstrated as representatives of the primary orders of birds, by some of our best naturalists, that very little need be said upon the subject; the nature of our present volume, however, requires that it should not be passed over in silence, although the analogy, under a different form, has been illustrated in a prior treatise. We shall, on this occasion, place the tribes of the *Insessores* in one column, and the orders of birds in another; when it will be perceived that the analogical characters are mutually descriptive of some of the leading distinctions of each.†

* Classification of Animals, pp. 226—229.
† Ibid. p. 231.

Tribes of the Insessores.	*Analogical Characters.*	Orders of Birds.
Conirostres.	Superior powers of prehension, as shown in the structure of the foot; notch of the bill small. Omnivorous.	Insessores.
Dentirostres.	Bill short, much curved at the tip, which is distinctly notched. Rapacious, and feed on animal substances.	Raptores.
Fissirostres.	Head large; mouth very wide; feet small; the toes more or less confined. Seize their prey during flight, which is very quick.	Natatores.
Tenuirostres.	Bill very long, slender, and slightly flexible; mouth very small.	Grallatores.
Scansores.	Bill short, thick, hard; head conspicuously crested; feet very robust; head small. Remarkably docile.	Rasores.

(283.) Let us now compare each of these groups more particularly with that which stands opposite to it. First, then, we have the *Conirostres* as analogous to the *Insessores*, an analogy which becomes indisputable, seeing that the first is the pre-eminent type, or representative, of the insessorial order. The *Dentirostres* and the *Raptores* have the strongest-toothed bills, a necessary consequence of both being the most rapacious birds in their respective groups; and every one knows that the shrikes are the falcons of the insect world, just as much as the *Raptores* are the devourers of the feathered creation. The most imperfect footed birds among the perchers belong to the *Fissirostres;* and this is precisely the leading distinction of the swimming, or natatorial, order. The humming-birds, typical of the *Tenuirostres*, have the longest and most flexible bills among their congeners; just as are the snipes, woodcocks, and sandpipers, among the *Grallatores*. Finally, the *Scansores* (and their representatives) are almost the only crested birds in the whole order of perchers: they have the tail, in one form or other, highly developed; and they contain those which show the greatest aptitude for domestication. All these characters and traits are well known to be the leading distinctions of the order *Rasores*. In one group we have the whole of the parrots, and the beautifully-crested woodpeckers; in the

other, the whole of our domestic poultry: how can relations of analogy be more complete than these?

(284.) Our proposition is, that this circle of the *Insessores* will be verified by its internal affinities, independent of any support from the analogies we are now bringing forward. But to substantiate what has been said, and said most truly, that "a natural group will stand any test," we shall now compare this with the corresponding divisions in the class of quadrupeds as a collateral evidence of its correctness, and in support of the remark we have quoted.

Orders of Birds.	Tribes of the Insessores.	*Analogical Characters.*	Orders of the Mammalia.
INSESSORES.	*Conirostres.*	Pre-eminent in their powers of prehension, and in general organisation; claws or nails not acute.	QUADRUMANA.
RAPTORES.	*Dentirostres.*	Rapacious, feeding upon other animals; claws acute.	FERÆ.
NATATORES.	*Fissirostres.*	Head very large; feet obsolete, or short and imperfect; habits aquatic.	CETACEA.
GRALLATORES.	*Tenuirostres.*	Size diminutive; upper jaw or mandible prolonged; run or fly very fast; eyes placed back in the head.	GLIRES.
RASORES.	*Scansores.*	Size large; head small; ornamented with appendages; granivorous or herbivorous; habits remarkably docile.	UNGULATA.

(285.) Before we make any observations upon this table, we shall take occasion to introduce some remarks upon analogies in general, arising from the degrees of this relation observed in the above table. Those between the *Insessores* and the *Mammalia* are of course more remote than between the groups in the two first columns, for the best and most obvious reason,—that, as the animals themselves are more remote from each other in general confirmation, so must their analogies be equally remote. It would be strange, indeed, were it not so; and yet so little do some writers appear to exercise their reason on this subject, that they actually bring

