

ART. IX.—*On the Migration of the Birds of North America.*

Read before the Literary and Philosophical Society of Charleston, (S. C.) March 15th, 1833; by Rev. J. BACHMAN.

For ages past, the migration of birds has been a subject of great interest to naturalists. The mysterious appearance and disappearance of many species, at different periods of the year, while many of them have never been seen in their migrations; the remote or unknown situations to which they retire; the sudden appearance of some birds in the spring, after one or two days of warm weather, and their equally sudden disappearance on the first cold day; all have conduced to create many vague and superstitious notions, in the minds of the uninformed, and have often left the intelligent student of nature in perplexity and doubt. Examples are seen, in the accounts so often published, of the swallows having been found, in great numbers, in caves and hollow trees, and in lakes and ponds; and of the common Rail or Sera, (*Rallus Carolinus*, L.) having been discovered in gutters and hollow banks.

Some have supposed that birds, like some animals, are, by their internal organization, capable of becoming dormant, during winter, and hence they readily listen to stories of birds having been found, concealed, in great numbers, in caverns, the hollows of decayed trees, recesses of old buildings, and other secluded situations; whilst others have contended, that they were, during the winter, preserved under the water, beneath the mud.

Amidst such contradictory opinions, on a subject concerning which the most intelligent naturalists are not yet agreed, there is a wide field open for inquiry and observation. The works of God, amidst the wonders of nature, are always worthy of investigation. If he has given to the birds of the air, instincts which cannot be equalled by the boasted reason of man—if he has communicated to them some mysterious faculties, which have hitherto baffled the researches and wisdom of the wise,—may it not be well for us, at least, to record the facts, so that, although we may not be able to explain these hidden mysteries of nature, we may be humbled under a sense of our inferiority, and thus be led to adore the wisdom of God.

Very little appears to have been written on the migration of North American birds; a topic probably regarded as of too little importance, to merit the research necessary to a satisfactory result on such

an intricate subject ; for the elucidation of which, I have myself possessed some opportunities, by witnessing the migration of birds, in three very distinct portions of America.

That instinct is truly mysterious, which, at particular seasons of the year, teaches birds to take wing and leave their native haunts, pursuing their onward course, sometimes across arms of the sea, and in most cases over rivers, mountains and forests, into far distant countries. It is equally surprising, that many of them, commencing their migrations in summer, should thus anticipate the cold ; while others return from southern climes, before the snows of the north have disappeared, and whilst winter still “ lingers in the lap of spring.”

Among animals and birds, we often discover a train of actions, all adapted to produce a certain effect, by the agency of certain means, without the exhibition of any part of a regular chain of thought, the essential characteristic of reason ; this substitute for reason is called instinct, a term which has given rise to many unsatisfactory theories. I shall, therefore, pass them over with a few brief remarks, on the difference between instinct and reason.

When certain species of birds, at their first season of breeding, being without experience, build all their nests alike, both in form and materials, this may be called the result of instinct. On the other hand, when man guards against danger, or makes provision for the wants of life, or seeks relief from diseases, by the application of medicines, he acts from reason, because he is instructed by the experience of the past. When birds, at certain seasons of the year, change the climate, in anticipation of cold or heat, they act from instinct, because, to many of them, it is their first migration ; and as they often migrate singly, and not in flocks, in such cases no experience can aid them. On the other hand, when man makes provision for the changes of seasons and climates, he acts from reason, and is instructed by his own experience, or the experience of others.

Whatever difficulties there may be, in accounting for that mysterious principle in birds, called instinct, and which induces them, at certain seasons, to change their abode, and again, after an interval of six months, to return to the neighborhood where, the year before, they reared their young ; the facts of these migrations are incontrovertible, and the reasons why they take place are becoming more and more apparent.

