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ORNITHOLOGIA DANMONIENSIS;

OR,

AN HISTORY OF THE HABITS AND ECONOMY

OF

DEVONSHIRE BIRDS.

EMBELLISHED WITH COLOURED PLATES, ENGRAVEN FROM ACCURATE AND
BEAUTIFUL DRAWINGS FROM NATURE:

WITH

AN APPENDIX,

CONTAINING

SUCH BRITISH BIRDS AS ARE NOT RANKED AMONG THOSE OF DEVON.

BY ANDREW G. C. TUCKER. *K*

VOL. I.

To me be Nature's volume broad display'd ;
And to peruse its all-instructing page ;
Or, haply catching inspiration thence,
Some easy passage, raptur'd, to translate,
My great delight.

THOMSON.

LONDON:

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1809.

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CHRONOLOGICAL TABLE

OF THE REIGN OF
HIS MAJESTY KING GEORGE THE THIRD

FROM 1760 TO 1800
BY JOHN G. SIDNEY

LONDON

PRINTED BY G. SIDNEY

Printed by G. SIDNEY,
Northumberland Street, Strand, London.

TO

J. P. BASTARD, Esq. and Sir L. PALK, Bart.

Whose senatorial career has been animated by an ardent love of their country, and the placid scenes of whose private life distinguished by those social and domestic virtues, which are the firmest pillars of individual happiness, and national prosperity, the following Work is, by their permission, respectfully inscribed by the

AUTHOR.

INTRODUCTION;

BEING

A CURSORY ESSAY

ON THE

Habits, Economy, and Manners of Birds.

CHAPTER I.

THE treasures of Nature lie open before Man; they invite him to their contemplation, and promise, that the pursuit shall mingle amusement with instruction, enrich his imagination, and strengthen his mind. Placed in a conspicuous part of the scene of Creation, blessed with luminous gifts, and endowed with extraordinary powers,—still, the Lion excels him in strength; the Lynx in vision; the Dog, and the Vulture, in smell; the Squirrel in agility, and the Deer in swiftness: and, even in mental endowments, he is, in many particulars, far surpassed by numerous races of the brutes beneath him. Aided by various instruments, the fruits of laborious reflection, he, slowly, and fearfully, ventures over the stormy abyss; while the tropic bird, trusting to its natural powers alone, and reckless of danger, seeks its prey, with the rapidity of lightning, upon the bosom of the ocean, unalarmed by its terrors, and unterrified by the wild of unskirted waters surrounding it. With unerring certainty, the Eagle, after the lapse of seasons, returns to her ancient habitation; the Swallow discovers

her former place of incubation, from distances immense ; the Nightingale again finds the grove in which she had poured her song ; and hundreds of the little warblers reject the poisonous fruits, that conceal destruction under an alluring exterior, with the certainty of the most acute reasoning skill. And, even in the sublimer affections, the inferior animals are his rivals ; the Dog exhibits the strongest traits of gratitude, faithfulness, and affection ; the Shrike, and a hundred others, of parental fondness, and the horned Screamer, if Margraff may be relied on, of the most deep-rooted individual love. It is not in every particular endowment, then, that man rises superior to other animals, but it is as one common centre of many perfections, one collective whole, that he mounts the scale of being, and places himself at the head. The investigation of every part of the regions, and of the works of nature, tends to increase his superiority, and to invigorate the energies of his mind ; to elevate him above himself, as he comes from her hand, and to make him participate, in some degree, in the first great attribute,—the wisdom of the Deity. Among the numerous races of animated beings, the light and airy tribes that enliven the forest and the field, and gratify us with the wild music of nature, demand some attention. Too impotent, to be dangerous enemies ; too shy, and volatile, to be domestic friends ; conferring benefits which are unregarded, committing injuries which are exaggerated, sought after for amusement, or to pamper our appetites ; we are inclined to investigate their habits, their customs, and their actions, with a degree of indifference, as if they were merely a beautiful part of the works of creation, or slightly beneficial to mankind. But they were not formed on purpose to adorn, and beautify, the scenery of Nature, to exhibit the delicacy and splendor of her paintings, gratify us with their luxuries, or cheer us with their melodies. Many of their species were, evidently, called into being for more important uses ; the Vulture, the Crow, the Raven, and the Pie, greedily devour the putrid carcases, which, if left to rot, and spread their poisons, might fill the atmosphere with contagion and death. Others disperse over the surface of the earth innumerable seeds, and become the planters of trees and

herbs, in places in which they would not else have appeared ; and almost all of the sparrow kinds, defend the fruits of our labors from the devastation of countless multitudes of insects, the exuberance in the increase of which, were it not thus happily checked, would be an evil insurmountable by all our efforts.

Besides, if we give credence to the assertions of the ancients, the actions of birds have led to important, and highly valuable discoveries. Among many others, Pliny¹ makes mankind indebted to the Kite, for the knowledge of the use of the rudder, so instrumental in the purposes of navigation.

But were there no other motive that stimulated us to this investigation, than that it leads us to a knowledge of the Omnipotence of that great and awful Being, who has displayed his wonders before our eyes, but hidden himself in impenetrable darkness, that alone would induce the philosophic mind to engage in the task. In every part of the animal world, his wisdom shines with a radiance, almost overpowering the strength of human intellect ; and, though difficulties and obstacles continually arise in the search, still enough is seen in the formation of these beautiful creatures to convince us, that the harmony and agreement of their various organs are not the combination of blind, irregular, unforeseeing chance, but of an Omniscient Creator, who has wisely suited the means to the end.

Formed, as are the feathered tribes, with a structure well adapted to permeate the untrodden regions of air, clothed in a soft, and delicate vesture, painted with a thousand colors, and endued with extraordinary swiftness, they in general pass a life of enjoyment, rather than of toil ; a

¹ Nat. Hist. Lib. 10. Cap. 10. Milvi videntur artem gubernandi docuisse (navem) caudæ flexibus, in cœlo monstrante naturâ, quod opus esset in profundo.

scene of pleasure, rather than of vexation. Externally, we remark a slender oval head, broad and sail-like wings, small legs, yet strong, a spreading fan-like tail to render the bird more buoyant, and to assist the evolutory motions of its flight ; a light plumage, in short, every qualification contributing to celerity, by which the animal is enabled to overtake its prey, or escape from its pursuers.

Though these advantages are the lot of most birds, yet many of their various species are defective, in some of these particulars ; birds of the Owl kind have large heads ; and Herons, and many water fowl, King-fishers, Water Ouzels, Nuthatches, Plovers, and various others, are remarkable for the shortness of their tails.

Some are noticed for extraordinary length of wing, with a corresponding rapidity of motion, while others, like the Razor Bill, the Puffin, and the Guillemot, are formed comparatively with wings of small extent, and yet are swift in flight. The Ostrich, the Cassowary, the Emeu, and the Penguin, have merely the rudiments of these instruments of aerial progression ; and the Bustard trusts more to the fleetness of its feet, than to the vigor of its wings. Although symmetry and elegance, in general, distinguish the feathered tribes, and swiftness is their attribute, the Dodo stands amongst them, as a cumbrous mass of listless inactivity, and ranks as the Sloth of birds. And the long legs of the Coot, the Water Rail, the Water Hen, and the Stilted Plover, rather impede, than increase celerity ; but these apparent disadvantages we find, when we have investigated their uses, are in truth real benefits to the possessor, and demonstrate the propriety of the provisions of nature.

The character of birds, like that of quadrupedes, is strongly affected by the nature of their food. The carnivorous kinds, prone to rapine and destruction, and maintaining their existence on the deaths of weaker animals, are wild, ferocious, and solitary. They rarely congregate, except among the vulture tribes, but each is the terror, and tyrant of its neighbourhood.

Gloomy dells secluded from the haunts of man; the tops of the highest trees in the darkest recesses of the wood; or the summits of the lofty rugged rocks and precipices, which nature has reared in barren solitude, they love to frequent. Such scenes are congenial with their dispositions, and by withdrawing them from society, increase their natural savageness of manners. The granivorous birds form the middle link of the chain. They are more placid, generous, and gentle, in their actions, than the rapacious kinds: yet some of them are bold and courageous, to an extreme degree. Like the harmless Rhinoceros, and Hippopotamus, though they are conscious of their powers, and formed for war, they rarely seek the combat. Their weapons, and their strength, are only exerted for their own security, in their own defence; and not for the destruction of others. They shun not society, their disposition renders them tractable, and fits them for domestication; and their prolificacy is, to man, a fountain flowing with a delicious, and almost inexhaustible repast. The Sparrow tribes are, in their manners, still more mild. Nature has forbidden them to prey on their fellows, and denied them the strong, and powerful talons, the firm and formidable bills, and that muscular strength, which she has bestowed on the carnivorous tribes; and having made them incapable of resisting their powerful foes, she has planted in them a timidity, that warns them to avoid danger. In general, they do not hide themselves from the sight of man, or live retired from his habitation; they love his vicinity, claim his protection, and as they destroy those pernicious swarms of insects, that riot on the bud, and cover the vegetable creation with their nauseous fæces, they render essential services to their benefactor. Compared with the rest of animated beings, on the grand scale of nature, birds hold a middle station. Inferior to man, and the quadrupede; superior to the fish, reptile, and insect. Inferior, more in their conformation and intellectual powers, than in the senses,—the prime movers of the living world. For birds are pre-eminent in sight and hearing; some of them, such as the Vulture, the Raven, and the Wild Duck, excel also in smell; and, though touch has been deemed that sense in which man exceeds all other animals, it still

is doubtful, whether the Goose, and the Crane kinds, are not endowed with it in a far superior degree. It is seated certainly in a different instrument, and is more limited and confined; but that exquisite sensibility of feeling which we remark in those species of the feathered race, which seek their food beneath the water, or the earth, and by which they discern it from surrounding substances, even when hidden from the sight, at least gives them a pretension to rival man in that sense, in which he is commonly supposed to be pre-eminent.

But birds possess one qualification which admits of no competition,—the power of flight. This enables them to soar above the clouds, to range through every climate, and to wander, wherever led by the impulses of inclination, or necessity.

CHAPTER II.

Cursory Description of Birds.

IN the survey of our habitable globe, we perceive the never-ceasing efforts of nature, producing animal life in every part of its regions. The whole scene is embellished with animated beings; even in the burning and barren deserts, under the torrid zone, where one might at first presume nothing living could subsist, the Ostrich finds security and food. And as of all the productions of nature, birds are the most innocent, and most beautiful, she has dispersed them with a lavish exuberance over the sea and the earth; they inhabit alike the burning climes of Africa, and the cold regions of the poles. They find subsistence on the face of the ocean, and on stagnant pools, on mountains, and on plains; in places, untamed by the hand of man, as well as in fertile fields, which boast of his cultivation. Our great ornithologist, Willughby, classed them under two grand divisions, LAND BIRDS and WATER-FOWL; and these, from the nature of their food, have been divided into *carnivorous*, and *granivorous* kinds. However excellent these divisions are in most respects, they are not in all instances accurate; as some birds, as the duck kinds, like other amphibious animals, are furnished with suitable organs, that enable them to live on the water, and the land; others, as the Woodcock, the Plover, the Curlew, the Sanderling, the Heron, and the Snipe, search for food in watery places, without possessing the power of swimming for their safety, or subsistence: and all species of birds are neither strictly granivorous, nor carnivorous, but some of them participate in the qualities of both, which have

been denominated omnivorous, by an indefatigable explorer² of the operations of nature. The sub-division is therefore also liable to exception, as necessarily must be every attempt to fetter within limits, fixed by man, the innumerable varieties of the productions of nature. Some birds are entirely insectivorous, others live on berries alone, others feed on fishes, and some indiscriminately devour flesh, grain, berries, and insects. The feet, however, form an immediate and obvious distinction of land birds, from water fowl. Those that spend most of their lives on the water, have in general webbed feet; yet there are some that swim and dive with facility, gracefulness, and celerity, as the Water Ouzel, the Water Rail, the Water Hen, and the Coot, which are either without the web that distinguishes water fowl, or possess in its stead, a thin narrow membrane skirting the toes. A small division has since been made, for the purpose of comprehending such as are not strictly either water fowl, or land birds, under the name of *WADERS*. The chief characteristics of which are, long and naked legs, long or broad bills, intersected with many nerves, large eyes, and short tails. But the Plover tribes, in many instances, do not resemble these. Granivorous birds have been peculiarly denominated, animals with muscular stomachs: although all animals possess stomachs with powerful muscles; yet, in these birds, their strength and vigor are in a far superior degree. They are commonly said to have two stomachs, but this is not consistent with the fact. Neither the crop, nor the bulbous expansion of the œsophagus, or gullet, just above the gizzard, is properly a stomach, but merely a dilatation of that tube. The former expansion, (the crop or craw) a little below the entrance of the gullet, forms a membranous sack, or capacious reservoir, in the common fowl, pigeon, and a few others, in which their food is macerated by the action of the œsophageal liquor, which is a whitish, dense, and viscous fluid, exuded in abundance from the glandulous excrescences,³ covering the internal surface of the

² Spallanzani.

³ These glands, or excretory ducts, produce this liquor in great abundance. Spallanzani introduced a piece of clean sponge into the crop of a Pigeon, and left it there twelve hours,

gullet. After the food has undergone this operation, it does not descend, in most of the species, immediately into the true stomach, or gizzard, but first into the lower extremity of the gullet, where that tube dilates, and there it remains for some time, under the action of the liquor secreted from its surface.⁴ This expansion of the œsophagus is called by some the *ventriculus succenturiatus*, or *bulbus glandulosus*, and by others the *echinus*, from the tubercular appearance of its interior, and supposed resemblance to the Sea Urchin. The gizzard, in most birds, is situated just under the lower part of the sternum, or breast bone; but in the Cuckoo, Land Rail, Goatsucker, Rook, Jay, Great Titmouse, Kingfisher, and a few others, it rests upon the abdominal viscera, behind the sternum, and forms a protuberance in the belly. It consists of four most powerful muscles, composed of strong compact fibres, covered externally with a tendinous coat, and lined with numerous nervous filaments, which are guarded internally by a very tough, ridgy, yellow membrane, of uncommon strength, and almost cartilaginous. They are readily distinguished from the other muscles by their color, and by their amazing firmness of texture. Their action is so prodigious, that they leave marks of their effects on the hardest metallic bodies, and reduce to powder solid globules of glass; and such is their power that the grain devoured by the bird is as completely triturated, and rendered fit for the operation of the gastric juices, as if it had passed between the rollers of a mill. The small, rough pebbles, taken into the gizzard by birds, though commonly supposed to assist digestion, are not at all necessary in the business of trituration, as demonstrated by Spallanzani. He proves, by the most convincing experiments, that the gizzard is as capable of reducing grain into a pultaceous mass without, as well as with them. They have

which had absorbed an ounce of it in so short a period. From a Turkey he obtained seven ounces in ten hours.—Spallanzani I. Vol. Dis.

⁴ In dissecting Shags, Guillemots, Razor Bills, and other water fowl, I have found parts of fish of different kinds, but particularly the Sandeel, (*ammodytes tobianus*) or Sprat, as it is commonly called in Devonshire, lodged in the œsophagus, and partially digested, most probably by the action of this fluid.

been deemed useful, in preventing the violent action of the coats of the stomach against each other, and some have considered them necessary to destroy the germinating principle in the grain ; but we would suggest, that they are taken into the stomach, to thicken its sides. The firm membrane which covers its interior coat is a production of the cuticula, and possesses similar properties, as it grows thicker and firmer from attrition. From this peculiar quality, the sides of the stomach of these birds, so far from suffering from their amazing friction against each other, and the pebbles, and their food, increase in strength and thickness,⁵ in some proportion to the action of their mechanical pressure. Some of the pebbles are

⁵ The observations of Spallanzani help to confirm this assertion : for he states, that the stomach of a pigeon, in which a rough, unpolished garnet had remained a month, became *three times as thick* as it commonly is. This ought to have led him to a similar conclusion. The various experiments which I have made, tend to corroborate this circumstance. All those fowls, which have retained large pebbles in their stomachs, even for the short space of ten days, have uniformly had them increased in thickness, beyond those of the same brood, the stomachs of which have not been acted upon by similar pebbles. In the Appendix to this work will be given, the comparative results of various attempts to elucidate this question ; but, when Spallanzani asserts that birds with muscular stomachs picked up pebbles from accident and not from choice, he certainly errs. For, whatever be their real utility, whether they do, or do not, assist digestion, or prevent the violent action of the coats of the stomach against each other, destroy the germinating principle of grain, or render by friction the internal coat of the gizzard thicker, and firmer, there are facts, in the economy of birds, which irrefragably prove, that they seek for them, and swallow them intentionally. I have found them in the stomachs of the Cole, and long-tailed Titmice, birds rarely seen on the ground, which most probably descended for that purpose, especially the latter, which, uniformly hunts for its food on trees ; and I have discovered them in the stomachs of the Nuthatch, and Creeper, birds still more rarely seen on the ground. From the gizzard of the Water Hen I have frequently taken stones, above a quarter of an ounce in weight, which, from their size, no one can reasonably presume were swallowed by accident. On the other hand, I have at times dissected the stomachs of Misselthrushes, Titlarks and Wag-tails, birds almost perpetually on the ground, and also those of the Whinchat and Stonechat, in which, no pebbles could, by the nicest search, be found. Some of the advocates for the utility of pebbles in grinding the food have asserted, that the bird seeks for the most rugged. This is not the fact. I have in the dissection of the stomachs of insectivorous birds, often found nothing but smooth grains of gravelly sand.

discharged by the mouth, in the same manner as birds of prey disgorge indigestible substances: though many of them are ground down, by the powerful action of the gizzard, mix with the food, and pass through the vent. To prove the power and strength of these muscles, and to demonstrate, that the trituration of grain, in the gizzards of granivorous birds, is solely the effect of powerful pressure, and violent percussion, the indefatigable Spallanzani made many curious, but at the same time, cruel experiments. Aware, that smooth and blunt substances, are not injurious to the gizzards of birds, his active mind led him to discover the consequences which would arise from the introduction of sharp, lacerating bodies. At first, he gave to a cock, several fragments of broken glass, (each about the size of a pea,) and wrapt up in paper, that they might not wound the œsophagus, in their passage to the stomach. When nearly twenty-four hours had elapsed, the animal was killed; the sharp angles of the glass had become obtuse and blunt, and the fragments had lost in weight twenty-four grains. On examining its gizzard, he found it glittering with innumerable, vitreous particles; but when, at another time, he inclosed those little pieces of glass in tubes, and caused them to be swallowed by a turkey, and an hen, and left a similar period in their stomachs, they were taken out, with their edges as keen, as when they were introduced. On the examination of the stomachs of the cock, and of two wood pigeons, to which he had given points of glass, he says, that there was no laceration, no division, not the smallest jagged appearance. Their stomachs were in every respect the same as those which had not afforded reception to any unusual substance. Surprized at the fact, he proceeds with experiments, apparently still more dangerous. Twelve small lancets, with sharp points and edges, fixed in a ball of lead, were given to a turkey, and left in its stomach eighteen hours, which was then opened, but nothing appeared in the gizzard but the naked balls, the twelve lancets having been broken to pieces, and three of them were found in the intestines, pointless and blunted; yet the stomach remained sound and entire. By repeated trials, he discovered, that the edges of these sharp instruments,

began to be obliterated and broken, in about two hours. Although the stomach of the Turkey appeared invulnerable to their action, yet two pullets suffered, as philosophical martyrs, under the torture of similar experiments. They were compelled to swallow headless pins; one died in consequence in eight, and the other in thirty-two hours. To a pigeon he gave an unpolished garnet, which remained in its stomach nearly a month; and though this stone was so large as almost to fill the cavity of its gizzard, the animal fed well, nor was the interior coat lacerated. And he draws these general conclusions from the whole of his observations, notwithstanding the above facts recorded of the pullets, that the stomachs of birds of the gallinaceous kinds, are not usually obnoxious to injury, from the introduction, and trituration of sharp substances, and that the muscular powers of their stomachs are capable of comminuting hard bodies, as well without pebbles⁶ as with them. He further remarks, that so hard is the internal coat, that lines the cavity of the gizzard of granivorous birds, that he drew lancets, needles, and bits of glass, often across it, with considerable force, without doing any perceptible injury. A cursory inspection shows us, that the stomachs of the granivorous kinds are thick, globous bodies, and formed of muscles of enormous strength, lined by a wrinkled coat of uncommon firmness of texture: still in all species of birds the gastric fluid prevails, but in a greater degree, where there is a want of the vast, muscular power, of the giz-

⁶ It was the opinion of the Florentine academicians, that hard substances were more readily broken, when the bird had many pebbles in its stomach, than when it had but few; but Spallanzani proves, that birds having no pebbles in their gizzards, abrade and break down hard and sharp bodies, without injury; and that trituration depends upon the strength and action of the gastric muscles alone, and not upon these foreign substances.—Spallanzani, Dis. I. Vol. P. 27.