forward the remoteness of some of the analogies we have already instanced, as a reason for not believing in their universality! If, as every one knows, there are different degrees of affinity in the animal kingdom, it follows as a necessary consequence of this fact (which no one will ever dream of denying), that there *must* be corresponding differences in the degrees of analogy. The analogy between the swan and the ostrich is one degree, that between the ostrich and the giraffe is another, while the analogy between the bee and the weaving birds (*Ploceanæ*) is another; and yet this latter, however remote, or however incomprehensible to amateur naturalists, is founded on as sure and on as demonstrable evidence as the analogy of the hawk to the shrike, or eagle to the lion. Such persons seem to forget that remote analogies can only be made out, or in fact understood, by tracing them through the various groups which intervene between those that are compared. It is like a man looking to the last and the first link of a graduated chain; and because these links differ so widely in size, stoutly maintaining that they cannot possibly belong to the same series; although, when he sees the intermediate portion, he is obliged to confess his error. To urge, therefore, that, — because of their remoteness, some analogies are too obscure to be easily understood, — the theory itself is objectionable, is to say that affinities must not be believed, because they do not all possess the same degree of resemblance.

(286.) The analogies of the insessorial tribes with the orders of quadrupeds, as shown in the foregoing table, will fully illustrate the principle maintained in the last paragraph. To a naturalist, unacquainted with the details of *both* classes, they will appear not only remote, but fanciful. "What can more clearly show the infatuation of theory," it may be argued, "when it is supported by the assertion, that a woodpecker is analogous to a cow!" Such reasoning, addressed to ordinary persons, will be quite sufficient to settle the question; and yet, upon looking a little farther into the matter,

the assertion would wear every probability of being, in one sense, strictly correct. The ruminating order of quadrupeds (*Ungulata*) is not only perfectly analogous to the rasorial birds, but it is here that these two classes evince the greatest propensity to pass into each other.* Now the climbers (*Scansores*) are almost as much related to the gallinaceous birds as these latter are to the ungulated quadrupeds, because the *Scansores* pass into the *Rasores*, and the *Rasores* of all birds are those which notoriously open the passage to quadrupeds; and thus a scansorial bird actually becomes analogous to a ruminating quadruped. The analogy, from the necessity of the case, must be remote; but, by means of the intervening links, it becomes established just as perfectly as if it was more immediate. Having already illustrated the relations of these two circles, in another place†, we shall now merely glance at their most prominent features. The *Quadrumana* are the most perfect of all quadrupeds, as the *Conirostres* are of all the insessorial birds. The *Dentirostres* and the *Feræ* are the most rapacious; the *Fissirostres*, although not aquatic (like the *Natatores*), have, nevertheless, the weakest and the most imperfect feet among the perchers. This is precisely the character of the *Cetacea* among quadrupeds; while, by comparing these two groups through the medium of the *Natatores*, the chain of resemblance is still more perfect. The analogy between the *Tenuirostres* and the *Glires*, as being the *most* aberrant groups in each column, are consequently the most remote; while that of the *Scansores* and the *Ungulata* has already been noticed.

(287.) Having now sufficiently marked out the characters and relations of the insessorial tribes, we shall proceed to illustrate each of them more fully in succession. The *Dentirostres*, by most writers, are usually commenced upon, from their obvious resemblance to the falcons; and having adopted this mode upon a former

* The horse, the camel, &c. are in one; the ostrich, emu, &c. in the other.

† Classification of Quadrupeds.

occasion,* we shall do so on this. It is a matter, however, of little importance, at what point the investigation of a circular group is commenced; nor is there occasion to adhere implicitly to any fixed rule on the subject, provided that the subordinate groups are treated of in the same series as they are observed to follow each other in nature.

(288.) Our survey of the Insessorial Order thus commences with the DENTIROSTRES, or *rapacious tribe*, whose prominent characters we have just noticed. The families of which this group is composed, with but one exception†, live almost exclusively upon insects, to secure which their bill is furnished with a distinct notch near the tip, assuming in the typical families the form of a prominent tooth. As a farther provision for procuring such sustenance, the angles of the mouth are more or less defended by stiff bristles, the legs are less robust than those of the typical perchers, and the claws are more acute. The bill is of various shapes in the different families. In the shrikes it is compressed; while in the flycatchers, which lead immediately to the swallow tribe (*Fissirostres*), it is much depressed, and the feet begin to be very small.