Those birds that migrate, are, from the very structure of their bodies admirably adapted to rapid and continued flight. Their

feathers are so light, that they float in the atmosphere, for many hours, with very little artificial support. The tubes of these feathers are hollow; the bones are specifically lighter than those of quadrupeds; the bones, also, are hollow, and instead of marrow, are filled with air. They are furnished with lungs of an unusually large size, adhering to the ribs, and provided with aerial cells, insinuating themselves into the abdomen. These, added to the great length and strength of wing, enable them, with ease and rapidity, to navigate the air—to elevate themselves above the clouds, and pass from one country and climate to another.

We perceive, then, from the very structure of birds, that they are admirably formed for rapid flight and migration. From a variety of accurate experiments, which have been made, at different periods, it appears, that the Hawk, the Wild Pigeon, (*Columba migratoria*,) and several species of wild ducks, fly at the rate of a mile in a minute and a half; this is at the rate of forty miles an hour, four hundred and eighty between the rising and setting of the sun, and nine hundred and sixty miles in twenty four hours. This would enable birds to pass from Charleston to our distant northern settlements in a single day, and this easily accounts for the circumstance, that geese, ducks, and pigeons, have been taken in the northern and eastern states, with undigested rice in their crops, which must have been picked up in the rice fields of Carolina or Georgia but the day before.* There is a well attested account of a falcon from the Canary Islands, sent to the Duke of Lerma, which returned from Andalusia to the Island of Teneriffe in sixteen hours, which is a passage of seven hundred and fifty miles. The story of the falcon of Henry the second is well known, which, pursuing with eagerness, one of the small species of bustards at Fontainbleau, was taken, the following day, at Malta, and recognized by the ring which she bore. Swallows fly at the rate of a mile in a minute, which would be one thousand four hundred and forty miles in twenty four hours. That many birds continue their migrations by night, as well as by day, and are thus enabled to make an additional progress, may be easily ascertained from their notes, which, in autumn and spring, the seasons of their migration, we often hear by night. The cries of geese,

* I had an opportunity, several years ago, in the state of New York, of examining the contents of the crops of several pigeons, taken from the same flock, which were pronounced by the country people to be rice. It proved, however, to be a different grain, the wild rice of the western lakes, (*Zizania aquatica*.)

cranes, and some species of land birds, are distinctly heard, and others fly silently. Wild pigeons are frequently seen, at early dawn, in the higher atmosphere. They fly higher by night than by day, and thus experience less inconvenience from darkness. The great Hooping Crane scarcely ever pauses in his migrations, to rest, in the middle states. I have heard his hoarse notes as he was passing over the highest mountains of the Alleghany; but he was always too high to be seen by the naked eye. This bird seems to take wing from his usual winter retreats in the south, ascends into the higher regions of the air, and scarcely halts, until he arrives at his breeding places, in or near the polar regions.

There are very few birds that do not migrate, either on account of food or climate. The observations of Captains Parry and Franklin, of Dr. Richardson and their associates, who wintered in the polar regions, prove, that birds which never visit temperate climates and which naturalists formerly supposed were wholly confined to the arctic circle, leave the intensely cold regions of the north in winter and migrate southerly to the distance of many hundred miles.—These adventurous explorers of the polar regions speak of the dreariness and desolation of these countries in the winter and the almost total absence of animal life. During the whole winter, spent at Melville Island, a pair of ravens, (*Corvus Corax*,) alone were seen and these they state had frequently a white ring around their necks, “caused by the accumulated encrustments of their own breath and giving them a very singular appearance.” The snow Buntings, (*Emberiza nivalis*,) the Ptarmigan, (*Tetrao Lagopus*,) and two other species of Artic Grouse, (*Tetrao Salicti* and *T. rupestris*,) were their earliest visitants in the spring; and these birds are in Europe and in the farthest northern settlements of our continent found only in the coldest winters, and on the highest mountains; still we perceive that even they find limits beyond which they cannot live in winter.