Doctors Hunter and Fordyce are of a contrary opinion; they maintain the proposition, that asserts the utility, and necessity, of these pebbles, in grinding the food of granivorous birds; but high as their authority indubitably is, it weighs but little against the well-conducted and numerous experiments of Spallanzani on this subject, and the opinion of Spallanzani is strongly supported by the well-known fact, that insectivorous birds swallow pebbles.

zard.⁷ Even in the granivorous tribes is found this solvent; but in them it operates but slowly, in the dissolution of flesh, and even on grain, seeds, berries, fruits, and vegetables; it appears to act with a very small degree of dissolving power, and rather to assist the preparation of the food into chyle, after it has been comminuted by the action of the muscles of the gizzard. Spallanzani filled porous, or partially open tubes, and sometimes hollow spherules, having small openings, with raw flesh, and thrust them into the stomachs of fowls, turkeys, ducks, geese, and pigeons; and he found that, after the flesh had remained under the operation of the gastric fluid upwards of thirty-six hours, it had lost nearly half of its weight, grown more tender than in its natural state, and changed to a cineritious colour; evident marks of solution, and of the weak action of the gastric fluid in these birds.⁸

In the granivorous birds, their food is first softened by the liquor flowing from the glands in the œsophagus, then triturated by the violent approximation of the muscles in the gizzard, and, at length, penetrated by the gastric fluid, which destroys its texture, dissolves its particles, and fits it for the nutrition and absorption of the animal. In the carnivorous and piscivorous kinds, the muscles of the stomach perform but a little part of digestion; in them it depends principally on the efficacy of the gastric

⁷ The stomach of the Cuckoo has been described as covered internally with bristly spiral hairs. I have dissected several, and, I must confess, that in neither of those, which I have inspected, have I been enabled to discover any hairs, attached to the internal coat of the gizzard, although there were, in one of them, numerous hairs of the rough beetle.

⁸ In those birds, of which animal substances are the proper food, the gastric fluid dissolves, most rapidly, the flesh exposed to its action. In two hours, Spallanzani found it, from the stomach of crows, changed in colour, the surface become flabby, and the cohesion of the parts destroyed, and a dark covering of jelly surrounded the flesh. He describes the operation of this menstruum as first softening the texture, and changing the colour; then succeeds a decomposition of the parts, and next a transmutation of the flesh into a kind of jelly, differing in taste from that of flesh.

fluid. But the stomachs of birds of prey, and of the piscivorous tribes, differ essentially from those of the granivorous kinds ; as they neither possess their strength, their firmness of texture, their figure, nor their powerful action. Composed of a thin membranous substance, in a sack-like form, without those vigorous and prodigious muscles that distinguish granivorous birds, nature has supplied the want of mechanical power, by this tasteless solvent, called, as we have before stated, the gastric fluid, of all animal menstrua the most active, which, in these kinds, dissolves readily the fleshy fibres taken into the stomach, and corrodes and concocts even bones, into a sort of gelatinous matter. Although thus powerful in its action on substances which constitute the proper food of the animal, yet, so confined are its effects, that it is perfectly harmless on the living fibres that enclose it ; and, in the carnivorous kinds, even tender vegetables, and delicate fruits, have been found to remain⁹ many hours under its action, without undergoing diminution. Wonderful, indeed, is this extraordinary property of solution ; for, while decomposing those things which are subject to its operation, it, at the same time, neutralizes the process of fermentation, and resists the dissolving heat of putrefaction. Nature has given to these birds the power of disgorging such substances as are not operated upon by the gastric juice ; else, as the œsophagus is larger than the intestinal canal, by which the food is emitted, when such substances are of great size, they would not pass off in an undissolved state. Many birds possess, as we have before-mentioned, a secretory organ, full of glands, formed by the expansion of the œsophagus, and situated imme-

⁹ I have frequently made similar experiments on various kinds of hawks. I have given twenty grains of barley to a Kestrel, which remained upwards of thirteen hours in its stomach, and which were disgorged without any diminution. In fact, they were swollen, and puffed up a little. I took eight of these grains, as soon as they were thrown up, and divided them nearly into two parts longitudinally, so as to expose the farinaceous substance to the action of the gastric fluid ; in about eleven hours they were again vomited, nor could I perceive they had lost any thing of their weight. It should be observed, that it was fed with small birds, none of the bones of which it brought up in the pellets it disgorged. To prevent the possibility of its discharging them without discovery, it was confined in a cage.

diately above the gizzard; which, as we have just described, is more membranous than muscular, in the carnivorous and piscivorous kinds; as the nature of their food requires but little attrition to comminute it, and as it is easier of digestion than that of those which live on grain; the latter bearing some analogy to herbivorous quadrupedes, while the former may, in this respect, be compared with other flesh-devouring animals, and even with man himself. Besides this expansion of the gullet, near the gizzard, which, in some few birds, as the Cuckoo,¹⁰ the Goatsucker, and the Bullfinch, nearly approaches the form of a stomach, Nature has bestowed on many of the species, as we have before-remarked, an expansive sack, or reservoir, just below the entrance of the œsophagus, called the ingluvies, crop, or craw, in which the food is slightly macerated, and prepared for the more easy digestion in the stomach.¹¹ This sack also serves, in some kinds, as a storehouse for the food of their young, from which the contents are ejected by the parents of the pigeon tribe, and given to their progeny. To render the food more nutritious, the Dove secretes in the spring, a white, serous liquor, resembling milk, from minute vessels, situated about the crop. The diversified means which Nature has adopted to answer the same ends, exhibit a boundless store. The Heron, the Shag, the Corvorant, the Rook, and many others, to which she has denied a crop like that of the Pigeon, she has given an elastic skin or

¹⁰ This organ, in the birds just mentioned, is exceedingly large. In the Land Rail, it is of an intermediate size; and, in the Tit Lark, it can scarcely be discerned. Its coats are thicker than the rest of the tube, and appear wrinkled, in a slight degree resembling the stomach.

¹¹ The crop is lined with small glands, which separate a viscid liquor on its internal surface. This assists the maceration of the food; and gallinaceous birds are sometimes suffocated, by the pulse and grain which they swallow expanding to a great size. In the year 1805, some mouldy chocolate, softened by water, was given to the fowls in my court; three of them died; one of which was a fine strong cock, called, by the children, "the old lord." Within twenty minutes after filling its crop with this food, of which all the fowls were greedily fond, it suddenly screamed loudly, leapt up, and instantly expired.

pouch, placed under the bill; while, on the male Bustard, she has bestowed a provision, somewhat similar to the additional stomach of the Camel, and of a size sufficient to contain many pints of water, so necessary for its partner and its young, in the dry and barren solitudes which it frequents. From the gizzard two tubes arise, one the œsophagus, or gullet, the passage for the admission of the food; the other, the intestinal canal for its emission. On this canal, near the vent, most birds have two appendices, or blind guts, as the Rail, the Jay, the Rook, and all the Sparrow tribes, though a few, like quadrupedes, as the Heron and the Bittern, have but one;¹² and, in the Woodpeckers, they are wanting.

In the former of these birds, they are large, and further up the intestinal canal, but in the Rook and the Jay they are small, and nearer the rectum; they are scarcely discernible in some of the Thrush genus; in the poultry kinds they are the longest. These appendices in the Water Rail, the Sandpiper, the Common Fowl, and many others, are evidently intended for reservoirs for the fœces, the mouths, or outlets of which are towards the rectum;¹³ but, in many birds, such as the Jay, the Tit Lark,

¹² I must confess, that in the multitudes of birds which I have dissected, I never found an instance of a land bird having but one appendix, and I have seen the appendices of the Rail, the Moor Hen, the Sandpiper, the Brown Owl, and the Common Fowl, full of fœces.

¹³ Buffon has most fancifully, and without his usual judgment, attributed the small size of the male Eagle to the want of a cœcum, and the superior stature of the female, to her having two cœca. Whether the male of the Eagle tribe in general be found without this appendage, I cannot determine; but in the dissection of the male Osprey, I found two small cœca on its intestinal canal, each about a quarter of an inch in length, offering no appearance of their being receptacles for the fœces. The observation, therefore, cannot extend to the Osprey. Indeed this opinion stands but on a slight foundation. The situation and smallness of the cœca, in all the Hawk tribes in which they are found, (as well as in most other birds) show us, that the office which they perform can scarcely be credited to contribute to the extension of the body of the bird. They are, in those birds, near the rectum; they have no connection with the body, but by the intestinal canal, and are so exceedingly diminutive, that even in those species of the

the Sparrow, the Chaffinch, the Wagtail, the Rook, the Nuthatch, the Water Ouzel, and most of the Sparrow tribes, they are so extremely small, as to be incapable of performing any material service, or containing any quantity of excrementitious matter; and in the smaller kinds in general, they appear like two little excrescences, or bladders. The intestinal canal, arbitrarily divided by anatomists into several parts, is in some birds extremely short, and with few windings, as in the Nuthatch, the Water Ouzel, and Heron, which, in the gallinaceous, carnivorous, and Pie and Sparrow kinds, makes many convolutions: and it differs not less in size, than in length, in various species of birds. In the Rook it is exceedingly large, in the Osprey slender to an extreme degree. The reason of the length, or shortness of its convolutions, is evident; if the food of the animal be readily digested, and easily yields the life-feeding chyle, the passage from its entrance to its emission is short; but on the other hand, if the food require a longer period, for maceration and preparation, it passes through an extended course. The duodenum, or upper part of the intestines, so called in the human subject on account of its being in length about twelve fingers' breadth, is almost contiguous to the œsophagus, or gullet, and takes its rise close by the place at which the œsophagus enters; and though intended for the emission of the contents of the gizzard, it is seated at its upper extremity, and is larger at its commencement than its termination. Contiguous as it is to the œsophagus, the food cannot pass from that tube into the duodenum on its entrance into the stomach, because the pressure of the gullet, in the act of admission, closes the orifice of the duodenum. And, on the other hand, the food, when comminuted and fit

accipitrine genus, in which they serve as receptacles for excrementitious matter, they contain but a trivial portion; and unless any one conceives that the small quantity which they can contain, there undergoes the process of becoming again nutritious to a wonderful degree, and then ascending back again through the intestinal canal to the absorbing vessels, he cannot presume, that this quantity of fœces can promote the growth of the bird. Even Monro, in his description of the anatomy of a Kestrel, strangely asserts that carnivorous birds have no cœca.

for emission, cannot naturally repass through the œsophagus, because little fleshy protuberances encircle it at its insertion in the gizzard, and hinder the food from returning without the most violent exertion. To prevent the bile from regurgitating into the stomach, the outlet of the duct, called the ductus choledochus, that conveys it into the intestines, is distinct from the stomach, else the bird, in the rapidity of its flight, would be subject to frequent regurgitations; and in order that it may be properly blended and mixed with the chyle, this duct enters downward, opposite to the course of the food. The lungs of birds are not divided into lobes, nor are they loose in the cavity of the thorax, but adhere to the back-bone and sides throughout their extent, in order to render their flight more even and steady; though in some of the smaller tribes, they are but slightly adhesive.¹⁴ They are soft, reddish, spongy, flat substances, covered with a thin, pervious membrane, supplying the place of the diaphragm, and communicating with the vesicles, or air bags, that spread over the thorax and abdomen. The two extremities of the branches of the windpipe terminate within the lungs; and the air, thus received into them, is emitted through little orifices, or perforations, into the thin, transparent, membranous bladders; many of which are divided by slight, filmy, transverse septa, or little boundaries; and the air is conveyed over the body by these bladder-like tubes; which seem to serve another purpose, that of confining the viscera, and preventing them from moving violently in the cavity of the body, by the motion of the bird in its flight. This property of being enabled to imbibe a considerable quantity of air, renders the bird specifically lighter when the lungs are distended, and some of the feathered tribes have air cells so generally distributed over them, that they are found even in their quills, pinions, and thigh-bones. Indeed, a large portion of the skeleton of birds is formed into receptacles, which contain air. In the

¹⁴ In the dissection of several of the smaller birds I have discovered, that the membrane, which connects the lungs with their sides and back, is so thin and lax, that the lungs are but slightly adhesive.

adult bird, many of the larger cylindrical bones have scarcely any marrow, but their hollow recesses communicate with the lungs, through the medium of the small membranous air cells, before described. Nature, in this instance, seems to have operated in a similar manner with respect to birds, as with fishes, to facilitate their ascent and descent, in the different elements in which they move. We know, that by the dilatation of the air-bladder, fishes become specifically lighter than water, and are buoyant in it; and it is, perhaps, partly from a similar exertion, that birds float with such ease in the light atmosphere, without apparent use of their mechanical powers. In the conformation of those birds, that take the longest and most extended flights, the air-cells¹⁵ are either proportionally larger, and so elastic as to be capable of great expansion, or more generally diffused; and the air, thus retained, is not merely serviceable in rendering them buoyant, but at the same time counteracts the resistance of the atmosphere, in the rapidity of their flight, and prevents their respiration from being impeded by that resistance. Nor here, perhaps, do its uses end. The air, in these internal reservoirs, increases, most probably, the strength of the voice, propels again into the lungs that which is received by inspiration, assists the evacuation of the fœces, and the expulsion of the egg.¹⁶ The liver, in

¹⁵ I have frequently inflated these air-cells from the mouth of the bird, and they expand to a truly surprizing degree. In the Osprey, one of them, when extended, measured nearly three inches in length, and two in depth.

¹⁶ To descant upon the various uses of the different parts of the economy of birds, on their relative proportions and concordance, on the admirable contrivance to adapt each part to its intended use, would far exceed the bounds which we have set to our Introduction; and in which we propose to give merely a cursory and short description of the feathered race. The few particulars which we have now given of their internal anatomy, are only intended as a slight introduction to a more general essay on their internal and external formation, which we shall probably at a future period attempt. The reader will forgive one observation, which demonstrates, that so trivial a thing as a feather, discovers the hand of the Deity. The outer web, for instance, of a quill-feather, is narrow, the inner one broad. Were but an inversion of this apparently simple

most birds, is divided into two *unequal* lobes by a pellucid membrane; each of these lobes rests on one of the sides of the body;¹⁷ the hepatic duct opens separately from the cystic, and its termination is sometimes preceded by pancreatic ducts, though often by a single one alone. Nor do all birds possess a gall-bladder. In the Osprey and Misselthrush it is large, and nearly oval, in the Sparrow extremely small, and in many of the species, as in the Pigeon, it is entirely wanting. Similar remarks extend to the spleen,¹⁸ which is found in many of the species and denied to others.

The little valve, or membranous covering of the orifice of the windpipe, called the epiglottis, though common to man and quadrupedes, is not given to birds; but in its stead, at the upper extremity of the trachea, or windpipe, a rima glottidis, with muscular sides, acts to prevent the food and drink from passing into the lungs; and, besides this precaution, several stiff, sharp papillæ guard its entrance; which, in the Wheatear, are black, in the Rook, greenish blue, in the Swallow, yellow, in the Goatsucker, light brown. The trachea itself is not firmly fixed to the vertebræ, as in men

contrivance to take place, the animal's wings would be unable to sustain it in the air; because the length of the layers, or rays, would of course weaken their strength, and offer a slighter resistance to the atmosphere, and in the rapidity of flight, would frequently furl backwards, and permit the air to pass between the quills: the shortness of the outer web would be insufficient to fold over the adjacent feather, and the whole wing be permeable.

¹⁷ The lobes of the liver of the Osprey are of equal size and weight, and to them is added what is rarely found in birds, a smaller lobe, resembling the lobulus spigellii in the human race.

¹⁸ In some birds the spleen is of a globular figure, as in the common fowl, but in the Rook it is of a lozenge form, and nearly two inches in length, and of a purplish hue. In the Osprey it is scarcely an inch long, and in the Pigeon it does not exceed a quarter of an inch, and in shape is of an oblong oval. It lies near the bulbus glandulosus, and the pancreas, the latter of which is of considerable size in carnivorous birds, of different form in many of the species, but generally wearing a twofold appearance.

and quadrupedes, but is loosely attached, to enable it to follow the flexions of their necks with ease, and without the danger of suffocating them. This, together with the formation of the cartilages¹⁹ which compose this tube, and extend all around it, enables birds to turn their heads so flexibly. On dividing the breast-bone, and laying open the stomach, we perceive the trachea,²⁰ in most birds, greatly contracted from the point at which it separates into two parts; but in some birds, as the Black-capped Gull, each of its divisions is larger at the point at which they branch off, than the trachea itself. The heart of birds lies in the thorax, with its apex toward the sternum, and, instead of the *valvulæ tricuspidæ*, the right ventricle is provided with a strong muscular flap. Their sternum, or breast-bone, unlike that in man, has a high ridge from the middle, similar to the keel of a ship; which, in general, is deeper in wild birds than in domestic fowls. This ridge, or vertical process, is called the *crista*, and in that of the Wild Swan, and of some of the Crane kinds, is formed a cavity for the reception of a part of the trachea. In the Puffin the sternum is of such a length, that it almost extends to the rectum, which ends in the cloaca, and this contains the terminations of the ureters, the genital organs, and what has been

¹⁹ The cartilaginous annuli, or little rings of the trachea of birds, are complete circles slightly overlapping each other at their superior and inferior edges.

²⁰ The trachea of different birds varies in formation. In the males of the Duck kind, particularly in the Golden-eye, it has long been known that the trachea takes a large globous form (called the labyrinth) at the point of divarication; and Willughby adds, “*et præterea superius in ventrem intumescit.*” And the still more wonderful structure of this part of the Crane, and the Wild Swan, long since attracted the notice of the naturalist. In the *crista* of the sternum of these birds is a deep recess, like a sheath, formed for the reception of the trachea, which makes a large convolution in this cavity. The use of this extraordinary apparatus, called the labyrinth, is still unknown. *Voci intendendæ* (inquit Willughbeius) non inservire argumento est, quod aves ejusdem tribus quæ eo carent, ut v. g. *Anates domesticæ* vocem validam et vehementissimam edunt; quodque nec ad urinandum conducatur, illud suadet quod colymbi dicti, qui præ aliis omnibus frequentissimè urinantur, diutissimè quæ sub aquis manent, eo careant.

called, from its discoverer, the bursa Fabricii.²¹ The kidneys lie in the excavation of the back-bone, and are flat and of a purplish colour, and in general form a double row of distinct, glandular bodies; from them runs a whitish-coloured duct, which terminates in the common cloaca, making an aperture distinct from that in the pœnis.²² We shall in our cursory survey, slightly notice the principal differences in the skeletons of birds, as compared with those of the Mammalia; but we cannot enter on this subject without making a few short observations on their brain. Their cranium is more cavernous than that of man, and the brain itself differs from ours in the smoothness of its surface, the few, if any, circumvolutions on its exterior, in the form of the optic thalami, and by the want, as is generally supposed, of many parts which are found in the human brain, such as the corpus callosum, fornix, pons varolii, testes, &c. which, if they exist in birds, have not as yet been discovered; and more peculiarly in the

²¹ The bursa Fabricii is, in most birds, of an oval form; but in some of the species, it is nearly globular. It was for a long time supposed that birds had no lacteal vessels, but that they possess them has been put beyond the reach of doubt.

²² Coitus avibus tribus modis, fœmina considente; ut in gallinis, accipitribus vel passeribus; aut stante, ut in gruibus; aut in aere, ut in apibus hirundinibus. Testiculi masculini, intra corpus dorso, infra jecur affixi sunt. Verno tempore turgent, et fiunt quinquies majores, quam hyberno. Hi non sunt dissimili forma, sed alter plurimum alteri magnitudine præstat. Avibus terrestribus, duæ perexiguæ partes generationis sunt intra corpus: sed aquaticis una sola pergrandis est. Per compressionem, aves terrestres potius quam ingressum, per ingressum aquaticæ, coeunt. Harvœus inquit..” In avibus et serpentibus, quibus fungosi sunt pulmones, parva cernitur urinæ copia, quod parum admodum et pitissando bibant, et eorum nonnullæ, nimirum aquilæ, nihil omnino; quare vesica urinaria iis non est opus, sed lotium in communem cloacam alvi quoque fœcibus dicatam destillant, iisdemque commistum simul egeritur. Differt hoc lotium in avibus atque in aliis animalibus; nam cum urinæ partes duæ sunt, serosior una et liquida, crassior autem altera, quæ in sanis hypostasis nominatur, et in urina jam refrigerata subsidit. Aves (contra quam vivipara animalia) majorem hujus copiam obtinent, eaque ab alterâ colore albo seu argenteo distinguitur; et non modo in cloaca reperitur (ubi abundat) alviq; fœces circumlinit; sed etiam in toto ureterum ductu, qui a renum tunicis hac ipsa albedine discernuntur.

great and disproportionate size of the cortical, compared with the medullary substance; whereas in man the latter is found in a greater quantity than the former; yet, if the whole of the brain of many of the smaller species of birds, such as the Sparrow, Chaffinch, and Goldfinch, be placed in the scale against the brain of Man, it will far exceed his, in proportion to the size of their respective bodies. The skeletons of birds are principally distinguished from those of the Mammalia by a skull, over which, in adults, there do not appear any real sutures; by a horny appendage to the mouth, called the bill, uniformly without teeth; by a moveable upper jaw; by a small bone nearly square, by which the lower jaw is articulated with the cranium; by not having an os intermaxillare; which is also wanting in Man, and some of the Monkey tribes; and by having only one occipital condyle; by the dorsal vertebræ being immovable, and the cervical vertebræ exceeding seven, the common number in the Mammalia (with few exceptions); by the small number of their ribs; by a sternum prolonged below into a vertical process; by a pelvis open in front; and by clavicles.²³ From their simple conformation, birds are subject but to few diseases, and yet are liable to an annual change of their plumage,²⁴ which generally happens in the autumnal season, or, according to a common proverb, “in blackberry time,” though the Cuckoo, and some few others, moult in the spring. In cold climates, birds are said to change their plumage twice in a year. From the continual attrition which their clothing undergoes, it must necessarily sustain considerable injury. To obviate this defect, and to make it adequate to the wants of the animal, especially to give it a

²³ Blumenbach on Comp. Anat.