(289.) In detailing the characters of any comprehensive natural group, our attention must always be fixed more especially upon the typical examples of that group, and the characters it exhibits; for, as the minor divisions branch off to the right and the left, and blend into *other* groups, it necessarily follows that these aberrant divisions lose many of the prominent features of their own type, and assume others more properly belonging to the next group. When, therefore, we say that the tribe before us is characterised by a strongly-toothed bill, by acute claws, &c., we speak only of its typical examples; — the intelligent naturalist understanding that there are not only many exceptions, but that he will

* Northern Zoology, vol. ii.

† The *Ampelidæ*, or berry-eaters, the types of which live more upon fruits.

find in *every* group, whether large or small, these aberrant divisions, or forms, which represent the other primary types of nature. How completely this law is verified in the circle before us will presently appear. Now it is upon the analysis we shall ultimately give of this tribe that we wish the accuracy of our whole arrangement of the feathered creation to repose. All the details regarding their internal affinities must, of necessity, be included in our systematic arrangement of birds, intended for the second volume; but the analogies *resulting from this analysis* are so highly interesting, and, at the same time, so demonstrative of the propositions stated in a former volume on the laws of natural classification*, that they must carry conviction to the mind of every naturalist who is at the trouble of investigating the facts upon which they are founded.

(290.) Analogical relations of a group are not, as some writers suppose, the *cause*, but the *effect*, of its natural arrangement. The clue of affinity is *first* sought for, and then, and not till then, do we seek for a uniform law of variation in its analogies. It would, therefore, be better, perhaps, had we began with giving the affinities of our groups in the first instance, and then have proceeded to show what analogical results could be drawn from them: the cause would then precede the effect. On the other hand, it may be said that, by stating the analogies in the *first* instance, we are, in fact, stating only so many propositions, the correctness of which is subsequently to be made good by the process of analysing affinities. It was under this last point of view that we acted upon the plan we shall now continue; that is, of stating the analogies in the *first* instance, and the affinities afterwards; although it is obvious that the former could never have been attained, without the latter had been first studied. In first instituting a most extensive comparison of the *Dentirostres* with the other tribes included in this order, we shall have occasion to notice many groups, whose details will be entered upon after

* Classification of Animals.

wards. This plan is subject to some inconveniences; but, upon the whole, it will give the general reader a popular insight into their chief peculiarities, and in some measure prepare him for the details, which will follow in their proper place. All these tables, therefore, must be looked on not as proofs, but as presumptive evidences in favour of those propositions stated in a former volume; which propositions can only be made good by the chain of affinity corresponding to that of analogy. Having now explicitly stated the plan upon which we shall uniformly act, we may proceed.

(291.) We have already stated that the Dentirostral tribe consists of five families: 1. The *Laniadæ*, or shrikes; 2. The *Merulidæ*, or thrushes; 3. The *Sylviadæ*, or warblers; 4. The *Ampelidæ*, or chatterers; and 5. The *Muscicapidæ*, or flycatchers. The first is the typical, the second the subtypical, and the three last form the aberrant group. The names of these families will suggest familiar examples, known to almost every reader: we, therefore, need not, at present, enter more particularly into their characters than what is stated in the following tables, the first of which is for the purpose of comparing these families with the tribes of the *Insessores*, and also with the primary orders of birds.

Families of the the Dentirostres.	*Typical and analogical Characters.*	Tribes of the Insessores.	Orders of Birds.
1. LANIADÆ.	Pre-eminently the representatives of the tribe.	DENTIROSTRES.	RAPTORES.
2. MERULIDÆ.	Bill more lengthened, the notch smaller; feet more adapted for walking. Omnivorous.	CONIROSTRES.	INSESSORES.
3. SYLVIADÆ.	Seek their food among trees; tail feathers more or less pointed. Insectivorous.	SCANSORES.	RASORES.
4. AMPELIDÆ.	Feed chiefly upon soft vegetables; plumage very brilliant in the male; dull in the female. Moult twice annually.	TENUIROSTRES.	GRALLATORES

Families of the Dentirostres.	*Typical and analogical Characters.*	Tribes of the Insessores.	Orders of Birds.
5. MUSCICAPIDÆ.	Head large; bill depressed, furnished with strong bristles. Entirely insectivorous; feed on the wing.	FISSIROSTRES.	NATATORES.