Birds migrate, either to avoid the cold of winter, or to find more congenial, or more abundant food, and I am induced to believe that in general, the latter is a stronger principle than the former. The small number that remain amidst the snows of the north are either carnivorous, such as a few of the Owls and Hawks, the Ravens. (*Corvus Corax*,) the Canada Jay, (*Corvus Canadensis*,) and the northern Shrike, (*Lanius borealis*),. These pick up a scanty subsistence by feeding on a few of the smaller birds that remain, or by follow-

ing the hunters and the wolves, and supporting life by picking the bones of the animals which they have left. Or they are composed of those birds that feed on the buds of trees, such as the Grouse, that live on the buds of the birch, (*Betula*,) Poplar, (*Populus*,) and several species of willow, (*Salix*,) Or those that feed on the seeds of the pine and spruce, (*Abies*,) as the Crossbills, (*Curvirostra*,) and pine Grosbeaks, (*Phorhula enucliator*,) or they are birds that are able to find subsistence on the seeds of plants that are protruded above the snow, or on the seeds of grass found in the barn yards or haystacks of the farmers, such as a few species of the sparrow. But those immense numbers of birds, that feed on insects and worms all migrate to those countries where they are abundantly supplied with this kind of food. These are the Swallows, (*Hirundo*,) the night Hawks and the Whippoorwill, (*Caprimulgus*,) the Tanagers, the fly catchers, and warblers. To them migration is essential to the support of life. The insects at that season disappear, the earth is bound in frost, or covered over with snow, and all the means of subsistence are removed; but long ere this these lively tenants of the air, have obeyed the impulse of some mysterious instinct, and have migrated to more congenial climes. To these may be added all the birds that obtain food from the muddy and moist places of the earth, such as the different species of Curlew, (*Numenius*,) the Snipes, (*Scolopax*,) and the sand birds, (*Tringa*,) as well as those ducks that obtain subsistence from fresh water ponds and rivers; these finding the swamps, brooks, and shores frozen over, migrate from the north to milder regions where they can procure suitable food.

Those birds that migrate but partially and spend their winters in the northern states, though in a milder temperature than their places of summer retreat, such as the eagles, hawks, owls, and grouse, are enveloped in a warm thick, and downy plumage, which in most of the species extends even over the legs and toes. Other birds are exposed to the water, as well as the cold, such as some species of wild ducks, (*Anas*,) gulls, (*Larus*,) petrels, (*Procellaria*,) and puffins, (*Puffinus*,) These, gaining a subsistence from the sea, are not obliged to migrate on account of food. In addition to their warmth of covering, which shelter them from the cold, they are supplied with sacs, containing an oleagenous substance with which they regularly lubricate their feathers, thus rendering them imperious to moisture. Whilst floating on the surface of the water, they often draw up their feet beneath their warm covering of down, and thus every part of the body

is protected against the influence of the cold. There is another circumstance, with regard to the capacity of birds, to endure cold, which is not generally taken into consideration, it is the high degree of temperature. The temperature of the human body is generally placed at 97 or 98 of Fahrenheit, that of warm blooded, animals two or three degrees higher, and that of birds as high as 106 making a difference of 8 or 9 degrees, between birds and men. A large mass of air penetrates the lungs and all the aerial sacs and canals of the bird, increasing the action of the heart and propelling the tide of circulation with great rapidity. The pulsation in birds follow each other in such quick succession that they can scarcely be counted. The heat of their bodies being much greater than that of animals enables them to bear with ease the rigorous cold in the distant north and in the elevated regions of the air.

Some birds migrate only from one extreme of our union to the other. Thus the many species that go under the name of Sparrows that breed at the North, with the exception of three, the Snow, Bunting, (*Emberiza nivalis*), the three Sparrows, (*Fringilla arborea*), and the white crowned bunting,* (*Fringilla Leucophrys*), spend their winters in tens of thousands in Carolina. When the meadow Lark, (*Sturnus Ludovicianus*), and the brown Lark, (*Anthus spinoletta*), find the snows of the north covering the earth, and hiding their favorite food, they retreat before it and seek sustenance in our Southern states. Other families of birds, such as feed on ripe berries, that abound in the winter also remain with us; these are the Robins, (*Turdus migratorius*), the wax bird, (*Bombycilla Americana*), and the blue bird, (*Saxicola sialis*), which feed on the berries of the Tupelo, (*Nyssa aquatica*), the Holly, (*Ilex opaca*), the Cassena, (*Ilex cassina*), and the small black and red berries of several species of Smilax and Prinos. The yellow crowned Warbler, (*Sylvia coronata*), is the only Sylvia out of fifty species inhabiting the U. States, that remain with us in the winter, and even this bird could not find a subsistence among us were it not that it almost changes its nature in winter and lives on the fruit of the wild myrtle, (*Myrica cerifera*.) This is also the case with the only fly catcher, that winters in Carolina, the Pewee, (*Muscicapa fusca*), which sometimes fattens on the seeds of our imported tallow tree, (*Stylingia cerifera*.)