²⁴ While labouring under the severity of this disordered state, the Cock ceases to crow, its spirits flag, it is no longer seen strutting exultingly in measured pace among the hens; it retires to some sheltered corner to conceal itself; its comb and wattles lose their bright red, and assume a pale brown colour; its eyes are sunk and hollow; it moves heavily; indeed all its actions display the debility of its body, and the decrease of those active stimulants, that are at once the source of motion and life.

warmer clothing for the winter, nature has endued it with the property of changing its vesture. Her benefits are sometimes attended with alloy. The nascent plumage absorbs so much of the animal juices as to impair the strength of all, tame the ferocity of the rapacious, and even destroy many weak individuals. Under the management of skilful persons the moulting season is accelerated. The bird is confined in an excessively hot temperature in a dark place, and a preternatural fever is induced; but as this premature operation is severe, it frequently destroys the life of the object of its care. In moulting, a thin case, or tube, of a quill-like substance, formed of layers, is at first protruded from the skin, and in which the feather is enclosed. This tube contains a thick, gelatinous liquor, which is of a different colour in different parts of the bird. This appears to be the colouring matter that gives the hue to the incipient feather, and not that which feeds its growth. We have discovered it in some of the feathers of the Large Titmouse, of a bright yellow in these tubes; in others, of a lead colour, inclining to black. In the Tawny Owl, the Jay, and the Kingfisher, we have seen it of a light brown; and in the common fowl, of a rufous colour; but in birds in general, it is of the dark hue before described. Indeed, in the same tube, we have remarked a yellow; or a brown liquor, and this lead colour tint together. But this is readily accounted for, as the downy parts of the feathers of most of the race wear a similar livery, a deep ash-colour hue, to absorb and retain the heat. The top of the vane soon thrusts itself out at the outer orifice of the tube, appearing like the hair-pencil of the painter. The shaft, which at first is very soft and flaccid, and of a jelly-like substance, lies in this tube; it soon indurates and increases to its common size, and roots itself in a kind of periosteum, or stiff tubular membrane on the surface of the body of the bird, through the opening of the nearer end of the tube. By expansion, the shaft gradually bursts the case which enfolds it, and it falls off in a manner not unlike the pod, or outward covering of the seeds of various vegetables; indeed, the whole of this process bears some analogy to that of vegetation; the shaft representing the stem, and the vane the leaf. In

a few months the skin begins to shrivel and recede from the shaft, and by the return of the usual period of moulting, it no longer encircles the feather, which, by these means, and by its own contraction, loosely hangs by its extremity alone. It is soon thrust out from the socket by the incipient feather, which is fed by a small vein and artery, these draw the nutriment, not from the reservoir of colouring matter in the tube, but from the body of the bird. The pith, that light, thin, and vascular appearance in the tube, and the medullary part, the soft, white substance found in the shaft of the quill, conduct and diffuse, from numerous blood-vessels, the nourishment over its interior; in the same manner as the umbilical artery feeds the infant in the womb. The nutriment ceases, and the blood-vessels dry up, when the quill is fully hardened; and the pith becomes a light transparent substance of no further service. As soon as the feather has fulfilled its office, it drops at the appointed period, like the one that preceded it. In the inspection of birds, their plumage is the first part that takes our attention. A dress, combining elegance and lightness with strength, comfort with utility, forming a most effectual covering to protect the bird against the injuries of heat, and cold, and of a humid sky. If we examine its texture, we are struck with astonishment; if we regard its hues, we are lost in surprize; in the nice adaptation of one part with another, in the order and disposition of the layers, in the admirable harmony and curious mechanism of the whole of this apparatus, we see a conformation and design, infinitely surpassing human contrivance, and which evince the regulating hand of God. This plumage is admirably suited to the intended purpose. A soft downy substance first clothes the body of the bird; and in those that require, from their habits and manners, greater warmth, it is generally of a blackish hue, to absorb and retain the heat, and is covered and overspread by various layers of feathers, admirably disposed, and in all instances adequate to their necessities and habits of life. The males are mostly distinguished for the vivid beauties of their colours, which render them more engaging and attracting to the eye than the females; and in the warmer climates, nature has embellished birds in

general with a splendour far superiour to their fellow denizens in colder climates. Although there are not wanting, even in the temperate and frigid zones, objects, which vie with the most gaudy species of the south. This beautiful vesture is thickened and increased in those fowls which spend their lives on the waters, to such a degree, as to be almost impervious by the element on which they subsist. It at once protects the animal from the injuries of the weather, and assists it in its progression through the air. Thus a combination of uses is seen to spring from the same means. Each feather is divided into two parts, the shaft and the vane, or web; the shaft is convex on the upper side, and grooved in the middle beneath, and, as we have already remarked, unites lightness with strength. A hollow base is filled with the connecting pith, to feed the growth of the feather; and the quill part is internally composed of longitudinal fibres, which split lengthwise into thin lamina, while the external parts, like hoops surrounding a cask, embrace the longitudinal fibres firmly together. The vane, web, or beard, springs out of the shaft, and is composed, on both sides, of numerous rays or layers, curiously united by capillary filaments, each of which bears some resemblance to a feather. Their under side is soft and smooth; and in birds of the Owl kind the exterior web is fringed with a light downy substance, and the first quill is serrated, probably, as they are not swift in flight, to prevent their prey from hearing their approach by the percussion of their wings on the air. The upper margin is divided into two rough edges, with hooked, or bearded bristles above, and straight ones below; these unite by the entangling of the hooks, and thus are neatly interwoven. The outer web is in general narrow, and the inner one broad and more expanded, particularly in the quill; but in feathers on the body both webs are frequently of equal size; and though at first sight all feathers appear alike, yet on nice examination prove of different formation. The quill feathers are dissimilar in shape from those on the body, and these frequently differ from those encircling the meatus auditorius, the rump, the head, and the vent. The quill feathers of all birds, which use their wings as instruments of flight,

are united in the way described; evidently to oppose to the atmosphere a light and buoyant instrument, impermeable by it: while the other parts of the plumage of the animal, not having the same office to perform, are commonly composed of lamina, or rays, unconnected by hooks, and are distinguished by a peculiar fringiness, particularly in the different species of Titmice, in the body feathers of the Jay, the Nuthatch, and the Rail; in the tufts around the external parts of the ear and the face of the Owl kinds; but those that compose the brown-tipped circle, round the heads of the latter birds, are more closely woven, and more matted, even than the rays of the wings, and strikingly resemble the petals of the daisy. To repair the injuries which the plumage of birds sustains by continual use, a white, unctuous matter is secreted in a small gland,²⁵ and sometimes in two glands, situated on the rump, at the top of which is a little apertory duct, through which the bird presses the oil with its bill, whenever its ruffled clothing requires repair. This gland, in many of the species is encircled by a small tuft of light, white feathers; and when the bird wishes to preen itself, it begins with placing its plumage in order, and then by pressing its bill on the gland, extracts the oil, and rubs it over the surface of those feathers that have been injured. By this operation they are softened and more readily arranged. Water birds in general secrete a larger quantity of this useful oil than land birds, as their plumage requires it for a two-fold purpose, to make it more impervious to humidity, as well as to repair it. The rancid odour of the flesh of many water fowl is communicated in a great measure by this oil, and the ill flavour is in some degree extinguished, by taking off the back-bone before they are dressed. The plumage of birds is neither of the same hues, nor brilliancy in the young, as in the old; nor are those of the same species always clad in exactly similar colours. In general, it increases in splendour of colouring with the age of the bird. Some young birds are covered with feathers of colours so different from those of their parents, that an inattentive observer would

²⁵ The Puffin has *two* glands and *two* apertory ducts.

scarcely believe them to be of the same race. Thus the young Cuckoo resembles the Hawk in its plumage, more than its progenitors ; while the young Henharrier bears no similarity in its colouring to its male parent, but is clothed in a dress remarkably alike that of its mother, the Ringtail. The colouring of the feathers of birds is not permanent. The young Cuckoo, when it first spreads the wing, presents an animal of such widely different hues from the old one, that a person, slightly acquainted with the feathered race, would with difficulty attribute its origin to the proper source. Its plumage is then dusky, shaded with tints of brown, and circled at the ends with narrow bands of white, and the tail feathers are barred with black, brown and white. Before it departs, the same feathers become shaded with brown alone, leaving a few nearly round spots of white on the line of the shaft of the feathers of the tail. The well known physiological fact, that even the hen birds of some species will resume in old age a plumage similar to that of the male, has been exemplified, particularly in the Peahen, the common Hen,²⁶ and Pheasant. When the young of the Flycatcher, the Redbreast, the Stonechat, the Whinchat, the Butcherbird, the Goldfinch, and numerous other species, quit the nest, they wear few marks of the colourings of their vesture in riper years. Some acquire, in a great degree, similar tints to those of their parents before the winter commences ; but most can be easily distinguished from them, until the following spring.

²⁶ In the year 1808, an acquaintance of mine had a Hen, the plumage of which nearly resembled that of the Cock ; its comb and wattles were of a monstrous size ; its spurs long and large, and a few of the tail-feathers were arched and bending, like those in the male ; it ceased to cackle, and assumed a hoarse crowing tone, and at the same time continued to lay. The Cock would not suffer it to approach him, without testifying the greatest rage. I went a second time to see it, and to request to have it dissected ; but it unfortunately had been killed some weeks before, on account of its disagreeable crowing. The owner jocosely assigned a different reason. " I killed it," said he, " because the women are masters in those houses in which Hens crow."

The wing of most birds is usually so placed, as to keep in equilibrium the whole of the body, and to balance the bird steadily in its flight. But all do not possess wings in exact equilibrium; the Grebes and the Divers have theirs placed before the centre, and when they fly, their flight is not directed in a horizontal line, but in an angle upwards of fifteen degrees. On the other hand, the wings of the Heron, the Moorhen, and the Water-rail, are behind the point of equilibrium, and to counteract the effects of this position of their pinions, they fly with their legs hanging down. On the upper extremity is a little appendage, called the bastard wing, it consists in general of but three feathers; in the Water-rail, the Heron, the Sparrowhawk, the Henharrier, and the Cuckoo, of four, and in some birds of five. It is a miniature of the first joint of the real wing, but the use of it is unknown. The bastard wing of the sluggish Water-rail is exceedingly large, the longest feather being nearly two inches in length. It does not certainly tend much to increase the speed of the animal, as those birds, which are endowed with the largest bastard wings, are not the swiftest in flight. Numerous species have the first quill in each wing extremely short, particularly the Titmice, the Golden-crested Wren, Willow Wren, Nuthatch, Waterouzel, Creeper, Woodpecker, Red-backed Butcherbird, Goatsucker, Blackbird, Fieldfare, Misselthrush, Starling, Jacksnipe, Whitethroat, Whinchat, Stonechat, Flycatcher, Pettychaps, Woodlark, Sedgebird, and Redwing. In others, as the Cuckoo, the Henharrier, and the Jay, the first quill²⁷ is nearly two inches shorter than the next in the wing, and the Little Wren exhibits a similar proportion. Of the wing of the Sparrowhawk the first quill is very short, and the fifth longest. Buffon was certainly mistaken, when,

²⁷ The first quill is certainly a characteristic, and as such ought to have been noticed by authors on ornithology. It is not a little remarkable, that most of the migratory land birds have the first quill of the wing very short. The Cuckoo, the Jay, the Sparrowhawk, the Henharrier, the Wren, and the Rook, form an intermediate class between birds with very short quills, and those that have them the longest, such as the Sandpiper, Golden Plover, and Brambling.

in opposition to Brisson, in his description of the Golden-crested Wren, he so positively averred, that this feather was not a quill, on account of its shape, insertion and use; for its form is exactly similar to the next quill, and its mode of insertion in no respect differs from it. All the quill feathers are placed with the greatest degree of regularity, and with the most admirable order, the largest and strongest bearing the heaviest share of duty; and all of them are covered, at their insertion, by layers of thick feathers above and below, called the coverts, to preclude the air from permeating the wing, and of course lessening the force of its impulse. Two powerful muscles²⁸ give vigour to the wing of birds, which are infinitely stronger in comparison than those in man, or quadrupedes; and these powerful supporters of flight are so contrived, as to unite enormous strength with peculiar elasticity. The pectoral muscle of an Eagle is nearly as thick as that in Man,²⁹ so that, if we take into the estimation their relative bulk, the great disparity in the size and force of this muscle excites our surprize.

The bills of birds are uniformly composed of two parts, or mandibles; one above, and the other beneath; yet they vary almost as much in form, as the birds differ in habits. Nature has accommodated all the immense multitudes that wing the air with such instruments as are

²⁸ The vast power of this muscle has induced many philosophers to presume, that, by man, the art of moving in the air was unattainable. They drew this consequence from the impossibility of providing springs, analogous to these muscles, of sufficient force to sustain his weight in the atmosphere; but in our days the spirit of curiosity has removed the seeming impossibility in a different mode. Machines have been fabricated lighter than air, and men, in this proud specimen of human ingenuity, have rode triumphantly in an element, which nature appeared to have raised against them, as an impassable barrier.

²⁹ Pectorales musculi hominis flectentes humeros parvi et parum carnosus sunt; e contra in avibus, vastissimi sunt, imo excedunt et magis pendent, quam reliqui omnes musculi ejusdem avis simul sumpti.

BORELLI, *de motu avium*.

most conducive to the wants and necessities of the possessors; from the huge, unshapely beak of the Rhinoceros Bird, and the unwieldy, indented one of the Toucan, to the slender bill of the Redbreast, the short, and weak one of the Goatsucker, the incurvated one of the Avoset, the long one of the Curlew and the Woodcock, the flat one of the Spoon-bill, and the strong, firm, angular, and compressed bill of the Turnstone. Generally the two mandibles are of equal length; in some instances the upper is longer than the under, as in the Hawk tribe, and rarely the under exceeds the superior. The races, formed to seek their food in wet and marshy places, are in general provided with bills of extraordinary length, or breadth, and with nerves reaching to their extremity, to enable them to find it, even when out of sight. For this purpose, some of these nerves line a part of the roof of the mouth. All birds possess them, but they that grope for their food have either a greater number, or they extend nearer to the extremity of the bill. Those individuals of the feathered race, whose principal food is insects, and which hunt for them chiefly on the ground, have short, slender bills; but to the Creeper, which also feeds on insects, and is compelled to find them in their retreats, imbedded in moss, nature has given a slender, long, and incurvated one. The Woodpeckers, the nests of which are formed in the hollows of decayed trees, have a firm, strong, sharp bill, well fitted to perforate wood; and the Grosbeak, the principal food of which is kernels and pippins of fruits, or hard berries, is possessed of a short, strong bill, admirably contrived for the opening of such substances. In the Hawk tribes, which live on animal food, and require strong bills for tearing it, nature has extended the upper mandible over the inferior, and terminated it in a sharp, exerted angle, well adapted for their use. Of these two mandibles, the upper one of which the bill is composed, in most birds, is immovable; but the Parrot tribes have the power of moving both mandibles. On the upper mandible are situated the nostrils, which, in some birds, as the Kingfisher and the Waterouzel, are covered with a membrane; in others, open and broad, as in the Goatsucker; in some, linear and pervious, as in the Rail and the

Gull ; in others, round and margined, as in the Cuckoo ; in some, oval, as in the Butcherbird ; and in the gallinaceous kinds, partly covered with a membranous valve. Small as are the nostrils of birds, and apparently ill adapted for a quick sense of smelling, yet many of their races possess this sense in an extreme degree of delicacy. The Vultures wind their putrid prey at an immense distance, and are often seen floating slowly along, in multitudes, as far as the eye can extend its view, directing their flight with certainty to the object of their voracious appetites. And the Crow and the Raven, with the sense of smell inferior to that of the Vulture, will discover at an immense distance the carcass that allures them. The Wild Duck trusts more to its smell than to its sight or its hearing, and marks the approach of an enemy from the notices which it receives from the tainted gale, when its other faculties would suffer it to remain in blind security. The tongues of birds are no less various, some are bifid, others divided into many filaments, as in many of the Sparrow kind : others are smooth and slender at the tip, as that of the Cuckoo ; the extremities of others are pointed with bristles ; others end in a stiff, horny substance, like that of the Woodpecker ; and the tongues of the Goatsucker and the Kingfisher, are exceedingly diminutive, like trunks of small trees in enormous caverns ; while, on the other hand, that of the Woodpecker with its spring-like cartilages, is of prodigious length, strengthened by two large muscles, tipped with a stiff, horny substance, and edged on its sides with firm spikes, to transfix the insects which lurk in the clefts and chasms in which they insert it. The heads of birds are commonly so framed as best to permeate the air ; they are in most of the species of a small and oval form ; although birds of the Owl, and some of the carnivorous kinds, have large heads.

All birds yet known have two eyes ; their exterior parts are not so hemispherical as in men and quadrupeds, but are formed with an obtuse and flattened front. The flatness of the organ of vision in birds, is, perhaps, one of the causes of their piercing sight, as the axis is.

shorter, the refracting power of the lens and cornea is decreased and diminished. Around the outer coat, a circle of scale-like plates of bone guards the eye from injury. But nature, in some birds, has used still greater precaution. An hard, osseous, scaly substance projects externally above and below the eye of the Puffin, and over the upper part of that of the Sparrowhawk and the Merlin rises an internal, strong, bony projection. She has given to most birds a thin, transparent membrane, called the nictitating membrane; which, by means of muscles affixed to the back of the sclerotica, can be contracted, or extended, at the will of the bird, so as to protect the whole of the exterior of the eye, and cleanse its surface, which otherwise, from its habits, would be obnoxious to perpetual injury. This membrane is sufficiently transparent for the admission of the rays of light; and though covering, like a curtain, the whole of the exterior of the eye, it scarcely obstructs its sight. Though Nature has been so careful in endeavouring to protect this organ from injury, she has given to all birds, for their greater safety, two eyelids: the under of which, in most of the species, is the largest, and ascends to close the eye; but the Swift, the Parrot, the Owl, and the Goatsucker, move both eyelids with equal ease. The latter, doomed to nocturnal activity and mid-day slumbers, possesses a peculiarly large, elastic, upper eye-lid, which it can fold over its eye in many plaits, to preclude the admission of the rays of light, and to permit it to doze in total darkness in the blaze of day. At the bottom, near the entrance of the optic nerve, lies a triangular receptacle, or purse, containing a dense, black fluid: which some persons have supposed to be requisite to suffocate the rays of light, as the pupil of the eye of most birds admits them in great abundance. Even in man, the inside of the choroides is tinged with black, that the rays which pass through it may not be reflected back again upon the retina to confound the object. The pupils of the eyes of most birds are round. In the nocturnal tribe, they sometimes appear elliptical, and in them they readily dilate and lessen, and the retina is more tender; consequently, when they are exposed to a glare of light, the pupil contracts to so small an aperture as to prevent the

ingress of many rays at once. This contraction occasions an indistinctness of vision; but though the pupil readily diminishes in the dazzling of the mid-day sun, it expands as instantaneously in the glimmerings of twilight. In birds in general, the organ of sight is peculiarly adapted for acuteness and strength of vision, by the power of expansion in the optic nerve; and as it forms a membrane (after perforating the sclerotic and choroid coats of the eye) which retains the impression of the exterior objects most vividly and distinctly. Hence the sight of birds is so perfect. The Eagle, though soaring in the clouds, discerns its prey on the earth. The Hawk, hovering in the atmosphere beyond the reach of our sight, darts unerringly upon the animal that is doomed to fall a sacrifice to its rapine. Besides, this organ is so advantageously situated, as to take within its compass the greater part of the horizon, although many of the races cannot discern a near object in a straight line with the bill. Though, to outward appearance, the eyes of most birds seem small, they are, in fact, comparatively large, each of their orbits being nearly one-third of the circumference of the head, whereas in man it does not exceed a sixth part. A slight variety exists in the colouring of the irides: they are, in most of the Sparrow kinds, hazle, or dark brown. In Woodpeckers, white; in the Landrail, Shag, and Corvorant, faint green; in the Waterrail, the Moorhen, and the Hedgesparrow, rufous orange; and in the Jackdaw, whitish grey; and in some of the Hawk tribes, bright yellow. But these colourings are not permanent. In the matured state, the eyes of the Cuckoo and the Henharrier are of a bright yellow; though when young of a dark brown; and the rufous iris of the Hedgesparrow is then dusky. External ears are not given to birds; instead of which, they are furnished with a winding orifice, that catches the sound, and conveys it through the auditory canal to the tympanum. Around this orifice a tuft of light feathers is placed, as a guard against injury, and yet so delicately constructed, as to permit the undulations of sound to pass between them. The auditory bones of their ears, though four in number, appear as but one, so closely are they connected together. The Owl kinds have a flap, or fleshy protuberance, covering this opening, which

in them is exceedingly large. Although birds do not possess the cartilaginous portal, or outer ear, yet their organs of sound are delicate. The Jay, the Magpie, the Bullfinch, the Parrot, and the Starling, repeat whole sentences with exactitude of pronunciation, and some of them whistle tunes with equal precision. But, in quickness of hearing, the Owl far exceeds all others of the feathered race. Nature has adorned some birds with a crest of long feathers, as the Lapwing and Peacock. Others are enabled to raise the feathers on the back-part of their heads, as the White-throat, Flycatcher, Chaffinch, Yellowbunting, Skylark, Woodlark, and Blackcap. Some are ornamented with a fleshy protuberance, called the comb, as in the Cock; others have a horny projection, as the Rhinoceros bird, and the Emeu; and some have a crest extending far down the back of the neck, as the Umbre. The wings of birds are almost as different as the forms of their bills; some have large, concave, hollow wings, as the Heron; others long-extended ones, as the Swallow and the Goatsucker; some have narrow wings, as the Waterouzel, Kingfisher, and Nuthatch. The wings of others are pointed, as the Sanderling and the Wagtail; while those of many other birds are rounded at the margin, like those of the Owl, the Partridge, and the Quail. In most, the secondary quill feathers are very short in comparison with the primary ones; but in the Sanderling, the Plovers, and the Rail, the primaries are but a little superior in length; and in the Goldenplover, the secondary feathers are indented, or serrated. Most birds are furnished with wings as instruments of flight; but there are some to which nature has denied the flag feathers, which assist their aerial motions, as the Ostrich, the Cassowary, and the Penguin. Still further to increase the speed of birds, or to render their motions more versatile, some possess long spreading tails, such as the Swallow, the Wagtail, and the Magpie. On the other hand, the Nuthatch, and the Waterouzel, the Partridge, the Rail, the Kingfisher, and most of the Duck tribe, have scarcely the appearance of them.⁵⁰ In some birds, the feathers