(292.) The reader will bear in mind on this, and all subsequent occasions, that the *affinities* are expressed perpendicularly, and the analogies horizontally; in other words, that each of these three columns form a circular group. In the first column the tyrant fly-catchers unite with the tyrant shrikes; thus bringing the *Muscicapidæ* and the *Laniadæ* together. In the second column the *Fissirostres* pass into the *Dentirostres*, by means of the broad-billed *Prionites* in one, and the *Todies* in the other; while the union of the *Natatores* with the raptorial land birds is well known to be effected by those eagles of the ocean, the frigate pelicans. The affinities being now intimated, let us turn to the analogies. The *Laniadæ*, being pre-eminently typical of the *Dentirostres*, are, of course, their representatives. The thrushes (*Merulidæ*), like the conirostral birds, seek their food as much upon the ground as among trees; both have the feet, in consequence, very perfectly formed, and the bill more than usually lengthened. The typical warblers all live among trees, the ramifications of which they explore, like the scansorial tribe, in search of insects; and their tail feathers, like those of their representatives, are pointed, although in a different manner. In this part of our series, however, the analogies become less evident; and their force diminishes still farther on comparing the *Ampelidæ* with the *Tenuirostres*. Still there are sufficient resemblances, however remote, to render it probable that others might be found, did we know more of the natural economy of these groups. The typical chatterers, however, like the tenuirostral genera, have the weakest bills and the shortest feet in their respective circles: no others feed so little

upon insects; and no others change their plumage twice every year: this latter character, indeed, is one of those which assimilates both groups to the *Grallatores* much more than we formerly supposed, before we had ascertained the fact of this peculiarity being confined to tenuirostral types. Having now reached the most aberrant groups in the circles we are tracing, nature begins to return to her original types; and both the affinities and the analogies become stronger as they approach the groups standing at the head of each column. Thus every ornithologist knows how completely the *Muscicapidæ* resemble the *Fissirostres* in their small depressed bill, their slender feet, their purely insectivorous diet, and their habit of taking their prey only upon the wing. The analogy, in fact, blends into an affinity; because the *Muscicapidæ* is that division of the dentirostral tribe which passes into the fissirostral, and connects the two circles. It is wholly unnecessary to enlarge upon the analogies indicated by the third column; for, if those between the first and second are valid, it follows that those of the first and third are equally so; seeing that we have already shown in what way the tribes of the *Insessores* represent the orders of birds (282.).

(293.) Some very interesting facts will be elicited by our next comparing the dentirostral families with those of the *Conirostres*, already stated to consist of the crows (*Corvidæ*), the starlings (*Sturnidæ*), the finches (*Fringillidæ*), the plantain, or fruit-eaters (*Musophagidæ*), and the hornbills (*Buceridæ*).

Families of Dentirostres.	*Analogies.*	Families of Conirostres.
LANIADÆ.	Rapacious, feeding upon living animals.	CORVIDÆ.
MERULIDÆ.	Legs adapted both for perching and walking.	STURNIDÆ.
SYLVIADÆ.	These contain the smallest birds in their respective groups.	FRINGILLIDÆ.
AMPELIDÆ.	Live almost entirely upon fruits; feet short.	MUSOPHAGIDÆ.
MUSCICAPIDÆ.	Bills uncommonly large; toes partly united.	BUCERIDÆ.

The rapacious habits of shrikes and crows are well known; for the latter have been frequently seen to fly off with young ducks and chickens from the poultry yard, and carry them to their nest as food. This analogy is also expressed by the French name of *Pie-grêche*, long since given to the shrikes, and by the corvine shrike (*Lanius corvinus*, Shaw) having been classed by Linnæan writers, although erroneously, as a crow. When we see blackbirds (*Merulidæ*), and fieldfares (*Sturnidæ*), feeding during the autumn in the same meadow with starlings, both looking after the same kind of food, and both flocks frequently intermixed, who can doubt that one family represents the other? It will be remembered that the warblers and finches are among the smallest of all birds; their feet also are more particularly formed for active exercise among trees, while they blend into each other so imperceptibly, that many of the titlarks (*Anthus*) cannot well be distinguished from true larks. The plantain-eaters (*Musophagidæ*) perfectly resemble the fruit-eaters (*Ampelidæ*), in living only upon pulpy vegetables: both have the feet very short, and both are remarkable for their rich colours. The resemblance of the *Buceridæ*, or hornbills, to the *Muscicapidæ*, or flycatchers, is particularly curious, since we might, at first, be puzzled in discovering how two families, so very opposite in their general aspect, could yet represent each other. The hornbills, of all the conirostral birds, have the most enormous and disproportionate bills; so, in fact, have the tody flycatchers (*Eurylaimus*), since the width of their bill is often greater than that of their head: both also have the feet very short, and the two outer toes united together more than half their length. No analogy, in fact, can be more perfect; for both, by this latter peculiarity, represent the web-footed order of swimming birds (*Natatores*), and both, like the swallows, have very round nostrils.