* It has been commonly believed, that this very rare species which breed at Labrador, does not migrate far to the south in winter. It however passes through Carolina early in autumn, and winters farther south.

It is doubtful whether there are any birds that never migrate during the changes of the season. Hawks and Crows are infinitely more abundant in the north during summer, than in winter; the greatest number of them retreat southerly; those of the south may at the same time proceed still farther toward the Equinox. Our cardinal Grosbeaks, (*Fringilla cardinalis*,) are found in New Jersey during summer, and are abundant in Virginia, hence the name of Virginia nightingale and yet during winter very few remain in those states. In the mean time as our number of birds, of this species does not increase, it is very probable that those which have been raised among us, remove still farther to the south. As our summer birds, such as the blue Grosbeak, (*Fringilla cœrulea*,) painted bunting, (*Fringilla ciris*,) and our warblers and fly catchers, abandon us towards the close of autumn, we receive at the same time fresh supplies of feathered hordes from Canada and the northern portions of the United States. Many of these remain in our mild climate of Carolina, during the whole winter. Some of them such as the Fox colored sparrow, (*Fringilla iliaca*,) the Siskin, (*F. Pinus*,) the Purple Finch, (*F. purpurea*,) and the Woodcock, (*Scolopax minor*,) only approached our southern climates in proportion as they are pursued by the cold. These seem to beg their subsistence on their passage, and linger among us no longer than their necessities require.

When our winter birds return to their breeding places in the north, they are in the early period of spring replaced by analogous species from the tropics, which resort to South Carolina and principally along our maritime districts, to engage in the affections and cares of reproduction. Of the many species of northern hawks, the red shouldered, (*Falco lineatus*, Wilson,) one of the most common species in the United States, is the only one that remains in our low country during summer. In the mean time, several interesting species from the south, arrive among us of gentler and less destructive habits, feeding principally on insects and lizards. The beautiful swallow-tailed hawk, (*Falco furcatus*,) a Mexican species which seems to be ever on the wing, builds its nest on the highest trees of our forests. The Mississippi Kite, (*Falco plumbeus*, Gmel.) with similar habits and also feeding whilst on the wing, is found occasionally in groups of four or five, soaring high in the air. This bird is so gentle when not on the wing, that it generally suffers you to walk under the tree without being disturbed. The black winged Hawk, (*Falco dispar*,

Temm.) is another of our visitors. It bears so strong a resemblance to an Asiatic species, (*Falco melanopterus*, Daud.) that, although it is described under another name, I have never been able to detect the slightest difference. It is occasionally met with as early as the beginning of February and breeds on a few of our islands along our sea-board. This species it has hitherto been supposed never migrated north of Florida. When the Gannets, (*Sula bassana*, Lacep.) leave us for their northern rocks, we are visited by the two species of Pelicans, (*Pelicanus onocrotalus*, and *P. fuscus*, L.) and by immense flocks of the wood Ibis, (*Tantalus Loculator*, L.) The latter commence regular systematic attacks upon our rice fields and on the fish in our ponds, first muddying the water and then killing ten times as many as they can consume, leaving a rich repast for the alligator. As strange as it may appear in birds so large and numerous, their nests have never been found. No sooner do the Virginia Rail, (*Rallus Virginianus*, L.) and the Sorà leave us, than their place is supplied by two species of kindred genera, the purple and common Gallinules, (*Gallinula martinica*, Gmel. *G. Chloropus*, Lath.) The latter is found breeding in nearly all the back waters of our rice fields; the former is seen but sparingly, and the large family of northern finches is succeeded by several interesting species, among the most beautiful of which are the Nonpareil, or painted Bunting and the blue Grosbeak. Thus by a wise benevolent provision of providence, the varying seasons bring along with them a succession of the feathered tribe, that either contribute to our sustenance or minister to our pleasures.