⁵⁰ Willughby contends, that the tail of birds principally conduces to steer their flight; but Borelli asserts, that the bird turns in the air more from the inclination of its head and motion of

which compose the tail are nearly of equal length, as in the Kingfisher and Waterouzel. In others they are forked, either greatly, as in the Swallow, or slightly, as in the Goldencrest, and the Titmice; in others, they are rounded, as in the Lapwing, the Redstart, and the Cuckoo, or wedge-shaped, as in the Magpie. Some have the two interior feathers covering the whole of their tails, when closed, as the Titlark, but most have but one. In many of the feathered race, these tail-feathers are weak and slender; but in the Woodpeckers and Creepers, they are firm, strong, and sharp-pointed. The thigh of land birds is commonly fleshy, and covered with feathers; but in the Waders, and many water fowl, it is partly naked.—In the males of the Coot and Waterhen, it is marked with a red circle, called the bracelet, which grows of a deeper red with the age of the bird. It glows more in spring, than in any other season of the year; though the bracelet of the male, after it has attained its second year, is always of a bright red. In the hens of these birds, it is generally of a greenish yellow hue. The legs of birds in general are bare of feathers, and unarmed, but those of the gallinaceous kinds have a sharp spur; and Owls, Eagles, Grouse, Cuckoos, Goatsuckers, and Martins, are booted, or feathered, nearly down to the toes. The external coverings of the legs of many birds are divided into scale-like plates, as in the Crow and Waterhen; plain, as in the Brambling and Fieldfare; and reticulated, as in the Snipe. The feet of birds in general are formed with four toes; three anterior, and one posterior; the exterior of which, in the Owl kinds and Osprey, may be occasionally turned behind: but many birds, such as the Plovers, the Bustards, and the Emeu, have but three; some have merely the appearance of the fourth, or extremely short, and apparently useless, as in the Snipe, the Gull, and the Rail. Others have four, as the Woodpecker and the Cuckoo, two placed

its wings, than from the assistance of the tail. Borelli errs, notwithstanding all his experiments, for every ornithologist knows, that birds with long tails perform, *with ease*, various evolutions in flight; but short-tailed birds, except the Snipe genus, turn with more difficulty, and generally fly in a straight line.

before, and two behind : while the Swift and the Goatsucker, by a particular conformation of the foot, are enabled to place their four toes forward. The Ostrich alone has but two. Some of the species have long legs and long necks, as the Heron ; others, as the Swan and the Goose, possess legs of ordinary length, with necks of immoderate extension ; and others have extremely short legs, in proportion to the size of their bodies, as the Goatsucker and the Cuckoo : and those which have long legs, have invariably long necks, to enable them to gather their food. The feet of most birds are so placed, as to preserve the body in equilibrium ; but in the Grebes and the Divers, they are situated so as to enable them to swim with facility ; but so far are they from the centre of gravity, that they walk on land with extreme awkwardness and labour. The toes in most birds are quite divided, though in a few they are partly connected by a small membrane, as in birds of the poultry kind ; while in others, as in the Nightjar and Ringplover, the inner and middle toes are united by a slight membrane, extending nearly to the first joint. In the red-necked Grebe, they are furnished with wide, oval membranes ; but in the grey Phalarope and Coot, they are narrow and scalloped. The membrane that margins the toes of the Waterhen, the Rail, and the Water-rail, is thin and narrow, merely skirting them ; but, on the other hand, the three fore toes, of the Goose and Duck kinds, are united, even to their extremities, by a full web. In the Shag, the Pelican, the Gannet, the Divers, and the Cormorant, their four toes are connected together by a similar web. The claws or nails of birds are sometimes slender and sharp, as in the Sparrow kinds ; broad, obtuse, and blunt, as in the Divers ; strong, sharp-pointed, and edged, as in the talons of Eagles and Hawks ; serrated, as in the Goatsucker, Cormorant, and Heron ; straight and slender, as in the hind toe of the Lark ; short and weak, with a small cavity on the inner side, as in the Cuckoo ; long and curved, as in the Titlark. In birds that seek their food on the waters, they are commonly small, blunt, and obtuse ; in those that seat themselves on the branches of trees, long and crooked ; in those that principally live on the ground, almost straight ; and in those that require

them as instruments of defence or rapine, strong, sharp, and firm.— Admirable, indeed, are the contrivances of nature, and always well adapted to the habits of the animal. Thus, the webbed foot of the Diver, the life of which is nearly spent on the watery element, furnishes an instance of the most incomparable contrivance and ingenious mechanism. The web contracts, when the bird uses no efforts to expand it, and the toes fold in a line beneath each other, presenting to the wave a narrow blade. The flexor tendons, from the foot to the leg, are of enormous size and strength, and powerfully compress the foot into this sharp front. As soon as the bird has pressed its wide-spread oar against the receding wave, and stretched it to its length, the muscles, which, by their elasticity, give way to its exertion, immediately draw the web and toes into their compressed state. The toes of land birds are so constructed, that when they are pressed together, at the centre or heel, they instantly clasp the object on which they rest. This beautiful construction gives security, without exertion; and in proportion to the rapidity of the motion of the seat, the more forcibly do the toes contract; as the contraction arises as well from the pressure of the branch, as from the weight of the body of the bird. By this conformation, the wise Creator has provided for the safety of the feathered tribe, even in the season of repose. The fury of the storm may threaten destruction to every thing in its course, the oak tremble at its base, and its top prostrate itself before the wild force of the tempest; yet the gentle, timorous dove sits cradled in security among its branches, heedless of danger; or sleeps soundly and safely amid the frightening terrors and awful convulsions of nature.

CHAPTER III.

Of the Incubation and Migration of Birds.

SPRING is the season of increased animation ; then, with the same bountiful hand with which Nature paints, in a thousand hues, the opening buds of the vegetable world, she diffuses fresh sources of life and gladness over the animal. All things that live own her renovating influence ; and even the chilling cold of winter, the howling blast, and the drenching torrent, seem willingly to yield their sceptre to the grateful beams of the sun, to milder zephyrs, and more congenial skies. A rich exuberance of food succeeds the scanty and precarious supplies of the frozen scene,—giving a fresh impetus to the blood, and exciting to softer desires. Thus encouraged and impelled, the little warblers resume their songs and their loves. Nature no longer lies hidden in a death-like silence ; every wood echoes responsively to the warblings of its tenants, every bush is enlivened by some feathered songster. How delightful the scene ! The sun rises in all the splendour of unborrowed light. Not a cloud darkens the blue vault of Heaven. Not a breath of wind ruffles the waters. The trees display their luxuriant foliage, and spread their umbrageous arms in wild extravagance, as if conscious of their dignity, in the grand spectacle of Nature ! More humble, yet more gaily caparisoned, the beautiful productions of Flora chequer the hedges and the green sward ; and, by mingling their various dyes, throw a richness over the whole. Man walks forth conscious of his dignity ; his ear is soothed with the melodies of the feathered throng ; his eye is captivated by the beauties around him ; he stands entranced in

ecstasy, and in rapture he exclaims, "These are thy glorious works, Parent of Good!" If the heart be unsophisticated and untainted, it prefers the loveliness of Nature, before all the allurements of artificial pleasures, and delights in participating in the general joy. It glories in the pleasing employment of unveiling the secrets of natural economy, of unravelling its mysteries, and elucidating the relations and concordances of the vast chain of universal being. The feathered tribes justly claim a part of his attention, as they conspire to enliven the scene with their songs, afford him a nutritious food, and destroy his minute foes: and it is at this season they are seen to the best advantage. At the approach of spring, the social spirit, which unites them in flocks, gives way to a stronger impulse; they then seek for mates to raise a progeny. Among their tribes, numerous species preserve their union with inviolable fidelity, and associate together even throughout the winter. The Golden-crested Wren, the Marsh-titmouse, the Hedgesparrow, the Stonechat, the Bullfinch, the Misselthrush, the Magpie, the Crow, the Raven, and the Eagle, often exhibit bright examples of conjugal love, and participate in one of the highest endearments of human existence. In the opening of spring, the male bird either seeks for a female, or awaits her arrival. In the latter case, he seats himself on some conspicuous branch, and pours forth loudly his amorous song. Oftentimes many females approach, accompanied by other males, then the strength and courage of the rivals are put to the test; and, spurred on by emulation, they exert themselves in battle for the favour of the favourite fair one. A great deal of coquetry is practised, nor is the conjugal engagement the work of a moment. Generally the older birds succeed in prowess; but the female is not always the prize of the victor. Sometimes, she is pursued by her lover, even for days, before she yields, and often all his labours are mispent. They practice so many uncommon evolutions at this period, and exhibit their passions in so many strange ways, that it well repays the attention of the contemplative mind, to trace them through their days of love. Now the male sounds in his loudest tones his threats of defiance; and in the next moment melts into a melan-

cholic softness, and woos the female in tender strains. Then he changes his notes to an harsh, broken, discordant, and quick-repeated chirp, and pursues her, from branch to branch: she often answers him; and this courtship will frequently continue, without intermission, for an hour. If the male be still unsuccessful, he again tries to subdue the obduracy of her heart, by the charms of music; and his song exhibits the wild, rapturous effusions of desire, mingled with the more modulated cadency of his calmer moments. He runs through his scale of powers, to arrest her attention; and dwells on those notes which seem to express, with most energy, his love. On the appearance of a rival, his crest rises in rage, his wings beat rapidly, his feathers swell, and he resumes his provocations to combat. But when the connubial engagement is concluded, the rivalry ceases, and the united pair, formed for themselves alone, search for a proper situation for their nest. With assiduity and skill birds in general prepare to form in conjunction (for in most instances they are both equally active in the important duty) their habitations; which are commonly distinguished by the figure and materials, of which they are composed. Some are contented with a slight depression of the earth, or a few sticks slovenly put together, the hole of a tree, or the bare wall of a barn, while the Sparrow Hawk, the Kestrel, and the Brown Owl, often perform their incubation in the nest of the Crow, the Magpie, and the Daw. However, individuals of the same species will often use different substances, in the composition of their nests, to suit the climate, or situation, in which they are built; contrary to the unfounded assertions of those, who aver that birds of the same species always make their nests with the same materials, and of the same form and in similar situations. To those persons who have more accurately studied their economy, this assertion instantly appears untrue. Even the Little Wren offers many proofs which demonstrate their error. At one time its nest is externally covered with moss, or white lichen, at another with straw, or withered leaves; suiting its external covering, to its situation, in order to conceal it from the eyes of its foes. The Hedge Sparrow, early in the spring, lines its nest with feathers alone, to render it more warm and

comfortable to its young: and the House Sparrow, in the hot months of summer, frequently deserts its cup-shaped fabric, in its favorite hole, to build one on a tree with a canopy, like the Magpie and the Wren.³¹ These are familiar examples, and every one may recognize them. They may be supported by instances obtained without much trouble or pain in the research. Between the tropics, birds in general are more careless in the construction of their habitations than in colder climes; but they exert greater ingenuity to secure them from their enemies. In our country, the water fowl content themselves with an ill-formed nest; but in the bleak, cold regions of the north, many of their species use every precaution in their power in the formation of their abodes, to counteract the effect of the chilling atmosphere: still is it true that, in general, each species preserves a peculiar architecture; but which, as we before observed, is often modified and varied by individuals, to suit particular purposes, and different climes. The same bird, which in the forests of Senegal would be satisfied with a light, cool apartment for its young, would require, on the northern confines of Tartary, a nest more warm, more skilful, and more commodious.³² The Duck, that, even in England, incubates in a loosely-constructed nest, slovenly composed of a few dry rushes mingled with a few feathers, would, in Kamschatka, or in Lapland, tear the plumage from its own breast to line the habitation intended for its progeny. The buildings of birds may be correctly divided into, nests *with*, or *without*, a canopy. Those that build their nests in trees, and hedges, *without* a canopy, rarely lay more than six eggs; while those that erect a canopy, with a small aperture, for ingress

³¹ And even the Magpie itself I have known to erect its nest, without its usual canopy.

³² There appears, even in the nests of birds, a regular gradation, from the unimproved spot on which the Goatsucker deposits her eggs, to the artless fabric of the Wood-pigeon; and from that to the elegant structure of the Chaffinch. The Pigeon, as we have before observed, lays but two eggs, and its nest is a clumsy contrivance. The Jay, that lays three or four, passes, in its building, only a step beyond it. The little birds, which in common deposit five or six eggs, approach nearer to perfection. The Willow Wren, the Pettychaps, and the Magpie, which lay seven or eight, cover their apartments, but neither so neatly, nor so warmly as the Wren.

and egress, lay many eggs, and consequently require a warmer apartment. The Wood Pigeon composes its nest of a few sticks, most awkwardly put together ; it is, in fact, a mere restingplace for its young, which never exceed two. The Jay, that raises an artless fabric without a canopy, seldom lays more than three or four eggs ; but the long-tailed Titmouse, and the Wren, the nests of which are canopied, have often from eight to twenty young ones. The Willow Wren, which also raises a canopied nest, but with a wider entrance, incubates on eight or ten eggs. The Goldfinch, the Linnet, the Chaffinch, the Whitethroat, the Bulfinch, the Thrush, the Hedge Sparrow, the Blackbird, the Green Grossbeak, the Sedgebird, the Reed Sparrow, the Yellow Bunting, the Red-backed Butcherbird, and the Titlark, and many others, the nests of which are cup-shaped, and without a canopy, rarely lay more than five. The Golden-crested Wren, which often deposits eight or nine eggs, to obviate the necessity of a canopy, forms its nest in a deep, oblong or purse-like shape. But birds that deposit their eggs on the ground, or in holes of trees, or walls, often rear many young ones. In the former instance, the earth retains and imbibes the heat of the sun-beams, and in the latter, the warm places, in which the nests are secreted, in a great degree compensate for the want of a canopy. With consummate art and elegance numerous species of birds select and unite the materials of which their nests are made, especially among the Sparrow kinds. In most of these, the male and female are alike actively employed. As the volume of their bodies is small, they in general use the warmest substances which they can procure. The down of the thistle, and other vegetables, the silky substance of the rush, the wool and hair of animals, and even their own feathers, constitute the interior linings of their commodious dwellings. In our climate, the Chaffinch, the Golden-crested Wren, and the long-tailed Titmouse, far exceed all their fellows in the neatness and beauty of these structures. The interior of all is in some degree depressed, and of the Sparrow kinds shaped nearly in the figure of a semicircle. No other form would answer so well. The eggs, which by their own weight, and the inclination of the nest, are pressed toward the centre, there meet the body of the bird,

and, consequently, are incubated in an equable temperature. Were the bottom flat, it is obvious that some of them might lie in the angles, and the body of the parent rest on the lining, instead of its eggs. In the choice of situation, birds regard the readiness with which they can obtain their food; and near those places in which it can be found in greatest abundance, or where they expect security, they fix their abode. Thus the Kingfisher and Water Ouzel build in the banks that margin our rivers. The Water Hen, and the Water Rail, amid rushes, or in hollow places, near ponds and streams: and the House Sparrow, in holes of walls. Thus the Missel-thrush, although in its general habits a shy and timid bird, resorts, in the spring, to the orchards contiguous to our dwellings, to avoid the predacious attacks of the Hawk, the Magpie, the Crow, and the Jay. Old birds, in general, begin first to raise their little habitations; and, from experience, place them more cunningly than the younger ones: and some species take infinite pains to secure theirs from the sight. The Nightingale artfully hides its nest in the bottom of a thorn, at the top of the hedge, covering the outside with withered leaves. The Stonechat, and the Whinchat seek a retreat under some little bank, or bush, and endeavour to conceal their nests with great skill. The nest of the Wheatear is not less cunningly hidden; and the Little Wren, in every situation, contrives to make the outward appearance of its comparatively-large apartment, as similar to the bank, or hole, in which it is placed, as its ingenuity can suggest; and the Golden-crested Wren, when it erects its nest beside the trunk of a tree, seeks for one covered with ivy, in which it may be entirely enveloped. Among the most early in the business of incubation are, the Rook, the Robin, the Wren, the Blackbird, the Hedge Sparrow, and the Thrush: and among the latest, the Yellow Bunting, the Cirl Bunting, the Goatsucker, the Linnet, the Greenfinch, the Goldfinch, and the Wood Pigeon. Few nests are found before the beginning of March, and fewer after the month of August. Some birds are remarkable for their ingenuity in rearing the little fabric, particularly the Swallow and the Martin; perhaps from them the idea was obtained of raising for our own habitations walls of straw, incor-

porated and blended with mud. The construction of the hemispheric nest of the Martin is, while it continues, a work of severe labor and toil ; as soon as the morning appears, the old ones mutually prepare to erect it. After the birds have fixed on a situation, they endeavour to lay a foundation, on which to rear the curious superstructure. This, in general, is an object obtained with difficulty : and they will sometimes erect many little lines of foundation, and desert them. They commonly raise two layers in a day ; one in the morning, and the other in the evening ; so that sufficient time may intervene to indurate the materials, and render them fit to support the weight of succeeding depositions. They begin the nest on the outside, clinging in a perpendicular posture to the wall, until the layers are sufficiently high to work upon from within. They then enter, and fixing their tails against the wall, they become the centre of their motions, and thus they readily form a semicircle around. They use their bills, for placing the materials in order, and oftentimes their chin, for compressing them together. Each layer, at first, consists of about one-sixth of an inch in thickness, until they are enabled to work on the inside, and then they raise deeper ones, and more extended, from one-third to half an inch in thickness, and sometimes even more ; and two of these layers are frequently raised in a day : but the foundation alone is sometimes a work of many days, as they are often obliged to stud the wall along for many feet, before they are satisfied with its durability. Sometimes they appear to be actuated by more than common activity ; at other times they raise but a slight deposition, and employ themselves but a short period in their labours. The materials used externally are mud and bits of straw, or other slight substance to make it cohere ; the former, if possible, is taken from the moist margin of a pond, or miry place ; but if the bird cannot procure materials thus ready for use, it selects a bit of dry mould, or clay, and flies to some neighbouring spring to wet it. This action is performed on the wing ; it skims along just above the surface of the water, frequently dipping its little bill in the stream. At other times, when it can discover the materials prepared, it mingles them together with little pieces of straw, or grass, with its bill. Every particle, of which the structure

is composed, is attached with great art and labor. The bird first spreads it close to the former depositions, and then intermingles it, by passing its bill down through it and the upper part of the lower layers, by a continual motion of its head; an act similar to the movement of the spill in drilling. By this operation a hole is made through the portion of clay added to the nest, and extended slightly through the layer beneath it. The next addition fills up this orifice, and overspreads it at the top, so as to connect it with the contiguous parts. A similar method is again employed; and the whole of the external shell, or incrustation, is raised on the principle of tubes fixed one in another, each at the top, as it is inserted, lapping over the one beneath. These overlappings are united, in a similar manner, across the intermediate space. A small orifice remains open for the ingress and egress of the owners; and when the exterior is completed, they line the interior with straw and feathers. The male and female sometimes work together, at other times in succession, each waiting till the other has finished its labor; the erection and the lining of the structure commonly employ them a month. The nest of the long-tailed Titmouse, though different in form and materials from that of the Martin, is equally as curious; and it is not a little surprising to mark this active, but diminutive bird, inserting in the bark of the tree, or twining round some small limb, the mossy materials of its foundation. Few birds use the same nests again; but the Eagle, the Martin, and the Swallow, resort to their former habitations for many years successively; and the Hedge Sparrow, the Robin, the Titmice, the Nuthatch, the Shag, and numerous species of the Gull kind, return to the neighbourhood in which they had before reared their young. When the nests of birds are finished, the important business of depositing their eggs commences; the greatest numbers of which are produced by the Duck, and gallinaceous tribes, the Titmice, and the Wrens. The smallest, and weakest kinds, or those that are most exposed to various enemies, without weapons to repel their assailants, which trust to their minuteness, their color, or their art, to escape; are commonly most prolific. To repair the devastations committed on their numbers, nature, careful to continue the species in the preservation of the

individual, has bestowed on them a proportional fecundity; and their prolificacy, in a great degree, counteracts their danger. The poultry tribes, and the Woodpeckers, Creepers, Coots, water, and land Rails, deposit more than the usual number laid by birds of the Crow, Hawk, and most of the Sparrow kinds. The Eagle, the Owl, and the Pigeon, in general, deposit but two eggs: the Guillemots, the Razor-bill, and the Puffin, rarely more than one; sometimes the eggs prove effete and barren; and at others far inferior to the common size.³³ Of all land birds that incubate in Devon, the egg of the Snipe, in comparison with its body, is the largest; and that of the Cuckoo,³⁴ the smallest: the former being superior in size to the egg of the Magpie, and the latter inferior to that of the Skylark. The eggs of birds, in general, do not bear proportion to the bulk of those which lay them: that of the Kite is considerably larger than the egg of the Raven; and that of the Guillemot is superior to the egg of the Turkey: the common Gull's exceeds, in size, the egg of the Fowl; and the eggs of the Razor bill, and the Fulmar, are longer and larger than those of the Pheasant. The most oval are presumed to contain males, and the round, and more obtuse ones, females: this is not a modern opinion. "*Fæminam edunt quæ rotundiora gignuntur, reliqua mærem*" says Pliny.³⁵ While the female is in the act of incubation, she is the most perfect pattern of patience and perseverance. The urgent calls of hunger remain long unsatisfied, and the appearance of danger ceases to intimidate. The Chaffinch, the Greenfinch, the Robin, and the red-backed Shrike, the Blackcap, and the Linnct, the Nuthatch, the Sand Martin and the Titmice, will often suffer themselves to be taken, rather than quit their eggs, and will continue, when undisturbed,

³³ I have found eggs of the Blackbird, Redbreast, and Hedge Sparrow, very far inferior in bulk to their common size.