(294.) We shall next compare this tribe with the *Scansores*, or climbing birds; to which, as they are

farther removed, we may expect their analogies to be less striking: some very curious coincidences, however, will result from the comparison.

Families of Scansores.	*Analogies.*	Families of Dentirostres.
PSITTACIDÆ.	Bill very short; distinctly toothed.	LANIADÆ.
PICIDÆ.	Bill lengthened, more conic; tail ending in sharp points.	MERULIDÆ.
CERTHIADÆ.	Bill very slender.	SYLVIADÆ.
CUCULIDÆ.	Bill and legs short; feed only upon soft substances.	AMPELIDÆ.
RAMPHASTIDÆ.	Bill enormous.	MUSCICAPIDÆ.

When we see the short and strongly-toothed bill of the shrike, reproduced, as it were, upon a parrot, we cease to wonder that the old systematists should confound affinity with analogy, and because the bills of the two birds so much resemble each other, should have placed the two groups close together, although the one is rapacious and the other frugivorous. We were long perplexed in discovering why nearly all the true thrushes (*Merulidæ*) have the ends of their tail feathers terminated by minute and delicate points; until, by instituting the comparisons we are now making, the explanation came to light. A tail, ending in very sharp points, is well known to be the pre-eminent character of the true woodpeckers; a family so very distant from the thrushes, that, but for this exquisitely beautiful bond of relationship, it would have been impossible to trace their analogy. There is, however, this difference, that the pointed feathers of the woodpecker are actually necessary to its economy, while those of the thrush are merely slender filaments projecting beyond the webs that are on each side the shaft. On looking to the *Certhiadæ*, or creepers, and the *Sylviadæ*, or warblers, innumerable points of strong analogy present themselves: these, as usual, have been mistaken for affinities; so that, to this day, there is scarcely an ornithologist who has not mistaken one for the other. The common gold crest (*Sylvia regulus*) climbs among trees, and is not only called a wren by the vulgar, but is placed in the same family with the

true wren (*Troglodytes Europæus*) by all writers; while others consider they actually belong to the same genus! No analogy can be stronger; yet it has already been demonstrated that this is no true affinity; one being a fly-catching warbler, the other a warbling creeper. We ourselves have not been exempt from error in this matter; since, on defining the subgenus *Oxyglossus**, some years ago (not being aware it had previously received the name of *Mniotilta*), we placed it among the scansorial creepers, although its true station is now proved to be with the warblers.† The cuckows (*Cuculidæ*), and the chatterers (*Ampelidæ*), which are the next parallel families, imitate each other in the soft and juicy nature of their food, which they are both enabled to swallow whole, by the great width of their mouth. The enormous size of the bill in the toucans (*Ramphastidæ*) gives us another remarkable analogy to the todies (*Eurylaimus*), whose bills are equally disproportionate for the size of the head; and this is rendered even more striking by the bill of *Eurylaimus corydon* Tem., having indications of that toothed margin common to the toucans.

(295.) Let us next bring this tribe into comparison with that of the Suctorial birds (*Tenuirostres* Sw.), for, dissimilar as they are, we shall yet find a distant, although very definite, relation between them.

Families of Tenuirostres.	*Analogics.*	Families of Dentirostres.
TROCHILIDÆ.	Gonys, or outer half of the under mandible thick and ascending; claws sharp and slender.	LANIADÆ.
CINNYRIDÆ.	Gonys not ascending; legs and claws stouter and more obtuse.	MERULIDÆ.
MELIPHAGIDÆ.	Bill slender, notched; feet of moderate length, very perfect; toes disunited	SYLVIADÆ.
PARADISIDÆ.	Bill stout: feet short, strong; hind toe nearly as long as the tarsus; toes disunited.	AMPELIDÆ.
PROMEROPIDÆ.	Feet short; toes much united.	MUSCICAPIDÆ.

Where two tribes, like these, are so very remote in affinity, it will always happen, as may naturally be

* We have since transferred this name to a genus of tree creepers.