Whilst some of our northern birds make Carolina their southern limit in the winter, there are others that make it their northern boundary, beyond which they dare not go at that season. Thus the Cat bird, (*Turdus Felivox*,) the white eyed flycatcher, (*Muscicapa Cantabris*,) the green Swallow, (*Hirundo bicolor*,) and several other species appear among us in small numbers after one or two warm days in winter. A few of these linger along our sea-board in sheltered situations during the winter, and they are found in great abundance through the whole of that season in Florida and Mexico. The whole crane and heron family, (the latter composed of twelve American species,) all spend their winters south of Carolina, with the exception of a few stragglers, from among the great blue heron, a very small number of the white heron, and a few of the young of the

hooping crane; yet all of these species of birds are numerous in Florida in winter.*

Many birds make occasional and partial migrations only, to procure a supply of food. Thus, the common partridge, (*Perdix Virginiana*), in seasons when there is a scarcity of grain in New Jersey, crosses the Delaware River, into Pennsylvania. The same has been observed along the Susquehanna and Hudson. The flight of these birds is so heavy, that they are seldom able to reach the opposite shores on the wing, but drop into the water, when they are weary, and swim across. This is also the case with that most delicious of all birds, the wild turkey. Along the Ohio, Missouri, and Mississippi rivers, numbers of these, in the seasons of a scarcity of their accustomed food, cross those rivers, partly by flying, and then by swimming, and in their wet and exhausted state are taken in great numbers, either in the rivers, or as they arrive on the opposite shores. The wild pigeon is another of those birds, that are supposed to be driven among us only by the extreme cold of the north. This is a mistake. These birds appear in Carolina, only at very long and uncertain intervals. Sometimes they visit us in cold, but frequently in mild winters. I have seen wild pigeons, in immense flocks, in Canada, in the coldest winters, when the thermometer was below zero. It is to be remarked, that the previous autumn had produced an abundance of beech nuts and buckwheat, their favorite food, and

* The following herons breed in Carolina, and all of them in communities with the exception of the least bittern, (*Ardea exilis*), a rare species, which conceals its nest among the rushes in fresh water ponds, where it deposits three nearly white eggs. Great heron, (*Ardea Herodias*.) Great white heron, (*A. liue*, Tem.) Snowy heron, (*A. candidissima*.) Louisiana heron, (*A. Ludoviciana*.) Yellow crowned heron, (*A. violacea*.) Night heron, (*A. nocticorax*.) Blue crane or heron, (*A. coerulea*.) The young of this species, are white until they are two years old. Green heron, (*A. virescens*), and least bittern, (*A. exilis*.) The American bittern, (*A. minor*), remains in our marshes during the spring, until about the 12th of May, when it retires to its breeding places in the farthest north. The *Ardea Pealii* of Bonaparte, as has been ascertained by Audubon, is the young of the *Ardea rufescens* of Buffon. Having had living specimens in my possession for some time, I am enabled to state, that the downy feathers of the young, whilst in the nest, are brown—the birds then continue white until the second year, when they assume a rufescent color. They are found breeding in great numbers on the islands of the southern extremity of Florida. In the same places are found also, the newly discovered heron, (the largest of all our American species,) which Audubon describes under the name of *Ardea occidentalis*. The brown-crane, (*Grus Canadensis*, of Temm. and Bonaparte,) is undoubtedly the young of the great hooping crane, as I have ascertained in a pair kept in confinement, which either in the second or third year of their age assumed the form and plumage of the adult bird, the *Grus Americana*.

that the ground was not covered with snow. It is only when the forests of the west have failed in their usual supply of mast and berries, that the wild pigeons come among us, to claim a share of the acorns and berries of our woods, and the refuse grains scattered over our rice fields.