³⁴ Some writer on Ornithology avers, that the egg of the Cuckoo is of the size of that of the Thrush; he evidently could never have seen it.

³⁵ *Ova parire solet genus pennis condecoratum non animas.* Ennius.

to sit on them until they are reduced to a state of debility and inanition: but the Yellow Bunting, that in common is so tame and familiar, will rarely return to its nest when once rudely driven from it.³⁶ Truly wonderful is the art which the hen displays: she turns her eggs with unwearied assiduity; she leaves them, when the warmth of the body has engendered too great a degree of heat, and she watches them with extreme anxiety until they are properly cooled;—and of some species, such as the Duck, and the Water Rail, the female, when she quits them, covers them with rushes. In our climate, one pair alone joins in nidification and incubation. The long-tailed Titmouse is the only exception, with which we have ever met.³⁷ Two pairs of these birds had united to share the toils and pleasures, of raising and supporting their mutual progeny. In these pleasures, the male of most species seems to participate, from his apparent transports and anxiety. Among the smaller tribes, the female's domestic care is soothed by his tenderness, caresses, and song. And in such as the Owl kind, the Nuthatch, the Woodpeckers, the Robin, the Chaffinch, and the Greenfinch, and most of the Sparrow tribe, the female, after she has engaged a few days in the business of incubation,³⁸ obtains a great part of her subsistence from his labours. She leaves her eggs only when disturbed, or when the pressing calls of hunger compel her: and most frequently in the incipency of incubation; as the period of the birth of her young

³⁶ I have seen the male Yellow Bunting in the nest, even before the number of eggs usually laid by its female is deposited; and I have frequently, towards evening, found many of the smaller tribes seated on their eggs, before the period of incubation had arrived.

³⁷ In the year 1798, the Author, in taking a walk with a friend, discovered a long-tailed Titmouse's nest, in which were thirteen eggs, and on which were then sitting three old birds; the fourth was seated in a neighbouring bush.

³⁸ The white Owl has frequently young ones in one nest, and eggs in another close adjoining; in that case the male principally feeds the young: and I have been assured, by a person on whose veracity I can rely, that he knew a pair of white Owls which had, at the same time, two young ones full fledged, two just hatched, and two eggs in a third nest, within the same barn.

approaches, she increases her assiduity and care. The greater part of the business of incubation devolves on the hen.³⁹ If she observe that she is watched, she will cautiously avoid returning while the observer is near, and if she be driven from the nest she steals privily from it, and endeavours to escape without notice. She retires from the sight by a slow, silent movement, through the thickest part of the bushes that surround her. The males of most of the Sparrow kinds, during the period of incubation, select some favorite branch contiguous to their nests, from which they serenade the female: but the males of the Hawk kinds keep in general at some distance. Touch but the eggs of the Wood Pigeon, the Blackcap, the Yellow Bunting, the Whitethroat, and the Redstart, and they will in general forsake them: but the Robin, the Chaffinch, the Hedge Sparrow, the Blackbird, the Thrush, the Linnet, the Greenfinch, the Titmice, and the Red-backed Butcherbird, will often suffer a part to be taken away, and changed for others differently coloured, or of a different size; follow their nest, though it be removed to some distance from the place in which they erected it, and hatch and foster the adventitious progeny.⁴⁰ But this peculiarity appears like caprice, since birds of the species just mentioned as less shy than their fellows, will often desert their nests if they be touched, and yet at other times they will sit on, and hatch the eggs of other birds, and even carefully attend the suppositious brood. The larger the bird, the longer time, in general, are the young in attaining maturity. The smaller species are commonly excluded in fourteen, or at most sixteen days, while others, such as the gallinaceous and Crow kinds, in about twenty-one; many

³⁹ It is not a little remarkable, that the male Yellow Bunting attends more to the duty of incubation, in general, than the female.

Birds commonly quit their eggs for a short time in dark cloudy weather, to feed, as if aware that the cloudiness of the atmosphere presaged the coming of rain.

⁴⁰ I have often removed the nests of birds of the Sparrow kinds, and I have found many of them follow them even *before* they were finished, and at the time of incubation, and when they contained young.

of the Duck species are hatched in twenty-eight days; but the Swan incubates nearly two months. The young of the Hawk, and Owl kinds, and of the Plovers, Water Hens, Rails, and poultry tribes, are at first covered with a soft down; and birds so clothed, when excluded, are in general a long time before they are full fledged. Some run as soon as they quit the shell; this trait is conspicuous in the gallinaceous kinds, and the young ones of the Goatsucker move from their nests at a very early period: others, like most of the Sparrow race, lie in a state of imbecility for weeks, alike incapable of supplying their wants, or escaping from danger. Young birds are voracious, and importunate; and it is with labor and difficulty that their wants are supplied; but the affection of the parents lightens the labor, and with unwearied, and, most probably, pleasing exertion, they fulfil the incumbent duties of their new situation. While the female is feeding the little ones, the male is assiduously searching for food, and by the time she quits the nest, he has approached it. Thus alternately employed, and relieved, they pass their days in the most grateful of all duties, the rearing of the pledges of their love. When the old one draws near to the nest, a gentle twitter announces its return, and as all are equally eager, the mouths of the whole brood are open to receive their food; which is distributed among them with as much impartiality, as the care and affection of the parents will admit. The one at the top, which is commonly a male, and generally the strongest, in defiance of their endeavours, often steals from his hungry brethren their portions. Sometimes the old ones feed their young in succession, after having satisfied the appetite of each individual. At other times, they pass immediately on, from one to another in instant succession. Many birds are remarkably attentive to cleanliness, particularly among the Sparrow tribes; though the Golden-crest, like the Hawk and the Owl, perhaps from the depth of its nest, suffers its young ones to repose on a congeries of filth, insects, seeds, and dung. When the young have attained sufficient vigor, and plumage, to follow their parents through the trackless air, they are essayed in the art of flying, which is frequently practised, until, experienced in the exercise, they can fearlessly ascend the untrodden sky.

“ But now the feather'd youth, their former bounds
 “ Ardent disdain, and weighing oft their wings,
 “ Demand the free possession of the sky.”

The anxious solicitude of the parents at this period, and their skill in instructing their progeny in the use of their pinions, form a scene highly gratifying to the contemplative mind. The young birds are roused from their state of inaction by the old ones, and they assemble on the sides of the nest. Then one of the parents, from an adjoining branch, begins the instruction, by first spreading abroad and fluttering its wings. It then slowly descends to the ground; this is frequently repeated. The timid and fearful young ones this moment appear determined to launch into the air and quit the nest, and in the next, overwhelmed by apprehension, they cling more closely to it, and by cowering display their fears. The parents use a light, airy chirp to stimulate the trial, and the young, thus encouraged, recover from their fright, and again make the attempt.⁴¹ If they are still intimidated the old one enters the nest, and compels them to quit it; and, when they reach the ground, a general twittering displays the joy of the family in the accomplishment of their desires.⁴² Few young birds return to the nest, and those which do are principally of those kinds that build and sleep in the cavities of walls, or in the hollows of trees. The care of the parents is still exerted; they hover round their artless little ones to give them protection; they point out places, in which to find subsistence; they lead them to shelter from the storm; they instruct them to avoid dangers, and discover for them retreats for their security, and repose. When they have attained the arts, which enable them to support themselves, if the parents look forward to the production of a second brood, they quit to join promiscuously in autumn, perhaps unconnected by affection, with the flocks of their congeners. But many of those species that have but one brood in a season, except their first be taken away, or destroyed, or which, having more than one, such as the Blue Titmouse, the Jay, the

⁴¹ Thomson's description of the first flight of young birds is as beautiful as it is accurate.

⁴² The stoics denied affection to beasts, and contended for a blind impulse. “ *Affectibus carent, habent autem similes quosdam impulsus.* ” Sen : de ira.

Woodlark, and the Bulfinch, associate together, with their young ones, and form the little family flocks which are so common in the autumnal season, and which separate only when impelled by hunger, or when they feel the impulsive call of the soft passion of love.

It is obvious, that those birds which are hatched and taught to provide for themselves earliest in the spring, are more strong and vigorous, as they are older, and of course more experienced, and better able to maintain themselves, than those of later broods. Many individuals continue their incubation to a late period; robbed of their former nests their efforts are repeated to raise a progeny. Numerous species have commonly two broods, as the Robin, the Yellow Bunting, the White Owl, the Red-backed Butcherbird, and the Wagtail,⁴³ and some, as the Wood Pigeon, are supposed to have even three, within the year; but if the egg be withdrawn the female of many species will continue to lay beyond the usual number. It is, therefore, probable, that though the eggs in the ovary do not in the spring appear in a state to be produced, yet a few days will bring them to maturity, if the female endeavours to exclude them; and that the number laid in a season in some degree depends upon the inclination of the individual.⁴⁴ It is well known, that if a

⁴³ I have known many birds to have two broods in the year. I mention this because some naturalists have doubted the fact. The Robin, the red-backed Butcherbird, the Sparrow, the Yellow-Bunting, the Wood Pigeon, the White Owl, the Greenfinch, commonly breed twice in a year.

⁴⁴ Four pairs of red-backed Butcherbirds built within a short distance of the town of Ashburton, in the year 1807. Although I had frequently tried to discover whether the same bird would again build and deposit eggs, if deprived of its nest, and had been fully satisfied by the result of numerous experiments; yet, as these birds are not very common in Devon, I was determined to repeat the trial on them. I took out one of their nests with five eggs in it, which was built in a large thorn, and in eight days it had erected another in a bramble, contiguous to the thorn, and laid three eggs. I took away the *second* nest, and in ten days more it had rebuilt a new habitation, a few feet from the situation of its former one, and laid four other eggs. I then suffered it to sit a brood, and endeavoured to conceal it, but it was so artlessly placed, that it was shortly afterwards discovered, and taken away. Another pair built adjoining my house. On the third of June, 1807, *five* eggs were in the nest, which I broke out, leaving behind a small

bird that usually hatches but once in a season, be deprived of her nest, with the whole number of eggs which she would have laid that year, had she been successful in incubation, that she will again build, and deposit a second and even a third lot. This evidently proves the assertion, that the number of eggs laid in a season in some measure depends on the inclination of the individual. In all birds the rudiments of their eggs have existence before impregnation, and they may readily be discerned in a chain, or link of little yellowish knobs, covered by a fine medullary film in the ovary. But these rudiments, though in appearance they form a perfect egg, are never prolific, or produce an animal like the parent, until they have been fecundated. Of the chain of eggs in the ovary of the female bird, only a part in general is impregnated at the same time, according to the pre-established rule of nature as to the number usually laid by the species. Though sometimes the female produces more than her common number, and at other times less. The stimulant, whatever it be that causes the egg to increase in size, separates it from the common chain, and protrudes it into the uterus, frequently acts without the influence of the male; and this accounts for the unimpregnated eggs often discovered in the nests of birds. From a defect in the parts of fecundation, she will sometimes, though rarely, deposit eggs of a smaller size, or different formation, or without the calcareous shell, in a thin vellum-like cover; or of monstrous disproportion, inclosing two yolks, and sometimes with two shells. In general, the eggs which the bird in a wild state lays, are produced in daily succession; so that the short period of twenty-four

part of its outside; in seven days the birds had re-lined the part left, and the female had deposited in it four eggs. This nest was also taken out, and in nine days more they had built a new one, distant nearly thirty feet from the former, and the female laid in it four eggs; which it hatched. I knew the nests of the four pair, and it should be remarked, that the eggs of each differed considerably from the others in their colours and markings: in those of one pair the ground was a light grey, with a few purplish spots, and very round; of another quite white and elongated, and with many brown spots: of the third, the egg was ivory white, with a few rufous spots, at the larger end, and the egg of the fourth was of a bluish cast, thickly beset with brown and ash-coloured spots.

hours is, in most instances, sufficient to surround the yolk in the uterus with the albumen and shell. But nature seems to have denied to the Cuckoo the power of producing eggs in such quick succession; probably many days intervene, as to her, between the production of the first egg, and the succeeding one, as the eggs in the ovary, at the time when the female Cuckoo is ready to lay, do not follow of a gradual size; the primary ones in the chain, or those which seem to be fecundated by the male, are irregular and disproportionate.⁴⁵ Perhaps this is the cause why the Cuckoo makes no nest; and as she would naturally feel no desire to incubate before she had deposited her first string of eggs, and as many days, nay, probably weeks, might pass away, before the last of the number fecundated would be produced, the prior egg, from the lapse of time, might be rendered inefficacious for incubation. The egg is divided into two parts, the vitellus, the yellow part or yolk; and the albumen, the double coat of white fluid; the former is surrounded by a thin film without blood-vessels, and then by the albumen, which is separated from the vitellus by a thin membrane.⁴⁶ Both the vitellus and the albumen are internally surrounded by a fine, but strong film, and externally, by an hard and testaceous substance, called the shell. This, in the eggs of some birds, as in the gallinaceous tribes, Pigeons, Woodpeckers, Martins, and Swifts, is white on the exterior surface; and in those of most other kinds, either of an uniform colour, or tinged or painted with streaks, patches, or spots. All eggs are

⁴⁵ The cause assigned by Monsieur Herissant cannot be the reason of the non-incubation of the Cuckoo. He adverts to its internal anatomy, and mentions the peculiarity of its stomach resting far back on the abdominal viscera; but such, in this respect, being also the conformation of the Goat-sucker, the Rook, the Bittern, and many others, it consequently follows, that as these birds incubate, it cannot be fairly assigned as the cause of the Cuckoo's non-incubation.

⁴⁶ I have seen an hen's egg of the shape of a lozenge, and some eggs from domestic fowls, as small as filberts, others nearly as large as the eggs of the goose; and I have found eggs in the nests of the Hedge Sparrow, Robin, and Blackbird, and of some other birds, greatly inferior to the common size.

white within. The external paintings on the shells of the eggs of the Sparrow-Hawk, Kestrel, and most of the carnivorous kinds, may be effaced by slight attrition; but the colouring of the eggs of the Hedge Sparrow, the Whinchat, and of most of the Sparrow tribe, is durably imprinted. The yolk, at first, before it descends from the ovary, is without the double white, which we have before mentioned: It is in the uterus that it is first surrounded by it. At the ends, or extremities of the exterior vitellus, are two little, white, flaccid ligaments, called the chalazæ, or cords, connected with the membrane that lines the shell; they are twisted, small and round, next the yolk, and terminate in a fringe-like substance.⁴⁷ They are evidently formed from the membrane that encloses the yolk. Willughby, Ray, and Derham, supposed, that they were intended to keep the smaller part of the yolk, in which lies the cicatricula, or couch, of the incipient animal, always uppermost, that it might receive a greater portion of the incubating heat: but this assertion Haller denies, and avers, that the animated being is found indifferently below, as well as above. As the hen, during her period of incubation, turns her eggs, this action corroborates, in some measure, the opinion of Haller; because it cannot be material to the formation of the chicken, whether the cicatricula recover its position from the action of the chalazæ, or the care of the Hen.

⁴⁷ The length of time, in which any of the feathered race becomes effete and barren, has not as yet been ascertained; but I am inclined to believe, from numerous observations, that birds continue to lay much longer than the period commonly supposed. A hen, belonging to myself, was killed by accident, whilst laying, after she had been in my court seven years; and she laid within three days after she was first brought thither. When she was killed, there still remained a string of fifty eggs at least in the ovary, and I have now a small egg in my possession, almost of a lozenge form, which was laid in the year 1793, by a hen, (as I was informed by a friend of undoubted veracity) then eighteen years old. I have dissected several female Goatsuckers, and I found in the ovary of one of them sixty-three eggs, in that of a Water Hen upwards of an hundred; and fifty in the ovarium of a Kingfisher. I have commonly found the string of eggs in the ovaries of most birds so great in comparison with the number usually laid by them in a season, that I strongly incline to think, that the greatest part of the feathered race would be fruitful till within a short period of their natural extent of life.

Prior to its exclusion, this membrane, which embraces the whole of the egg, indurates, and forms the shell; but it is not nearly so hard in the body of any bird when it has attained maturity, (except the Cuckoo) as after it has been exposed to the atmosphere. About the centre of the yolk lies a little filmy circle, containing a thin fluid, surrounding a small white speck, from which the bird springs: the former is called the cicatrix, and in which the speck floats, as in a cradle. This speck begins to expand within one hour after incubation, drawn into being by the external heat. It is probable that, though it appears as a small crude, ill-formed, and ill-digested mass, that it contains within itself, though hidden from human sight, all the parts of which the bird is composed; and which are regularly developed by the result of the action of the vital principle, which disengages them from that lethargic state, in which they before reposed. Shortly after incubation, the cicatrix enlarges, and red blood may be discerned on the surface of the yolk bag, at the end of thirty-six hours. In the beginning of the third day the heart is seen to beat; the backbone thickens, the head is bent; the eyes appear, and crimson blood begins to fill the little vessels that lead to the heart. Its movement is then distinguished by a triple pulsation; the eyes, by their immense size, and the black dense fluid with which they are tinged; and the vertebræ may now be distinctly seen. On the fourth, the stomach, intestines, and liver appear, and a vascular film rises round the navel. This is supposed to supply the place of the respiring organs, which become discernible on the following day, but do not perform their office until the chick escapes from the amnios, the name by which the cicatrix is known when it is much enlarged. On the fifth, the wings unfold, and the points of the feathers appear. On the sixth, the chick moves voluntarily, and the abdominal viscera are greatly increased, and both ventricles of the heart may be discovered in active pulsation. On the seventh, the juice that ossifies is secreted, and the heart wears the appearance of having two separate ventricles; and two successive pulsations may be remarked both in the ventricles and auricles, as if there were two hearts. By the eleventh day, nature has completely developed

the form and combination of the little being; on the fourteenth, the animal opens its mouth to breathe, if the shell and surrounding membrane be broken. The incubatory heat dilutes the white which is supposed to be pressed into the vessels of the chicken through the yolk, by the action of the air enclosed between the membrane and the albumen. In the same manner the yolk grows more fluid, changes to a greenish hue, and is absorbed by the chick, and serves for its food. It continues to increase in size and strength, until the time arrives when it bursts from its imprisonment. This is sooner or later, according to the species to which it belongs. At each end of the egg is placed a small bag, containing air, which is encircled by the thin membrane that lines the shell, and this air expands with the heat of the parent, and affords a supply to the incipient and evidently breathing animal.⁴⁹ The most capacious of the air bags lies at the

⁴⁹ This is a short account of the progressive growth of a *chicken*, which, as soon as it escapes from the shell, commences a life of activity. Those birds, which remain in inactive imbecility for many days, wear a very different appearance in their reciprocal periods of incubation. At the time when the young of the Sparrow, of the Hawk, and numerous other kinds, burst from their confinement, they exhibit the picture of helpless beings. They are totally incapable of the least active exertion; their frames are without vigour, their legs without strength, and their eyes without sight. Indeed, most birds are born blind. As soon as the young one quits the shell, a small black line may be observed across the eyelids; the eyes are closed, but they, as well as the abdomen, appear of disproportionate and monstrous size. If the lids be forced open, the pupil and iris of the eye are obscured by a film, and overspread by a light mucous substance. At the end of three days, in many of the species, the little animal seems to peep through the lids, but it is still incapable of distinct vision. At the end of five days it begins to notice objects, and its power of sight is greatly increased in strength. At the time of their emancipation from the shell, the young of the Sparrow kinds are slightly clad in a long down, which is soon removed by the incipient feathers: this down is of different colours in different birds; in the young of the green Grossbeak, it is of a pure, snowy white; in those of the Whinchat a rufous yellow; in those of the Robin, and of the Hedge Sparrow, dusky; and in those of the Water Hen, quite black; in the young Hen Harrier of a faint blush colour; in the young Wood Pigeon, as well as in the young of the Hawk tribe, it resembles wool. Little black dots, scarcely discernible by the naked eye, mark the places of the quills; a few similar spots are found round the rump, though some birds, such as the Goatsucker, and some others, when they escape from their imprisonment, are nearly clad in feathers.