† Northern Zoology, vol. ii. p. 205.

supposed, that the typical families will bear a much fainter analogy to each other, than what will be found between the aberrant groups. Thus, upon looking to a shrike and a humming-bird, we can only be surprised that there actually is that agreement in the bill which we have just noticed. There is also, towards the end of the upper mandible of a humming-bird's bill, a peculiarity which shows us the very first development of a tooth: the sides are suddenly turned inward, and thus a slight angle is formed exactly at that part of the margin where the real toothed process of the shrike appears (*fig.* 1. *a*). This structure is not seen in the *Cinnyridæ*, the types of which, moreover, have the *gonys*, or under edge of the lower mandible, either straight or bent downwards, like the generality of birds, but never *upwards*, as in shrikes and humming-birds. The resemblance, also, in point of colour, between the lineated ant-thrushes (*Pitta*), and some of the African sun birds (*Cinnyris*) holds good in the present instance. It is no less curious than true, that the humming-bird, if we consider its diminutive size, is even more bold and courageous than a shrike: it not only attacks others of its own tribe, with the greatest fierceness, but all small birds who presume to alight upon its favourite feeding tree. This trait in its character we have repeatedly witnessed. From the very fine and acute structure of its claws, we may naturally suppose they are used in these battles as offensive weapons, since the bill is obviously too weak. If this latter fact was ascertained, these two opposite genera would possess a habit unknown to all others of their respective tribes. The similarity between the warblers (*Sylviadæ*), and the honeysuckers of New Holland (*Meliphagidæ*), is much stronger than would at first be imagined: and we accordingly find that authors have blended them together. To this day we have the worm-eating warblers (*Vermivora*), confounded with the genus *Diceum* by M. Cuvier, and several of the true warblers, put on so much the appearance of tenuirostral birds, that even a

scientific observer would not at first detect their true nature. As both families represent the scansorial or climbing tribe, we find that the ends of their tail feathers terminate in points, more or less developed: witness, *Sylvia, Parus, Sylvicola, Setophaga*, &c., among the *Sylviadæ*, and the whole of the true *Meliphagidæ* in the other family. The valuable information on the habits of the paradise birds (*Paradisidæ*), given by M. Lesson, confirms our previous supposition that they were analogous to the fruit-eaters of America: both are the largest birds in their respective tribes; both feed almost entirely upon fruits; both have the plumage particularly brilliant, and developed in the most extraordinary and unusual manner; and both have short but very strong feet, with the hind toe very large. A single glance at the feet of the African hoopoes (*Promeropidæ*), and those of the typical flycatchers (*Eurylaimus*), shows in how beautiful and perfect a manner the two families correspond; both representing, at the same time, the short legged, web-footed, order of swimming birds (*Natatores*), not only by the peculiar imbecility of their feet, but by always living in the vicinity of water.

(296.) From the last family we continue our comparison to the *Fissirostres*, or swallow-like tribe, merely for the sake of pointing out two extraordinary resemblances; since all the others, from the great difference of the two groups, are too obscure to be dwelt upon.

Families of Fissirostres.	*Analogies.*	Families of Dentirostres.
CAPRIMULGIDÆ.	Seize their prey by the foot.	LANIADÆ.
HIRUNDINIDÆ.	Seize their prey by the bill.	MERULIDÆ.
MEROPIDÆ.	——?	SYLVIADÆ.
HALCYONIDÆ.	Gape very wide, reaching beyond the eyes.	AMPELIDÆ.
TROGONIDÆ.	Bill short; wide, strong feet; syndactyle.	MUSCICAPIDÆ.

The shrikes are nearly the only birds in the order of perchers which have a distinct tooth towards the *middle* of their bill, but this very character we find also in several of the foreign goatsuckers. Both these families, according