It is, perhaps, not improbable, that the occasional changes in the migrations of the birds of our continent, may, in the course of time, introduce among us some species of birds from the south and west, that are not now found here. A large number of the feathered race follow the improvements of civilized man. No sooner does cultivation commence, than many birds, which were unknown in the forest around him, are seen in his fields and orchards. A new species of grain attracts the graminivorous bird—a particular plant or tree, on which certain caterpillars or insects feed, invites the *Sylvias*, *Vireas*, and *Muscicapas*; and the tubular flowered plants of the West Indies, transplanted into the soil of Florida, are already beginning to attract some of the many species of humming birds of the south. In the days of Wilson, (one of the most observing of our American ornithologists,) the great Carolina Wren, (*Troglodytes Ludovicianus*,) and the pine creeping warbler, (*Sylvia Pinus*,) together with several other species that are now common in the northern states, (where I sought for them for many years in vain,) were there unknown. They have now extended their summer migrations, as far north, at least, as Boston. The cliff swallow, (*Hirundo Lunifrons*, Say,) a Mexican species, was first seen on the banks of the Ohio, in 1815. These birds excited much interest, from the peculiar structure of their nests, built of mud, and clustered together, resembling a bunch of gourds. From year to year, they continued to increase and advance eastwardly in their migrations, until they have now extended across the continent, as far as Canada and Maine. The olive-sided flycatcher, (*Muscicapa Cooperii*, Nutt.) has but recently made its appearance in the north, and on the mountains of Virginia; and in the latter situations, the newly described Bewick Wren of Audubon, (*Troglodytes Bewickii*,) has supplanted all the other species of that genus. The fork-tailed flycatcher, (*Muscicapa savana*, Bonap.) has, only within a few years, commenced leaving the tropical wilds of Guiana, and a few stray birds of that species are almost annually seen in the middle states. The solitary flycatcher, (*Vireo solitarius*, Vieill.) which was so rare with us ten or twelve years ago, that scarcely a bird of that species could be found in a year, has of late become so

abundant, that in the month of February five or six can be counted in particular situations, near our city, in a single day, and their sweet notes form a considerable addition to the concerts of our feathered choir. The orange crowned warbler, (*Sylvia celata*, Say,) so long confined to the far west and the orange groves of Florida, has become equally common in our immediate neighborhood. The pectoral sandpiper, (*Pelidna pectoralis*, Say,) and the long-legged sandpiper,* (*Tringa himantopus*, Bonap.) which were formerly so exceedingly rare, that Wilson knew nothing of their existence, are now found every summer, in small numbers, along our sea coast. It may not be unworthy of remark, in this place, and in confirmation of the views now advanced, that no less than eight or nine species of birds, either wholly undescribed or not previously known to exist in the United States, have recently been discovered in the neighborhood of this city. A few of these may have long existed in the country, and escaped the researches of former naturalists, but I am under an impression that some may have but recently come among us.† From these facts, we may easily perceive, that after all the additions that have been made to our American ornithology, by Wilson, Bonaparte, Cooper, Nuttall, Richardson, and especially the indefatigable Audubon, the field still remains open to the investigation of the student of nature, and promises a rich reward.

There is one singularity in the migration of American birds that is as yet involved in some obscurity. A vast number of northern warblers and fly catchers do not pass over the low countries of Carolina in their migrations and the closest observers have not been able to find a single specimen of many species that are abundant in the north, and that all migrate southerly in autumn. It is possible that migratory birds pass southerly in two immense channels, one leading from Hatteras, or some of our capes a little farther south, and then across the gulf of Mexico to the West India Islands where, they spend the period of our winter in immense numbers. They

* From specimens, in various stages of plumage, which I possess, of the long legged sandpiper, I am disposed to believe, that Swainson and Richardson, in their *Fauna Boreali-Americana*, have been deceived by the variations in the plumage and size to which this bird is subject, and have described it three times under the names of *Tringa himantopus*, *T. Audubonii*, and *T. Douglassii*.