larger end, and the air contained in them communicates with the chicken through the fine pores of the membrane, and serves, at the same time, to resist the pressure of the surrounding atmosphere, supply it with air, and act, most probably, by mechanical pressure on the fluids that are absorbed by it.⁵⁰ We, as well as many other persons, have heard the young bird chirrup in the shell; an act which indubitably proves that it breathes in air. When it has attained the state of maturity, it exerts its efforts to escape from confinement, by stretching its body, or by piercing the shell with its bill. In this operation the patient parent often assists. The noblest parts of the animal rise first into existence, whilst the most ignoble members, or those on which its vitality does not depend, receive the vivifying touch from the hand of nature later in time. This wonderful and curious process, which, from a mere speck of jelly-like germ, educes into life a surprising specimen of living organization, arrests our attention. In a few short weeks, the motionless speck, which lay, for a time, concealed within a small portion of the compass of an egg, darts unfettered through the unbounded horizon, with the rapidity of lightning, or the swiftness of the storm; crosses vast seas in search of subsistence; roams from empire to empire; or strays from the ice-bound countries beneath the poles, to the hot and steaming waters under the line. Birds, in general, except the rapacious kinds, prefer the neighbourhood of the habitations of men; there, though fear often prevails over their inclinations and appetites, they delight to haunt. The Rook, the Blackbird, the Thrush, the Sparrow, the Redbreast, the Wren, the Yellow Bunting, the Cirl Bunting, the Hedge Sparrow, the Chaffinch, the Titmouse, and the Greenfinch, find subsistence in a district, which they leave only when compelled by power-

⁵⁰ Rarely in a wild state do two birds of a different species unite; in general, they are peculiarly chaste in their loves, but when they overstep their usual boundaries, and take a partner of a different species, if the female be impregnated, an intermediate, or bastard, species, is produced; if it be a male, it is supposed to be incapable of propagating descendants similar to itself; and if a female, her offspring soon returns to the colour of the common species. Most naturalists presume, that, in order to the production of young, by different animals, that they must be species of the same genus.

ful incentives. Thus various tribes, which, at certain seasons, cannot obtain in their customary haunts sufficient food, or securely rear their young, change, from necessity, the climate and their places of abode. Possessing the means of conveying themselves, with celerity, from one part of the globe to another, and capable of accomplishing their aerial journies with a velocity almost as swift as the thought of the calculator, what, to animals less bountifully endowed, would be an exertion of trouble, pain, and fatigue, is to them an act of comparative ease. Of those that are compelled to seek their food in various climates, some live entirely on the insect tribes, which fill the atmosphere with their countless numbers, and which, at the approach of winter, commonly retire to a state of torpidity and inaction. While others, confined to search for food in the tender sod, or near stagnant waters, or in miry places, which, when congealed, no longer afford them subsistence, are obliged to wander to more favourable skies in quest of sustenance. They are not operated upon by one cause alone; fear, as well as climate and temperature, is a powerful inducement to their changing of their abodes.

Thus the Penguin, which once frequented the little islands near the shores of Newfoundland in immense multitudes, has now quitted its former retreats, and retired to some distant country, where man, her great enemy, seldom appears: and the Swallow, the Swift, the Goatsucker, the Cuckoo, the Whitethroat, the Redstart, the Blackcap, and other birds of passage, are tremulously alive to the state of the atmosphere. The migration of some birds appears to be more confined than that of others; a simple line or track marks their journey, from which they rarely deviate. In winter, the Fieldfare, the Redwing, and the Woodcock, hasten from the north toward the southern climes, and return at the approach of spring to its vast morasses and umbrageous forests, for the purpose of incubation; and many species of the feathered race never desert us, and some of them merely range from one county to another. While birds of the Crane kind, universal wanderers, confined to no particular district, fly from climate to

climate, as their wishes, or their necessities, direct. The annual migrations of the Woodcock, the Redwing, and the Fieldfare, and the myriads of water-fowl that cover the seas of the north, as well as of the smaller race of short-winged summer birds, are so obvious, and so generally known, that one might presume that the migration of the Swallow would not be disputed.⁵¹ Possessed of expansive wings, vast strength of pectoral muscles, amazing swiftness and agility, the distance of hundreds of miles cannot deter it, when the vicissitudes of the seasons, and want of its favourite subsistence, compel it to search in other regions for an atmosphere swarming with abundance of the insects which constitute its food. The constant change of country, by various birds, was well known to the ancients. The husbandman, in the early ages of the world, noticed the seasons of their coming and departure, and predicted sterility or plenty from the periods of their disappearing, and of their return. His calendar, in ruder times, was not formed from the sun alone ; signs and appearances, drawn from the animated beings around him, regulated his actions. Ælian informs us, that the Rhodians welcomed the return of the Swallow, which was sacred to their household Gods, with a solemn song. Anacreon mentions its disappearance at the approach of winter, and makes its journey to Memphis, or the Nile : and Virgil records the effects of the *frigidus annus* on many birds, and sings, in his immortal verse, their flight from the churlish winter to warmer climes : and Aristotle and Pliny remark, that the Swallow disappeared in the winter months. Our cursory observations on migration will be confined to the habits, actions, and manners, of the birds which we profess to describe. But this subject has been involved in useless difficulties, and to the discussion have been added unnecessary doubts. The division of our feathered wanderers into two classes, as winter and summer

⁵¹ All those animals, which are formed to repose in a state of torpidity through the winter, want the means of conveying themselves to warmer climates, beyond the reach of the rigour of a northern atmosphere ; and as their food is to be found in abundance only in the summer season, had they not been formed for torpidity, they must soon have been extirpated.

migrants, has veiled the subject in darkness instead of elucidating it, because with respect to themselves, they are all uniformly *winter* migrants. The common division is only correct, when it relates to the time of their return and departure to and from particular situations, but when applied to the birds themselves, it is unphilosophical and untrue. All birds belong to the country in which they are born; and which they desert not from inclination, but necessity. They all, without exception, quit the colder regions for warmer climes, and at first proceed from north to south. Impelled by that universal principle which operates upon the wide extended circle of animated nature, the love of the place of their nativity, as they quit it from necessity, so they all return to it as soon as that cause ceases to affect them. Want of food in the cold season of winter drives them from their native shores. The love of the place of their birth, and the impulses of desire, stimulate them, on the opening of spring, to return.* Nature has placed inclination in the balance against compulsion; and, by a principle powerful in operation, impelled the feathered wanderers to revisit their native shores. In Devon the Swallow commonly appears in the beginning of April; a few show themselves before the tenth of that month, as the harbingers of spring; and these are generally found in our warm vallies, or near ponds and watery places, in search of food. There, at that season of the year, insects are most abundant. The multitude of Swallows increases daily, and, by the twenty-fifth, the major part of those that return to us has in *general* arrived. The accession of numbers to the colony

* Ekmarck says, in his *Migrationes Avium*, “*Grallæ tanquam conjuratæ unanimiter in fugam se conjiciunt, ne earum unicam quidem inter nos habitantem invenire possimus.*” It is evident that the Fieldfare and the Redwing breed in the north, and Linnæus remarks of the former, “*Maximis in arboribus nidificat;*” of the latter, “*in mediis arbusculis sive sepibus nidificat.*” Scopoli, in his *Annus Primus*, in his account of the Woodcock, adds, “*Nidificat in paludibus Alpinis.*” And M. Wallerius, in a letter to Mr. Pennant, says, “*Scolopaces rusticolæ penes nos nidificant sed autumnali tempore abeunt, ac vernali redeunt.*” This account refers to Sweden. In this Introduction will be given a list of birds of migration to and from Devon, and of their periods of disappearance and return.

seems to be by small flocks in the beginning; though we frequently find that hosts of them appear, as it were instantaneously, about the latter end of April. The Swallow leads the van, the House-martin and the Sand-martin arrive next, and the Swift brings up the rear. The business of choosing their mates employs them a few days after their arrival. They assemble together, their twitterings are then loud and constant, whether seated or in their flight. About the middle of August, when the first broods have attained some strength of wing, they assemble in vast numbers, on trees, or on roofs of houses, towers, and other lofty buildings, crowding the sides most exposed to the genial warmth of the sun. A few meet at first at the place of rendezvous, to form the nucleus, round which numbers are continually collecting. They line the roof, hang pendent from the walls horizontally and perpendicularly, and differently from their usual habits. Many weeks elapse before their assemblage is complete; but no time is lost in preparing themselves for their intended journey. Some are pruning their feathers as a preparation for flight, while others wave the wing, in circles round the building, in trial of its vigour and its strength; now they launch into the air, and wheeling round in an extensive circuit, return and alight. The movement is often alternate, others supply their places in the atmosphere, till at once, as if obedient to a signal of command, all the members of the colony spread their wings. These preparatory exertions are continued commonly from twenty to thirty days, until they are ready to depart. On the morning of their departure their unusual garrulity increases, and their chirpings may be heard at a considerable distance.⁵³ At first, some of the individuals of the wandering host begin the chirping, to which the others attend in silence; but after a short period

⁵³ “ Dans un sage conseil par les chefs assemblè
Du depart general le grand jour est réglè:
Il arrivè; tout part, le plus jeune peut-être
Demande, en regardant les lieux qui l'ont vu nâître,
Quand viendra ce printemps par qui tant d'exiles
Dans les champs paternels se verront rappelés !”

has elapsed, most of them join in the song. The imagination, perhaps, wanders into the regions of fiction when it pourtrays these first twitterings as lessons of prudence and caution from the old, as descriptions of the difficulties to be surmounted in the voyage, of the advantages of migration, and of the dangers that await the unwary and impotent; and the general chorus, as the answer of the young of their determination to observe and fulfil their duties. Although these opinions should be merely the wild flights of fancy, their actions evidently are the effect of cogitation and design. They often ascend, as if by some sudden impulse, in perfect unison, to vast heights in the atmosphere, and return by a circuitous course to their former situation. At length, a loud, chirping, simultaneous scream announces their departure, and, making an extensive sweep, they ascend beyond the reach of the eye by spiral convolutions. Similar movements are made by the second brood, which commonly takes its flight before the tenth, or, at the latest, the fifteenth of October. A few still remain, and some of them, unable to accompany their fellows not from want of inclination but of power, sink into a state of torpor and inaction, from a life of wonderful agility and violent exertion; and, most probably, never become reanimated. But if we take the aggregate of those that have been thus discovered in a torpid state, they will bear no more comparison with the immense multitudes that annually migrate, than one does to thousands. Nay, if we add to them the numbers which have been seen some time after the flight of their fellows, the relative proportion will be but slightly increased; and even this transitory appearance in a warm winter's day may be attributed to a few weak individuals which were then preparing to migrate, or so impotent, that they could not quit their native land.⁵⁴ At

⁵⁴ I have often seen a few Swallows and Martins in the latter end of October, several times in November, and twice in December: (among other instances, five Martins and three Swallows on the nineteenth of October; three Martins the twentieth of the same month, and four Martins on the eighth of December, 1808; and on the fifth day of December, 1805, a fine sunny day, I discovered, in a warm sheltered situation, a flock, composed of thirty-two Martins, hawking in the air with all the agility of a summer's flight, which were most probably either preparing for depar-

an early period of the spring, after their return, they have been observed to disappear in cold weather for several days together. Perhaps, the birds which fled from their usual haunts during the intemperate state of the atmosphere, which naturally drove their insect food to their retreats, might

ture, or doomed to seek in our cold climate a winter's retreat.) Candour is the soul of truth; and although I totally disbelieve the assertion of the torpidity of the whole race, it would be uncandid in the extreme had I not related such circumstances as have come to my knowledge, which confirm the opinion that a few birds of this genus remain behind. In the month of May, in the year 1801, the thermometer at Teignmouth, in Devonshire, stood at thirty-eight, and the Swallows were so affected with the cold, that they could with difficulty fly; their flight was weak and debilitated; the boys pursued them with sticks, some of them were in this manner destroyed, and multitudes of them retired into crevices of walls to shelter themselves from the frigidity of the air. In the tower of the church of that town, some years before, a person of my acquaintance found, in spring, many Swallows closely locked together like a cluster of Bees, apparently insensible; he took them home, exposed them to the sun in a warm room, and shortly after they recovered their strength and flew away. A mason, whom I believe to be a man of undoubted veracity, assured me, that he had discovered Martins at different times in the tower of the chapel of Teignrace, (Devon) in the winter season; he believed that they were lifeless, but he used no endeavours to recover them. James Templer, Esq. of Stover Lodge, in the same parish, assured me, that, when a boy, he found, in the winter season, several Sand-martins in a torpid state, clung to a branch of a tree, which had been recently taken from a ditch; these birds recovered by being placed in a warm situation. In May, 1807, several Swifts were taken up that had fallen to the ground, chilled by the cold atmosphere; many of them recovered by being exposed to a warmer air. And I have been assured by Danes and Norwegians, that a few Swallows and Martins remain in their countries secreted in holes of walls and trees; but that the multitude quits them at the end of summer. Aristotle asserts, that the Swallows, even in Greece, commonly passed into warmer climates at the approach of winter, though many of them lay torpid in sheltered situations; and he also avers, that they have been thus found stripped of their plumage. Pliny gives a similar account, and he enlists among migratory birds the Blackbird and the Thrush: "*hi plumam non amittunt, nec occultantur;*" and he adds, from his own observation, "*sæpè visi, quò hybernium pabulum petunt.*" Even modern naturalists countenance the opinion of the torpidity of the whole of the Swallow tribe; but in the vast series of years that have rolled away since the time of Aristotle, but few instances of the discovery of torpid Swallows in their hybernacula have been adduced:

Vel qualis gelidis, pluma labente, pruinis;
Arboris immoritur truncò brumalis hirundo.

have been found by a prying eye in some warm, sequestered valley, or hovering over some sheltered stream, exerting themselves for subsistence, instead of dozing in inactivity.⁵⁵ But so strong and decisive is the evidence produced, to support the probability of the torpidity of a small number of individuals, that it cannot be resisted with success; but, when it is made to embrace the whole of the Swallow tribes, it ceases to be worthy of our attention or regard. Those that remain are said to seek a retreat in the openings of trees, in the holes of walls, in the chasms of rocks, and in the hollows of cliffs. Still it is doubtful, whether any of them, admitting that they lie congealed in torpidity and insensibility through the winter, ever attain a vigorous state of reanimation; whether they have any sensible evacuations, or the machine altogether loses its functions, the heart sensibly pulsates, or the atmosphere is inhaled by the lungs, and warms the blood of the sleeping animal. From their internal organization one would conclude, that nature did not form them for a state of torpidity, as they want the cold blood of the Dormouse, the Marmot, and the Bat. From their external form, one would assert, that she had fitted them for long and extensive flights. Mr. Pearson has incontrovertibly demonstrated, that Swallows, even in our climate, may be preserved active and alive throughout the winter; that they continue their song in confinement, and even *moult*, when an intense frost congeals the ground; and it has been proved,

This is the strongest proof that can be offered against the absurd opinion of the torpidity of the *whole* of the Swallow race; for, were it true, among its numerous partisans would have been found, in such a lapse of time, hundreds who would have started up to give testimony in support of an hypothesis, which has so much engaged the attention of the naturalist. I have found birds of this genus (the Swallow, Sand, and Common Martin) in the marshes near Newton, hovering over the Teign, and also on the borders of the Dart, when not one could be seen in the neighbouring towns.

⁵⁵ Many Swifts and Swallows became torpid in the month of May, 1807; I saw several of them in that state; the air was extremely cold, the thermometer stood in the middle of the day at 41 degrees. Some died, others recovered.

by experiments equally as decisive, that they only fall into a state of torpidity when exposed to the power of a cold atmosphere. But the second hypothesis, to account for the disappearance of Swallows, and the places of their retreat, is marked by monstrous absurdity and preposterous belief; physical impossibility, gross delusion, and eager credulity, here walk hand-in-hand. The advocates of submersion deny their annual flight to distant regions, and represent the poor delicate birds, that studiously shun at other times every appearance of humidity, as assembling to immerse themselves in rivers, lakes, and ponds. On their margins, at the approach of winter, they magically lose their usual antipathy, and become anxious to sink in the stream, on which before they never ventured to recline. A grand funereal dirge is performed, as the proëmium to the tragedy, and they plunge into the watery element, while the song quivers in their throats. Without recurring to the assertions of mariners, many of whom have seen the Swallow in its migration; without referring to the testimony of travellers, who have discovered it in Africa at the period of our European winters;⁵⁶ without adverting to the testimony of Herodotus, who avers, that the Swallow lives in Egypt throughout the year; one argument alone will overthrow the supposition, that it is capable of sustaining life for months in a watery grave. The great anatomist, John Hunter, dissected numbers; and, in the objects of his inspection, he found the organs of respiration similar to those in other land birds; consequently, as an animal fitted only for terrestrial existence, it could not long survive in a subaqueous retreat.

⁵⁶ See Adanson's Voyage to Senegal, Admiral Wager's Letter to Mr. Collinson, and Mr. Pearson's Account, in the Philosophical Transactions, of Swallows remaining active throughout the winter. Barham, in his Travels in North America, says, that he has seen vast flocks of Swallows and Sand-martins passing onward from Florida northward toward Pennsylvania to breed, about the middle of March. Frisch tied bits of water-coloured thread round the legs of Swallows before their departure, which returned in the spring, with the thread not discoloured. And Buffon placed many in an ice-house, but the congelation soon destroyed them. And it should be remarked, that the tail of the young Swallow at its departure it but slightly forked, but on its return it cannot in this respect be distinguished from its parents.

Little anatomical knowledge is required to convince us of the truth of this remark ; and no great power of argumentation is necessary to demonstrate the absurdity of the belief, that a bird so tender, which cannot bear the inclemency of a cold vernal season, should become, at the approach of winter, so hardy an animal as to be capable of sustaining life in a dense, frigid element, where every other land bird, formed internally like itself, would meet immediate death ; and should undergo a metamorphosis more strange and unnatural than any of the poetic fictions of Ovid, or the fabulous tales of the Proteus-like divinities of Homer.⁵⁷ If all the Swallows and Martins plunged into a watery abode, to remain torpid throughout the winter, they would necessarily be often discovered in multitudes by some of those, who, from pleasure, or in their avocations, are frequently engaged on the streams. Though the bottoms of our rivers are continually disturbed by various instruments, what man, in Britain, ever saw the fisherman bring up Swallows in his dredge, or in his net, or on his spear ? The currents of many of our rivulets and streams are often turned ; and yet, in our history, there is not one well-substantiated fact of the discovery of Swallows at their bottoms ; which must have been the case, had they constantly immersed themselves at the approach of winter. But their manners and their actions prove the reverse. If they reposed in neighbouring ponds and rivers, we may fairly demand of the advocates for submersion, why do they, at the time of their departure, ascend to such towering heights in the air, that the eye can no longer trace their flight ?

⁵⁷ It would be presumptuous to assert, that no Swallows have been found in a state of submersion. Many names, venerable as naturalists, record it as a fact ; such facts, we believe to be very rare, and they merely prove a discovery in a few solitary instances, *without accounting for the manner of their immersion, or the time of their continuance in the stream.* In our country such assertions carry doubt on the face of them, as the seasons in which they are supposed to have been discovered immersing into, or arising from, the stream, corresponds with the periods at which the Swallow retires to low, warm vallies, or marshy places, abounding with insects ; and there it might be chilled by the coldness of the atmosphere, sink entangled among the rushes, and, when discovered, give birth to intentional submersion.