to the observations of White, use the foot to secure their prey; while swallows and thrushes seize theirs alone by the bill. The little teeth along the margin of the trogon's bill, almost disappear in the Asiatic species, while the todies (*Eurylaimus corydon* Tem.) show a tendency to assume this character. The analogies of the remaining families of the *Fissirostres* can only be traced through their other representatives. That between the *Halcyonidæ* and the *Ampelidæ*, for instance, is only seen by looking to the wading order, rather than to the chatterers; since we then get an explanation why the bill of a kingfisher so perfectly resembles that of a heron, — why both live near water, and catch fish, nearly in the same manner. But having now traversed the circle of perchers, the analogies have become insensibly reversed; or rather, have so imperceptibly changed their character, that they are, as it were, doubled. Whether we are thus to account for no immediate and apparent analogy existing between the *Meropidæ* and the *Sylviadæ*, and between the *Halcyonidæ* and the *Ampelidæ*, we know not: certain it is that their relations appear to be very obscure. But may not this arise from the *Fissirostres* possessing a greater tendency to unite themselves with the *Scansores*, and thus to complete their own circle, than to pass into the *Dentirostres*, and thereby enter *another* circle? This property of aberrant groups we have before remarked upon. Let us see, therefore, whether there is a stronger resemblance between the *Fissirostres* and the *Scansores*, than between the *Fissirostres* and the *Dentirostres*. If this proves to be the case, we shall have an important confirmation of the above opinion.

Families of Fissirostres.	*Analogies.*	Families of Scansores.
CAPRIMULGIDÆ.	Bill very short, hooked, sometimes toothed; gonys ascending. Take their food by the foot.	PSITTACIDÆ.
HIRUNDINIDÆ.	Tail frequently stiff, rigid, and ending in horny points.	PICIDÆ.
MEROPIDÆ.	Bill very long, slender, greatly compressed; feet syndactyle.	CERTHIADÆ.

Families of Fissirostres.	*Analogies.*	Families of Scansores.
HALCYONIDÆ.	Bill broad at the base; toes frequently placed two before and two behind.	CUCULIDÆ.
TROGONIDÆ.	Bill strong, thick, the margin serrated.	RAMPHASTIDÆ

No one, it is true, would ever mistake a goatsucker for a parrot, yet how singularly do they resemble each other in some of the most remarkable peculiarities of their structure. The facility with which swallows perch and retain their hold, in the most perpendicular situations, is a power only possessed by climbing birds; but the analogy is carried much farther by a genus of swallows (*Chætura*), whose tails are more stiff and sharp than those of the most typical woodpeckers. By comparing the bills of any of the South American creepers (*Dendrocolaptes*), with those of the bee-eaters (*Meropidæ*), and we shall be at no loss to discover the analogy of the two families; and this resemblauce even extends to their feet, the three anterior toes, in each group, being all united together at their base. The analogy between the two next families in the table is still more remarkable, for not only are the toes of the puff birds (*Tamatia*) arranged like those of the cuckows, but the likeness is so strong as to have deceived every naturalist into a belief that they were actually united by affinity: we have shown, however, that no two tribes can be more distinct in manners and natural economy. They *must* be kept separate in all systems professing to be natural. There remains, therefore, but one more comparison,—that between the trogons and the toucans: by these two families, as we conceive, the *Fissirostres* and *Scansores* are united. We accordingly find that this is effected by the motmots (*Prionites*), which indisputably present not the slightest affinity to the hornbills, and yet they show the strongest inclination to unite with the *Fissirostres*, by means of the *Prionites platyrhynchus*, and the *Galbula grandis* in their own circle.

(297.) That analogies change, and become intermixed, in certain groups, according to the position occupied by such groups, is a fact we have before

insisted upon, and of which we shall now give additional proofs. In speaking of the various analogies exhibited by the climbing birds (*Scansores*), we have shown in how many ways they may be represented. The correct series, however, appears to us to be the following: —

Tribes of Perchers.	*Analogies.*	Families of Climbers.
DENTIROSTRES.	Bill short, hooked, toothed.	PSITTACIDÆ.
CONIROSTRES.	Bill conic.	PICIDÆ.
SCANSORES.	Ends of the tail feathers naked, hard, acute.	CERTHIADÆ.
TENUIROSTRES.	Mouth smooth, bill slender, flight rapid.	CUCULIDÆ.
FISSIROSTRES.	Catch their prey in the air.	RAMPHASTIDÆ.

That the parrots represent the shrikes, and consequently the *Dentirostres*, is quite evident; and both these, it must be remembered, are subtypical groups. The perfection of the whole order of perchers lies with the *Conirostres*, — while the perfection of the scansorial structure is unquestionably in the woodpeckers: thus do the *Conirostres* and the *Picidæ* agree. The scansorial tribe, however, is aberrant, so also are the creepers who, by having different modes of climbing, may be said, in *one sense*, to be even superior to the woodpeckers. The former can descend a tree with just as much ease as they ascend it; but the latter seldom climb but in an upward direction. Rapidity of flight and very soft food are the two most prominent distinctions of the cuckows and the suctorial *Tenuirostres;* while the very singular custom remarked in the toucans, of throwing their food in the air, and catching it in their mouths before it is swallowed, is the first and most remarkable developement which nature gives of the tribe of *Fissirostres*, to which these birds unquestionably lead. Such are our ultimate conclusions on the true analogies of this tribe.

(298.) On looking, however, to the analogies of th *Fissirostres* (a group which stands at the opposite point of the circle of *Insessores*), we find that although its

families correspond with those of the *Scansores*, they do not reciprocally represent the same analogies to *other* groups. This will be evident upon studying the following table : —

Tribes of Insessores.	*Analogies.*	Families of Fissirostres.
DENTIROSTRES.	Seize their food by the foot ; bill short, hooked.	*Caprimulgidæ.*
CONIROSTRES.	Typical in their respective circles.	*Hirundinidæ.*
SCANSORES.	Passing by means of *Prionites* into the	*Trogonidæ.*
TENUIROSTRES.	Bill very long, slender, and entire.	*Halcyonidæ.*
FISSIROSTRES.	Pursue their prey upon the wing ; feet small, weak, syndactyle.	*Meropidæ.*

In the two first analogies there is no alteration ; since the *Caprimulgidæ* as correctly represent the *Dentirostres*, as they do the *Psittacidæ :* and the *Hirundinidæ* maintain the typical station corresponding to the *Conirostres* and the *Picidæ*. Here, however, the mutual correspondence of the groups cease ; for the *Trogonidæ*, which correspond to the *Ramphastidæ*, do not stand opposite to the *Fissirostres*, but to the *Scansores*, being that tribe into which they blend. True it is that this analogy would seem to be obscure, and even questionable, were it not for the genera *Prionites* and *Nyctiornis ;* yet setting aside these forms, every one must perceive that the trogons, of all the fissirostral birds, are those only which exhibit any similarity in their structure to the gallinaceous order. Both have short and remarkably convex wings, the quills of which are very stiff and curved inwards, while the *Calurus pavoninus*, Sw., or peacock trogon, makes this analogy comprehensible to the most ordinary observer. We may, therefore, establish the analogy of the trogons to the *Scansores* by their similarity to the *Rasores*, and this without insisting on their actually passing into the *Ramphastidæ*. We next proceed to the *Halcyonidæ*, which represent the *Tenuirostres* and the *Grallatores ;* so also does *Cuculus*, and therefore nothing more need be said on these analogies : but the case is very different regarding the next. The *Meropidæ*, as we have before seen,

typify the *Certhiadæ;* but the former appear, from our table, to represent the *Fissirostres*, whereas the latter we have formerly compared to the *Scansores*. Two analogous groups are thus made to represent different tribes. How can this be explained? We reply, that if the four first analogies in this table are correctly stated, this, which is the fifth and last, *must* be correct. And this position will be evident on looking farther into the matter. Of all the three *aberrant* families of the *Fissirostres*, the *Meropidæ* are those *only* which pursue and *search after their prey upon the wing*. Now this fact we know from personal observation. We have seen the trogons, the puff birds (*Tumatia*), and the jacamas, of South America, *watching* for passing insects, within the shady nooks of thickets, and *then only* darting upon them; and we have seen flocks of bee-eaters, annually come from Africa to Italy and skim over the gardens, plantations, and open country, searching after insects precisely in the same manner as swallows. Now as the *Fissirostral* group is an aberrant tribe in the circle of *Insessores*, so all other groups intended to represent it must also be aberrant in their own circle. This is the case with the *Meropidæ;* and, therefore, as the trogons represent the *Rasores*, and join the *Scansores*, so do the *Meropidæ* typify the *Natatores*, and, consequently, the *Fissirostres*.

(299.) We now conclude our introductory exposition of the dentirostral tribe. However tedious it possibly may appear to the general reader, we feel persuaded it will be acceptable to the true naturalist, whose delight it is to contemplate that UNITY OF DESIGN, amidst the most diversified and inexhaustible variety, which can alone emanate from OMNIPOTENCE.

GENERAL INDEX.

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ASSISTED BY

EMINENT SCIENTIFIC MEN.

ON

THE NATURAL HISTORY AND CLASSIFICATION

OF

BIRDS.

BY

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