Why do they, for so long a season, exert themselves in such extraordinary preparations, if their journey terminate in a contiguous stream? Why such preenings—such circlings—such trials of their wings? Where can they discover beneath the water a well-guarded retreat, in which they may repose in security, evade the attacks of enemies, and defy the rapidity of the stream? If nature intended them as an anomaly to her laws, would she not have provided them with different organs from the rest of the feathered creation? Would not their plumage be impermeable by humidity, and their bodies indestructible by the want of vital air? Has any one yet discovered this water-proof vesture, these extraordinary organs, these unusual provisions of nature, in the Swallow tribes? Has any one marked the Swallow torpid in vacuo, or submersed it in water, and seen it recover, after the lapse of a few days *only*, its animation? Does it respire while submersed? Has it then lost its animal heat, which can only be kept up by respiration? If it do not possess this extraordinary conformation, if its organs be not dissimilar from those of other land birds; if it respire in torpidity, and retain its animal heat; if its plumage be not impervious to humidity, it could not exist in a watery grave; it would die when the frozen surface precluded the access of the air; it would fall a sacrifice to the action of the water, be suffocated by its pressure, or destroyed by its penetration. True it is, that were we unacquainted with the habits of the Water-ouzel, we should not readily give credence to an assertion of its diving for food; for, without the web, the characteristic of water-fowl, we see it sink into the stream. On a cursory inspection, the Swallow appears equally as well fitted for submersion; but a closer examination soon convinces us, that the one has been clothed in a thick, impenetrable plumage to resist the entrance of humidity, although its stay beneath the water is but *momentary*, while to the other nature has denied an impervious clothing. All the arguments for the doctrine of submersion are deductions from a few solitary, most probably deceitful, instances, while the advocates for the migration of the Swallow adduce a forcible train of facts, which readily convince the unbiassed mind. The general nature of

land birds; the formation of the organs of respiration, and the powers of the wing of the Swallow; the want of that structure of the heart, which distinguishes fishes and amphibious animals; the slightness of their clothing, the openness of their nostrils, the impossibility of existing when the air is excluded, or of moulting in the stream; the testimony of various persons who have seen Swallows actually in their journey to distant lands; and the well known migration of the Woodcock, the Fieldfare, the Stork, the Redwing, and the Crane. Besides, the doctrine of submersion took its rise in the days of darkness and superstition, and the credulity of its founder seemed to increase in an inverse ratio to probability. He fishes up myriads of Swallows from the vasty deep, and revives them with as much facility, as the rays of the Sun expand the buds of the vegetable world.⁵⁸ It is charitable to presume, that the Reverend Archbishop was the dupe of the designing, who imposed on his credulity by false reports,

⁵⁸ In septentrionalibus aquis, sæpius casu piscatoris extrahuntur hirundines, in modum conglomeratæ massæ, quæ ore ad os, et ala ad alam, et pede ad pedem, post principium autumnî sese inter cannas descensuræ colligant. Massa autem illa per imperitos adolescentes extracta, atque in æstuarîa portata, caloris accessu hirundines resolutæ, volare quidem incipiunt, sed exiguo tempore durant. Lib. 19. cap. 29. Ol. Mag. Hist. Etmuller, in his dissertations, asserts the same, and bears witness to it. Several naturalists have credited and supported this strange opinion; and even a modern traveller of some note, Mr. Forster, attempts to revive it. Spallanzani, that indefatigable and accurate investigator of nature, appears at one time to have credited the submersion of Swallows; the only doubt, which he raises, is, whether the Swallows, spoken of by those who support this doctrine, are of the species well known to us, or are birds of similar size, colour, and figure, but of a different nature; he concludes, from various experiments made to discover whether birds of the Swallow tribes are capable of supporting cold, that Swallows, found in water, or under ice, are specifically different from ours, because these are destroyed by a small degree of cold. To elucidate this question, he confined nine Swallows, in an ice-house, which, without becoming lethargic, languished, grew debilitated insensibly, and died within forty-one hours. Their deaths were not occasioned by hunger, as others lived without food even for five days, while the most vivacious existed under the influence of the cold of the ice-house but forty-eight hours; and he, therefore, ascribes the acceleration of their deaths merely to the privation of heat. The author has made many experiments for the purpose of elucidating this question, which will be stated in the Appendix to this work.

which he credited as philosophical and true. But he did not confine his relations within the common bounds of improbability; he laughs at reason, and bids defiance to common sense; and relates the most disgusting and monstrous fabrications with all the simplicity of truth. He, who could gravely speak of the fall of Mice from the sky, and describe a floating island of animated matter, a mile in diameter, as a well-known animal on the coast of Norway, was fit to be the historian of the annual torpidity of Swallows beneath an element, which is a gulph of destruction to those beings, unprovided by nature with the necessary organs to remain in it. Not only the Swallow, the Martin, the Swift, the Goatsucker, and the Cuckoo, are migrants; various species of short-winged summer birds,⁵⁹ perform an annual journey from one country to another. Ill fitted for such extensive flights as the Swallow tribes, they contentedly seek for subsistence within a narrower sphere. Their journies are bounded by a few degrees, which they rarely exceed, as they find in the neighbouring Southern states, all that

⁵⁹ What naturalist ever discovered the Nightingale, the Redstart, the Flycatcher, the Black-eap, in our hedges in the winter season, or in a state of torpid inaction? Whoever met with flocks of Fieldfares, or Redwings, in this country, in the summer season, or found them submersed? Their powers of wing are far inferior to that of the Swallow: they are as regular in their appearance, and no one denies their migration. The Norwegians in general foster the belief of the submersion of Swallows. I have conversed with a great number of natives of that country, who uniformly gave credence to this doctrine. Some of them fancied, that they had themselves known proofs of the fact; but on close consideration, they all, except one, admitted, that their belief was founded on the relations of others, who drew their belief from a similar source; and the one who seemed to have ocular demonstration, mentioned, that when he was a child, he was present, in the winter season, at the felling of an hollow oak which lay in a stream near Drontheim, from which were taken two of the Swallow genus, but of what species he could not determine, nor whether the part in which they lay concealed was submersed. If they seek more southern climes than Europe can afford them, they need not traverse vast distances over the sea. Mr. White, in his History of Selborne, vol. i. p. 235, asserts, that his brother had frequent opportunities of attending, in spring and fall, to the migrations of birds. He speaks of myriads of Swallows as seen passing the Straits of Gibraltar, and particularly notices that many of our soft-billed summer birds of passage were among them.

will satisfy their necessities and desires. The Willow-wren, the Petty-chaps, the Blackcap, the Sedge-bird, the Whitethroat, the Redstart, and a numerous list of little warblers, return again to their native shores, when spring leads on the painted summer, and all is mirth, abundance, and gaiety, to hunt for asylums for themselves and their young in our hedge-rows and our woods. Endowed with feelings and propensities stimulating to a change of climate—but denied the powers of wing with which the Swallow is gifted, and abhorring alike too great a degree of heat, as well as an extremity of cold—a temperature in unison with their feelings, which can supply them with food, constitutes the object of their pursuit; and by this stimulus to change, impressed on the minds of these beautiful and serviceable little animals, nature, ever attentive to the benefit of mankind, has, in this instance, conferred a blessing almost unregarded, and added a pleasure universally admired. The northern climes are principally, by these our summer residents, cleared of the noxious races of insects;⁶⁰ the exuberance in the increase of which would otherwise destroy the labours of

⁶⁰ Most of our residents of the Sparrow kinds assist, although, in fact, many of them live commonly on grain. The Sparrow itself is extremely useful, but not to the degree which has been asserted. Four thousand Caterpillars have been mentioned as the amount of the weekly destruction of one pair of birds for their young; but such is not the fact. The Sparrow certainly feeds its young partly with caterpillars and partly with worms and insects, the farinaceous substance of grain, and the pulp of fruits; but many of our summer residents live entirely on pernicious insects, and confer advantage without injury. Still, if the injuries committed, and benefits conferred, by the Sparrow, were placed in the balance; the scale of injury would quickly kick the beam. It is not a little surprizing, that the legislature should be so anxiously attentive to the preservation of a *few* species of the feathered race for the delicacy of their flesh, or the amusement of the sportsman, for the gratification of a small portion of the community, by enacting laws, teeming with penalties against the poor and unqualified; with penalties ill according with the spirit of legislation of a free people, and most destructive in their consequences to the very birds themselves, which they are intended to preserve; and yet, at the same time be totally regardless of the fate of our little friends; without the assistance of which the surface of the earth would soon present a scene of terrific desolation, from which the eye would recoil with horror, and hope itself could glean neither comfort nor consolation for the affrighted mind.

man, and, as if they received the reward of their exertions from his bounty, they seem to endeavour to repay him with their songs. When winter drives the busy insect throngs to their retreats, the summer birds retire; and nature, pivoting her cornucopia on the margin of a circle perpetually in motion, scatters her blessings, in its revolutions, over every climate, and every land; and, while abstracting one pleasure, with the benevolent hand of the kindest mother, she leaves another in its stead. To birds that quit us in the autumn must be added our winter visitors, among which are the Redwing, the Fieldfare, the Woodcock, and the Snipe, and all that innumerable assemblage of water fowls, which are bred in the north. When the places to which these birds resort to breed can no longer afford them nutriment, when the earth is locked up in bars of chilling ice, and the current of the stream is fixed and motionless, they are compelled to wander in quest of food. By what principle they are guided in these distant excursions has been a question often agitated; our own sweet poet, in his nicely-framed numbers, asks,—

“ Who bade the Stork, Columbus like, explore
Heavens not its own, and worlds unknown before;
Who form'd the council, fix'd the certain day,
Who guides the phalanx, and who points the way ?”

We would answer, REASON !

REASON, the mover of the human soul,
Acts not on part of being, but the whole:
For nature's laws, in due proportions, give
This high prerogative to all that live:
From him, the favorite in her mighty plan,
Him first, and foremost—speaking, laughing man;
To the light forms, that in the blaze of day,
Float on the winds, or on the sun-beams play.

Guided by its dictates, the Crane wings its way from the cold Arctic Circle,

through the mild regions of the Temperate Zone, and even extends her flight beyond the limits of the Line. The Woodcock again discovers the vast umbrageous forests of the North, and the Swallow, the hot plains of Africa.⁶¹ Blessed with a memory tenacious and retentive, and with mental powers, adequate to the conducting of them in their wanderings, they return, after the intervention of many months, to the same country, the same province, nay, many of them to the self-same spot, where they had before reared their young ones in security, and found protection for themselves; their bodies, framed to be sensible of the slightest change of atmosphere, constantly intimate to their sure guide, when they soar beyond their rout, and exceed the parallels of latitude to which most of them are confined. It is probable, however, that the short-winged race retire from their summer retreats, in pairs, or in small companies, by easy flittings, till they reach the shore, and then they try the strength of their pinions in crossing the sea; but the powers of wing of these birds have, in general, been greatly under-rated, and rarely has the amazing strength of their pectoral muscles been taken into the account. There can scarcely be a doubt, but that, were it necessary, most of these little creatures, weak as they appear, can traverse vast distances, and take very long flights.⁶² Ac-

⁶¹ Vide Ekmarck's *Migrations Avium*, and Adanson's *Voyage to Senegal*.

⁶² A friend assured me, that he saw a flock of Linnets alight on a ship in which he was, upwards of one hundred and fifty miles from any land; and that *three Woodcocks* passed over the same vessel, about forty or fifty miles to the eastward of Tercera, one of the Azores; one of the Woodcocks was so much fatigued that it endeavoured to rest on the yard. To be fully satisfied, beyond the possibility of doubt, I applied to the crew individually, and they all confirmed the statement made by my friend. I was informed by a respectable sea-captain, who had long been part owner of a large ship, that, as he was sailing in North Latitude about 56, West Longitude about 14, an Owl, of extraordinary size, with plumage as white as snow, slightly tinged with streaks of brown, fatigued by exertion, alighted on his vessel; that it was taken, kept many days, and afterwards flew away. His description of it agreed with the *Strix Nyctea* of Linnæus, and the *Harfang* of Buffon. He assured me that he neither before this occurrence, nor since, had seen a bird of the same species, nor did he know from what country it came. He added,

customed as we are to measure the actions and ability of other animals by our own powers, a standard generally unjust, we forget to allow sufficiently for difference of organization ; though birds, relatively to us, may seem imbecile animals, yet, as to themselves, in aerial excursions, they are possessed of astonishing strength.

Many of the short-winged race that return to us in the summer season, join in the chorus of the warblers in our woods ; and such of them, to which nature has denied the voice of harmony, render essential service to us by the destruction of our minute foes. They contribute, by their exertions, to preserve the nicely-poised balance between increase and destruction, and to clear the atmosphere from the contagion, which would arise from the deaths of myriads of insects, dispersing from their decomposition the active miasma of putrefaction.

that he had observed multitudes of small birds at a great distance from land ; and that he had taken Larks between Majorca and Sardinia, from immense flocks, which he conjectured came from France or Italy, and were on their flight to Africa. And I have received accounts from numerous mariners, which corroborate the fact, that many of the smaller species, even of those which are not termed migrants, are at times discovered at sea, far from land. From the result of many experiments, I am led to suppose, that birds in general fly more rapidly than we are inclined to admit. The speed of the swiftest racer will bear no comparison with that of the Swallow ; a short period of extraordinary exertion will diminish and exhaust the strength of the quadruped ; while the bird for hours can glide through the air with the rapidity of lightning, unimpeded by the causes which would produce, in its competitor, total debility, and a want of power to continue in action. Swifts are known, in the summer season, to remain on the wing, without resting, the greater part of the day ; a Swift, that had been sitting a brood, was taken, and given its liberty at the distance of nearly two hundred and twenty yards from its nest, which it regained in less than seven seconds.

CHAPTER IV.

On the Manners and Affections of Birds.

THE different species of birds, in their flight and manner of walking, move in peculiar attitudes, by which the practical ornithologist can, with facility, distinguish them; whether, like the Swallow, pursuing its insect food on the wing, now skimming near the surface of the earth with surprising agility in waving lines, or wheeling high in the air, with astonishing rapidity of evolution; or, like the Kite, sailing slowly through the atmosphere, or resting on its bosom insidiously lurking for prey; whether restlessly fluttering from branch to branch, like the Titmice; or watching, in motionless stupidity the scaly fry in the shallows, like the Heron; whether running with velocity, like the Wagtail, or strutting, in slow and solemn pace, like the Raven and the Daw; some obvious distinctions arise, which inform the attentive and judicious investigator, with certainty, of the object of his view, even when the colours and shape of the bird cannot accurately be discerned. Thus the long-winged Hawks, or those of the generous tribe, as they were once called, depending upon their swiftness, their piercing sight, and undaunted boldness, for the capture of their prey, usually slide through the air with astonishing velocity, sometimes moving their wings with extreme rapidity, then rushing on without apparent exertion from the force of the former impulse; but Kites, Buzzards, and the short-winged Hawks, unendued with that swiftness which distinguishes the former birds, wave slowly round in circles, prowling for

subsistence, depending on intimidation more than agility, and terror than courage, or hover over it with motionless wings, and in equal balance, at other times flapping them with great agitation; or, like the Henharrier, which steals along the hedges to pounce upon its game, with the cunning of the Glutton, rather than the boldness of the Lion. Most birds of the Hawk kind dart perpendicularly toward their quarry, until they arrive within a few feet of it, then, in an instant, they change their position, and fall horizontally upon it, so as to fix their talons in the defenceless animal. Ravens, Rooks, and Crows, nearly close their wings in flight, and often ascend into the air and turn themselves in a thousand playful attitudes, and quickly descend, striking each other with their wings, their feet, and their bills. Jays and Magpies fly straight, but sluggishly, as they move their wings tardily, and flap them so much round their bodies. Woodpeckers pass from tree to tree, in a track many degrees out of an horizontal line, and in curves, closing their wings in the manner of the Jay, and proceed, not by constantly-reiterated impulses, but by exertions at intervals, like the action of the mariner, who presses forward his boat by the intervening strokes of the oar. The flight of Wildgeese and Ducks is swift, horizontal, and regular; the former appear to be under great discipline in their acute-angled progressions, like an inverted V; the leader retiring when fatigued, and his place is instantly supplied by the foremost or hindmost of one of the lines; at other times, they range themselves in close-compacted columns, and wheel and turn with the simultaneous precision of well-disciplined soldiers. The Gull flies with an uneven, unsteady motion, often elevating one wing and depressing the other; now sailing along with outstretched pinions, and in the next moment, by a single slight exertion, pressing forward in a similar manner as the Hawk kinds; whilst the Corvora and the Shag, this minute almost raze the bosom of the ocean, in the next, ascend high in the air, and, by a quick celerity of movement, proceed in a nearly straight line, like the Guillemot, the Razorbill, and the Puffin. The flight of the Gannet is not, in its general movements, dissimilar from that of the Gull tribes; but when it descends upon its prey,

it falls with amazing velocity, with its head in a perpendicular position throughout the whole of its descent, because it seizes its food with its bill. The Wagtail moves in curves, resembling the undulation of a wave; but the Kingfisher and Waterousel, by a swift, straight, yet almost imperceptible and noiseless motion of the wings, dart along just above the surface of the water; but the Partridge, creating a constant, loud, and whirring noise, flies with scarce less speed, and in a similar manner. The flight of the Swallow is a natural barometer, when it moves rapidly round and high in the atmosphere, it indicates a settled state of fair weather; and when it skirts silently along, just above the surface of the earth, it warns us of the approach of rain. The Swift, of all English birds the most renowned for celerity, glides round in circles, with one wing depressed and the other elevated, both waved with such instantaneous rapidity, that the eye can scarcely perceive the motion; on the other hand, the Skylark mounts into the clouds, by a continual and quickly-repeated agitation of its wings, and descends toward the ground by a constant fluttering, or darts with the rapidity of an arrow toward the earth, in an oblique line. The Titlark and the Rocklark, like all the Lark genus, ascend by repeated agitation of their pinions, but descend with their wings in a quiescent state, and forming right angles, their tails elevated and their feet hanging down; while the Woodlark, balancing itself in the air, pours forth its cheering strains. The flight of the Starling is swift, easy, and little laboured, and, of all the Thrush genus, wild, irregular, and desultory. There is not among birds a single species that travels the vast expanse of Heaven, but which has some particular mode in its flight, by which it may be distinguished from individuals of a different race; and a slight examination of the actions of the feathered creation, will educe the conclusion, that swiftness does not wholly depend on expansion of wing. The short-winged Kingfisher, in its aerial motions, is marked for celerity; and the broad-winged Buzzard, for its tardy movements. Birds, which have small wings, have thick and close-connected coverts, which greatly assist their flight; and on the whole it may be observed, that strength of the pectoral

muscles, as well as the expanse of feather, the hollowness of the bones, and lightness of the bodies of birds, and the air-cells within them, contribute greatly to rapidity of motion,⁶³ and birds that move their wings

⁶³ One of the translators of Buffon, in a note at the end of the first volume of *Birds*, combats the opinion, that lightness of feather, and hollowness of the bones of birds, are among the causes of their rapid flight. He laughs at the doctrine as absurd, and yet, in the same breath, pronounces a theory as unphilosophical as ridiculous. "The rapid flight of birds," says he, "results wholly from the prodigious power exerted by their large pectoral muscles." This evidently is untrue; strip a bird of its plumage, and what would be its rapidity of flight? The pectoral muscles of the Ostrich are of enormous size and strength, and yet it is not buoyant in the atmosphere; because nature has denied to it the flag-feathers of the wing. The pectoral muscles of the Bat are weak, and but little stronger than those of the Mouse, yet the one flits through the atmosphere, while the other by no exertions can mount into the air; deprive the former of its membranous wing, it grovels on the earth, and is immediately rendered incapable of flight, and yet its pectoral muscles remain. This strange theory is supported by positions equally ill-founded. Birds do not use their utmost exertions to overcome the resistance of the air; the Kingfisher often darts along, through a considerable space, by the force of *one* impulse of its wing; and, by its buoyancy, the Hawk remains suspended in perfect stillness. Nor is it more correct, that those birds which have the longest necks, and consequently make the most acute angle between their shoulders and their bills, fly the fastest. The Swift, the Swallow, the Goatsucker, the Pigeon, and the Hawk kind, are most rapid in flight, and yet are not remarkable for length of neck; but they possess a vast expansion of wing, with pectoral muscles of immense strength. On the other hand, the Water-rail, the Heron, the Bittern, the Water-hen, and the Land-rail, are formed with long necks, and yet their action on the wing is awkward, graceless, and tardy. The fact is, that many means conspire to produce rapidity of flight; the specific gravity of birds, arising from the hollowness of their bones, and lightness of their feathers, the smallness and figure of their bodies, the expansion of their wings and tail, the length of the flag-feathers, and the closeness of their union, the thickness of their coverts, the elasticity and number of their internal air-cells, and the immense strength of their pectoral muscles. It is from a combination of powers, and not from a single one alone, that they acquire celerity; without strong pectoral muscles, their wings would be useless; without flag-feathers, these muscles would be of no effect in flight; and without a proportional lightness of body, both the muscles and the wings would move in fruitless effort. As some of the propositions, offered to support this truly fanciful opinion, are built on calculations, perhaps the best mode to upset them is to place figures against figures in the scale. Assuming as a fact, according to the translator's assertion, that the specific gravity of quadrupeds is nine hundred times greater than air; yet it does not follow, that an equal quantity of superficial matter

most rapidly, most increase their speed. The Jay, the Owl, and the Magpie, flap their wings nearly close round their bodies, and slowly, and, by this action, lose the advantage of their extension;—the Gull, which appears to be a bird of moderate powers of wing, makes a less angle in its motions; but the movement of the wing of the Kingfisher can scarcely be perceived, by the most acute power of vision, to fall beneath an horizontal line. Many birds, in their flight, use strange contortions, as the Goatsucker and some of the Pigeon tribes, which frequently clash their wings together, making a loud noise from their collision; others, as the Wood-pigeon, whose firm pinions stoutly lash the air, raise a great sound in flight; the Partridge and the Woodcock create, by the impulse of their wings, a loud, whirring buzz; but the Owl skims along in irregular curves, with softened strokes, scarcely occasioning the slightest noise by their percussion. Some quit the ground nearly in an horizontal line, as most of the Sparrow tribes; a few with a spiral flight, like the Bittern; others mount almost perpendicularly towards the sky, like the Lark and the Woodcock; some descend gradually, and others by a sudden jerk, like the Water-rail, with their wings placed almost erect; the Swift, on account of the length of its wings, and shortness of its legs, can only rise from the earth with the greatest exertion, it throws itself nearly on one side, and then, by a violent agitation of its upper wing, and by pressing its under foot against the ground, it at length ascends. The Goatsucker quits the place on which it rests by first violently clashing its wings together over its back, and, receiving the force of the impulse from the return of its pinions, springs into the air. Almost all birds slightly unfold their tails in flight, to render the

in a bird occupies no more than triple the space. The Goatsucker, with wide-spread wings and tail, covers an expansion, or is supported by a column of air upwards of two hundred superficial inches, and yet its body is but six inches long, and scarcely three ounces in weight; on the other hand, the Rabbit, that weighs four pounds, occupies, by the surface of its body, not exceeding one hundred superficial inches; and, consequently, according to the well-known law of hydrostatics, the quadruped must sink in a medium, in which the bird might be supported with ease.

body more buoyant, increase their speed, or assist their versatility; and those which have short tails generally proceed in a straight line, and with few windings; whilst the long-tailed birds commonly skim the air in a thousand directions, with a facility which the others cannot acquire. Different as is their flight, almost as various are their modes of walking; the Turkey and the Peacock strut in pompous, measured pace, "as if the ground were honoured with their tread;" the Duck and the Goose waddle awkwardly from side to side, exciting ridicule by their movements. The Wag-tail leaps, as it were, by a succession of quick hops, or runs with such swiftness, that the eye can with difficulty perceive it place one leg before the other; the Land-rail drags his feet laggingly along in an awkward manner, with a poking, outstretched neck, often falling from crossing its legs; the Redbreast hops along with stooping head, and elevated tail flirting to and fro, and frequently bending like the act of curtesying; the Sparrow moves by a side-long motion, and proceeds by an acute-angled, yet stiff and prim, march; the Magpie now jumps as if its legs were fettered, and in the next place it struts with the solemn pace of the Daw; the Woodpecker ascends the highest trees by a quick motion, resembling that of the feline genus in climbing. All the divers, and those other birds, the legs of which are situated behind the centre of gravity, appear, in their awkward, unsteady gait, to be constantly losing their equilibrium, and to ramble to and fro like a ship in a storm. But not alone by their flight and manner of walking may birds be readily known, their various actions and attitudes, even when seated, are certain marks of distinction to the attentive ornithologist.

The life of quadrupeds, it has been remarked, bears some proportion to the period in which they attain maturity; *diutius gestari quibus sunt longiora vitæ spatia*, says Pliny; but this rule bears no relation to birds. After a few days incubation, which answers to gestation in other animals, they quit the shell, and in a few months they are decorated with the brilliant colourings of their vesture, their pinions gain their strength, and they

become the parents of a new race. The vital principle is peculiarly active in them, and though they shoot almost instantaneously into fullness of being, their existence is prolonged, in proportion to their size, beyond the term of life in man or quadrupeds. Of that term in man, one-half is consumed in the imbecility of infancy, the raw period of youth, and the weakness and dotage of old age; but birds are gifted by nature with the peculiar advantage of passing but a few weeks in imbecile listlessness; and some of them, as soon as their eyes open on the light, begin to provide for themselves. Ravens are said to live beyond a century, and the life of the Eagle is extended as long; Parrots and Geese are reported to exceed in age the common date of the age of man; and it has been averred, that Swans have seen a revolution of years far beyond the life of Nestor. Even the smaller species enjoy a proportionate vivaciousness; Larks,⁶⁴ Linnets, and Goldfinches have lived beyond twenty years. It appears, in general, that those birds, which are covered with down at their exclusion from the egg, enjoy the longest period of life.

⁶⁴ In a little village, in which the Author once resided, the age of a Skylark was celebrated, on a brass plate, in the following rustic lines:

“ Within this wall there lies a Lark,
“ Whose age I think well worth remark;
“ Take fifty-five from seventy-three,
“ And then his age exact you see.
“ And in remembrance of his age,
“ These lines were writ beneath his cage.”

This plate was placed in the most conspicuous situation, immediately opposite to the entrance, and the owner did not plume himself a little on this high flight of village poesy. He took care to inform the reader, that he wrote it *all himself*; nor did Homer for his Iliad, or Milton for his Paradise Lost, feel more parental fondness than the writer of these lines. So ardent are mankind for fame, and so thirsting with desire to obtain it, that many, who have no hopes of being enrolled and immortalized in the pages of history, content themselves with being recorded on the face of the parish clock. The bird was full grown when it came into the owner's possession; and it must, at least, have been nineteen years old.

Over quadrupeds many land birds possess another advantage, that of an harmonious voice ; by which they can express their passions and affections, soothe the hours of incubation of their partners, and pour forth in concert the full tide of harmony. This power of song is almost confined to the Sparrow tribes, and in most species to the male, and if the female sing, which is very rarely the case, her notes are far inferior to his. At the opening of Spring, when nature begins to attire herself in gaiety and splendour, the little warblers most exert themselves in song ; they then contend, in active rivalry, for the graces of some favourite fair, or strive to solace their partner during the period of incubation. But the song of birds is not merely the voice of love ; many of those that cease from their strains in summer, when the young brood demand their utmost exertion, (for they all sing most earnestly when most idle,) in autumn, with the loss of their cares recover their song ; then their warblings are marked with softer modulations and sweeter cadency ; they are less broken and interrupted, though they no longer rise to that pitch of elevation occasioned by desire. The Redbreast, the Wren, the Thrush, the Linnet, the Skylark, the Woodlark, the Titlark, and the Goldfinch, warble on till the cold of winter makes their subsistence a work of toil ; and, as plenty is one of the stimulants of song, when that season passes away without its usual rigour, many of these resume their strains. And the Waterouzel, regardless of the frozen atmosphere, enlivens, with its delightful notes, the margins of the ice-bound streams.

The lungs of birds, by their imbibing such a quantity of air, enable them to prolong their notes, which are modulated as well by the tongue as by the flexible muscles of the larynx. From the great quantity of air imbibed by their lungs, their voices are comparatively sonorous and loud. The neighing of the Horse is weaker than the scream of the Peacock ; the bellowing of the Ox than the boom of the Bittern ; the bleating of the Sheep than the cry of the Woodpecker ; and the full notes of the Nightingale far exceed in strength the shrill squeak of the Hare ; the Goatsucker

and Grasshopper warbler are true ventriloquists, and gifted with the power of throwing their voices to a distance. The filaments, into which the tongues of birds are broken at the tip, contribute greatly, it is said, to the mellowness of their tunes. Besides the song of the male, it possesses, in common with the female, short, twittering, inharmonious notes, which seem to be their common language, and by which they express their desires. Most of the songsters sing only when perched; but the Skylark, the Woodlark, the Titlark, the Sedge-bird, the Blackcap, the Redstart, the Whinchat, the Stonechat, the Whitethroat, the Waterouzel, and the Swallow, sing on the wing. The Nightingale, the Woodlark, the Sedge-bird, though all diurnal songsters, pour forth nocturnal songs;—the Woodlark in circles in mid-air, the Nightingale on some favourite bush, and the Sedge-bird on the wing, or among the reeds. Some birds imitate human⁶³ speech; the Parrot, the Raven, the Magpie, the Starling, the Bullfinch, and the Jay, are now most remarked for loquacity; but the ancients, according to Pliny, Porphyry, and Statius, taught the Cock, the Nightingale, the Redbreast, the Thrush, and the Partridge, to articulate words. Some speak in broken and unconnected sentences: others are enabled to support a conversation. Pliny tells us of a Raven, which every day learned new expressions, and by whose eloquence his master was rapidly acquiring a fortune, until, envious of his prosperity, a neighbour destroyed the bird; but the Roman people, who delighted in crowning conquerors, in grandeur, and in show, decreed a public funeral for the ill-fated bird. Of those birds that sing, the Nightingale, by universal consent, ranks as the leader of the wild choristers of the grove; and among us the Missel-thrush is the largest bird, the voice of which is harmonious; and the common Wren, the smallest, gifted with a pleasant song.⁶³

⁶³ The power of song has given rise to different opinions concerning its cause, one party attributing it solely to love, the other denying it to be its effect: the advocates of the latter opinion approach nearer to the fact; by love we must understand sensual appetite, which, in all of the warblers, is excited and active only in the spring and summer; it follows as a consequence,

We have already made some remarks on the migration of birds, a propensity so active in most of the feathered race; but it is not less remarkable that birds, in general, which migrate, also congregate; some in

that if any of them continue their song in the cold season of winter, when they no longer feel the influence of desire, that love is *not* the *sole* cause of their song. Many birds, in the dead of winter, when the days of love and incubation have long expired, even in a wild state, gratify us with their melodies; while the vegetable world lies benumbed around them, while the hot impulse of desire is chilled and frozen, they make the woods echo responsively to their warblings, or imitate, in hurried notes, the babblings of the stream. I have, again and again, heard the Water-ouzel sing in the months of November, December, January, and February; and the Goldfinch, the Linnet, the Thrush, the Woodlark, the Skylark, the Wren, and the Robin, in October and November: and throughout the mild winter of 1806, the Thrush continued in full song. The author heard several of this species in the month of November, and one on the third of December, 1808. If we say with the one party, that love is not the sole cause of song, and with the other, that it is only one of the causes, that its sensations give a rapturous elevation which birds do not at other times attain, we should, perhaps, be more correct. The disputants have not ended here; the song of birds seems fruitful in contentious themes; some of the advocates of the first opinion have been the supporters of innate song; but the Honourable D. Barrington asserts, that the young Sparrow, educated by the Goldfinch, never uses the broken interrupted chirp of its fellows, but the song of its tutor; and the Cuckoo, uniformly before it acquires its slow-told notes, chirps like its foster parents. I have found this so generally the case, that I have scarcely ever erred in pronouncing the species which had reared the numbers of young Cuckoos which I have had in my possession. The *regular* song of birds is as evidently artificial as the language of man. Nature endued both with the power of utterance, but taught neither what to utter; a bird, that had never heard one of its kind, would no more sing like the rest of its species, than a savage, who had been reared alone in the forest, would speak like the people from whom he sprung; he would utter the harsh, jarring, discordant sounds of nature, but no regular language; it would express its passions in crude chirpings, but not in the modulated mode of its congeners. Buffon, the most eloquent, the prince of natural historians, sagaciously remarks, that sweetness of voice and melody are qualities in birds, which are partly natural and partly acquired; that in all populous and civilized countries most of the birds chaunt delightful airs, but that in the extensive deserts of Africa and America, with few exceptions, the winged tribes utter only harsh and discordant cries.

I had often heard and read, that bird-catchers preferred birds taken in one county to those of the same species caught in another. For a long period I had no opportunity of ascertaining the

large flocks, as the Swallow, the Martin, the Fieldfare, and the Redwing ; others, as the Ringousel, in smaller parties. Indeed, this principle of association may be remarked in active exertion, in most species of the feathered race. Few disown its power, and those only in consequence of an organization which forbids them to unite, or from the ferocity of their manners, or the nature of their food. Some in small family flocks, others, in larger companies, composed of many families ; and others, in immense multitudes gather together ; the cause of their union is social love, and of their dispersion, sensual appetite. In autumn this congregation begins, and the society disperses again, in pairs, in the spring ; the pleasures and advantages derived from community are then relinquished, to reap higher gratifications in individual love. Most birds own the influence of that natural principle, every where the foundation of human society ; a love of their fellows. This secret, but impelling, spur to union, connects the race of Sparrows as well as men ; but when this active propensity to social union, this common impulse, would be detrimental either to others or themselves, nature, with that benevolent care, exemplified in all her works, has suppressed this sensation, as injurious to the individual, or noxious to its fellows. Thus, Lions never range in hordes, as their concentrated power, in irresistible fury, would spread devastation over their course. Eagles and rapacious birds, formed for rapine and destruction, find their pleasures in solitude ; but Vultures, which prey on putridity, and fatten on corruption, unite in multitudes to devour the carcasses which contain within them the seeds of contagion and pestilence ; and Woodpeckers, from the nature of their food, are condemned to a lonely life, secluded from the joys of society and the endearments of mutual connexion. When the social

cause of this opinion ; and, to my great surprize, I at length found, that the chirping song of the Chaffinch in Devon, is very different from the notes of the same species in Dorsetshire and Wiltshire ;—in the latter counties, the former part of its song, if song it may be called, is totally dissimilar from that of the Chaffinch of Devon, though the closing notes are exactly the same.

union is broken by the excitement of love, most birds retire in pairs⁶⁶ to produce new life, to raise their habitations, and the male to soften, by his song, his love, or his blandishments, the fatigue of his patient partner during the period of incubation. The Cuckoo alone, of all the denizens of the air, feels not the claims of parental affection, or the transports of pleasure on the birth of her young ; she drops her egg in the nest of a stranger, regardless of its fate ; denied by nature the participation of those warm emotions, which so highly delight the whole of the feathered race, except herself, and placed without the ban of connubial and parental joy ; the season of love is, to her, a season of dulness and insipidity, without a gleam of interest, pleasure, or affection, to brighten the scene. , But the affections of birds in general are usually more vivid and active than we are inclined to allow ; they possess the most acute feeling, practise the most officious tenderness, and display an anxious attachment that disregards danger, and sets the voracious calls of hunger at defiance, when their young demand their care. The hen, though so fearful and placid in her general deportment, assumes, in the moment when danger threatens her brood, a degree of courage that does not calculate on native strength, or greatness of powers ; her aspect suddenly becomes enraged, her feathers rise in anger, and she then fearlessly attacks the animal from whose presence, at another time, she would retire in terror and alarm. The Lapwing, the Titlark, the Willow-wren, and the Partridge, and numerous other birds, when their nests are approached, indicate their fears by their cries ; they will place themselves immediately before the observer, as if wounded and unable to fly, and run the risk of their own safety, to decoy their enemy from the spot in which their young lie concealed. This violence of affection overwhelms all other passions, stimulates the most indolent of the feathered race to active industry, gives a higher tone to their feelings, sharpens their sagacity, and places them in a situation from which the tenderest mother might take lessons of regard. But strong as this parental

⁶⁶ Some birds are polygamous, as the Cock of the wood ; but most are monogamous.

attachment is in most of these denizens of air, it sometimes gives way to an opposite feeling; the mother that to-day watches, nourishes, and protects, her offspring with an extravagance of fondness, to-morrow deserts them, and leaves them to perish. It is true this rarely happens, nor unless the parents have been disturbed in the discharge of their duty, or their young ones have been often exposed to the prying eye of wanton curiosity. Few birds, even under the most distressing circumstances, quit their young; and it is generally those whose native wildness implants a fear in their minds that undermines, and at length suppresses and destroys, the deep-rooted and powerful impulse of parental affection.

Of the feathered race, when they are robbed of their young ones in their presence, none but those of the most solitary dispositions, or which constantly shun the appearance of man, but will follow them even to a great distance, attend them in captivity, and provide them with food, however laborious and dangerous the employment;—their happiness centering in their offspring, neither their own desires nor safety are put in competition with the wants of their progeny, and every difficulty the parent can overcome is surmounted. But not only toward their young do birds pourtray a strong affection; many of those which live in monogamy throughout the year, or only in the vernal season, exhibit decisive proofs of attachment and affectionate regard. If one of the smaller birds be deprived of its mate,⁶⁷ it chirps its sorrows in the most doleful tone, its misery is evinced

⁶⁷ Marcgrave asserts, that the *Palamedea Cornuta*, or Horned Screamer, exhibits one of the most perfect patterns of connubial affection; and that, when one of the pair dies, the other takes no sustenance, but sits beside the dead body of its mate until melancholy and hunger destroy it. I have often witnessed striking instances of affection in the Wagtail, Crow, Gull, and several other birds. In the prior part of the month of March, 1807, I shot at a flock of Chaffinches, and, while reloading, observed a male Chaffinch, in an unusual manner, flapping its wings, uttering mournful tones, and running round a hillock at a distance. Induced, by these strange actions of the bird, to attend to its motions, I at length approached it, and perceived on the ground a female Chaffinch then expiring; the male flew away, perched on a neighbouring tree, and continued for

in its actions, it runs wildly about, it flies in a thousand contorted modes, its wings flap in disappointment and grief; place its dying partner before it, and its sorrows increase, its little bosom, agitated by conflicting passions, displays in the wildness of its manner the pangs that rend it asunder; but if fear predominate over its feelings, and it can no longer pour forth the effusions of tenderness over its expiring mate, it retires to a neighbouring tree in melancholic sadness, to vent, in unavailing mournings, its anguish and its agony.

The transition from the affections of birds to their discernment, is natural and easy, as the one presupposes the other. In obtaining their food they display no small share of sagacity;—the Lapwing beats the ground with its foot to bring up the worm from beneath. The Wagtail skims in a line the surface of the thatch-covered cottages, from the eaves to the roof, then flies off to gain the eaves again, and ascends as before, that its prey may not be alarmed and retire beyond its reach. The Swallow often follows the course of the horseman, to catch the flies roused by the horse's feet. Gulls, Rooks, Wagtails, and many other birds, seek the paths of the plough; and the little Redbreast the furrows made by the spade of the gardener. Starlings mingle with Rooks, as Jackals with Lions, or the Pilot-fish with the Shark, to participate in the food which their larger companions reject or despise. The Woodpecker utters its harsh scream to rouse the frightened inhabitants, thrusts its long-armed tongue into the ant-hill, and writhing it violently round, drags out the little insects impaled on its barbs. The Corvorant, in rivers, endeavours to drive the scaly fry into some nook or inlet, in which it may, with greater ease and facility, destroy them. The Kingfisher, in suspended balance, hovers over the shallow stream, to attract its prey by the brilliancy of its plumage. The

some time its mournful chirping. My heart was melted at the sight; and I wished that guns and gun-powder could not deal destruction; and more, that I had not been the cause of so much pain.

R. Jordan delin.

J. Warner sculp.

THE SPARROW HAWK.

Published Feb. 4. 1869, by T. Cadell & W. Davies, Strand London.

THE YOUNG HEN HARRIER.

THE REDBACK'D SHRIKE.

THE WOODLARK.

THE YELLOW WAGTAIL.

THE GREEN WOODPECKER.

Published Jan. 4 1899, by T. Cadell & W. Davies, Strand, London.

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OF
ORNITHOLOGIA DANMONIENSIS:
OR
An History of the Habits and Economy
OF
DEVONSHIRE BIRDS.

BY A. G. C. TUCKER.

INSCRIBED, BY PERMISSION,
To J. P. BASTARD, Esq. and Sir L. PALK, Bart.

THE WORK TO CONSIST OF TWO VOLUMES.

CONDITIONS.

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 3. That no order for fewer numbers than those comprised in one volume shall be received.
 4. That the domesticated birds shall not be included.
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LONDON:

PRINTED FOR THE AUTHOR, AND SOLD BY T. CADELL AND W. DAVIES, STRAND.

1809.

Prospectus.

A monographical Description of the Birds of this county has not hitherto been undertaken, although a county so fruitful in this beautiful part of creation, and offering such an ample field to the enquiries of the Ornithologist. The most cursory inspection of the face of Devon, would convince the beholder that its spreading woods and thickly-intermingled hedgerows, its cultivated hills, and warm and luxuriant vallies, the sea which environs two of its sides, and even its very heaths and moors, afford favorable asylums to the feathered race. Nor would the observer err. The multitudes of birds which annually resort to Devonshire, and the still greater flocks that constantly reside with us, abundantly prove it worthy the attention of him who directs his studies to the examination of this part of the works of nature.

In an age so enlightened as the present, it would be fruitless, indeed, to endeavour to recommend the study of natural history by a long detail of the advantages resulting from it; as it evidently tends to enlarge and strengthen the powers of our minds, and properly employ our leisure time. And, especially, as from the stores of nature we obtain every thing that is conducive to the sustenance of the body, to its repair, or its preservation. The benefits which we have received from the labors of the naturalist are innumerable. To him are we indebted for many exotic plants and animals which adorn our gardens and our fields, administer to our wants, or gratify our inclinations. Most, if not all, of the farinaceous plants, so necessary to our existence, are not the spontaneous gift of nature to our soil; but to the hand of man are we indebted for their introduction. The pheasant, which decorates our woods, yields a rich viand to the epicure, and affords amusement to the sportsman, came from afar. The peacock, which embellishes the inclosures of the rich, is not a native of Britain; and even the race of common poultry, so long reclaimed from the wilds of the forest, and so long an inhabitant of our isles, which furnishes our entertainments with delicacies, and supplies us with a profusion of wholesome and nutritious food, derives its origin from Persia, or the still more distant regions of India.

The science of ornithology, though but a small link in the chain of natural history, abounds with interesting examples of patience, sagacity, ingenuity, and affection; with objects for the gratification of our appetites, for the enlivening of our prospects, and for the soothing of our ears with their melodies. But, above all, this beautiful page in the grand volume of nature is crowded with countless proofs of the omniscience of the Creator, and displays, in no small degree, his wisdom, magnificence, and power.

Of all men the author is the worst critic on his own work, he beholds it with the partial eye of a fond parent, and endeavours to screen its very defects; he praises as a beauty that which to the rest of mankind appears as deformity, he incurs censure for his presumption, or, what is still more rare, injures his own productions by his diffidence. By its own merit then let this work stand or fall; the author has devoted many of his leisure hours to the investigation of the manners and actions of the birds, which he professes to describe, and the present work is the offspring of the information obtained in the research.

ASHBURTON, 23d March, 1809.

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