† Some of these birds have since been figured and described by Audubon, under the following names: *Muscicapa dominicensis*, Briss. *Parus Carolinensis*, Aud. *Fringilla Bachmanii*, Aud. *Fringilla Macgillivraii*, Aud. *Sylvia Swainsonii*, Aud. *Sylvia Bachmanii*, Aud. *Rallus elegans*, Aud.

are often met at sea during the period of their migration and are frequently known to alight on the rigging of vessels, where they rest, for an hour or two, and then again pursue their onward course. The other path of migration and probably the most common, to which I refer, is along the Alleghany mountains which extend through the whole interior of our country. They vary occasionally in their flight so as to follow not only the range of mountains, but the courses of rivers. In these views I am supported by Audubon and Nuttall, and they are strengthened by the fact that the Rose-breasted Grosbeak, the Baltimore Oriole, the Scarlet Tanager and a number of species of warblers that seldom visit the maritime districts of Carolina are found to pass along our mountains and from thence through the states of Louisiana, Mississippi, and Arkansas. Some of these birds remain in Mexico; some enter within the Tropics, and others possibly pass beyond them in order to find a climate similar to that which they have left.

It has recently been ascertained that some of the birds that are found in the north of Europe and have hitherto not been known to exist in America, migrate from the polar regions, along the Rocky mountains sometimes as far south as Mexico and in their spring migrations return by the same route. The Magpie, (*Corvus Pica*,) and the Bohemian wax-wing, (*Bombycilla garrula*,) and a few others, are of that number. Several other birds, peculiar to the American continent, never visit the cultivated districts of the United States, but take the same course in their annual migrations; among these are the black water-ousel, (*Cinclus Pallassii*, Tem.) the evening Grosbeak, (*Fringilla Cooperi*,) Clarke's Crow, (*Corvus columbarius*,) and the Columbia Jay, a most splendid bird, figured by Anderson, rivalling in beauty the bird of Paradise. The spotted thrush of Latham, (*Turdus naevius*,) the arctic Blue-bird, (*Erythaca arctica*, Swain.,) the *Emberiza picta*, Swain., and the saffron headed Troopial, (*Icterus xanthocephalus*, Bon.) are also of this number. Those birds only, that breed in the arctic circle visit both Continents. It is computed that out of almost four hundred and fifty species already known in North America, only twenty seven land, and eighty one* water birds are natives of both continents; conse-

* This number has been considerably increased since the publication of Richardson and Swainson's Fauna Boreali-Americana, in which it is to be feared the mania for adding new species of birds has been indulged to a considerable extent.

quently three hundred and forty two species are peculiar to our own continent. The land birds that visit both continents are composed of Eagles, Hawks, Owls, and most of the genus *corvus*, and a few other species possessing great strength of wing, and warmth of covering, enabling them to migrate with ease, and to bear the rigors of the polar regions. The water birds are either composed of Ducks, which breeding far north, are enabled to reach the regions of Norway and Russia, and visit the shores of Europe, or they are of the Gull, Tern, and Petrel, species which find sustenance every where on the bosom of the ocean, and may therefore, with great facility, navigate the widest seas. Still, it will be observed, that the number of birds that migrate from one continent to another, is very small, and I am under an impression, that these migrations take place but seldom. Such is also the case with our animals of which very few are found on the eastern continent. In fact, our whole kingdom of nature not even excepting the insects and plants, presents peculiarities which well entitle it to the name given it, by its first discoverers of "the new World."

Whether many of our migratory birds that leave us early in the season, may not pass beyond the tropics, and retire to latitudes in the southern hemisphere, of the same temperature with that which they left, is a subject that remains for the investigation of future naturalists. Why may they not take advantage of the reversion of the seasons, and rear a second brood in South America? The purple martin which is found in our whole country during summer as far as the 60th degree North latitude, is known to breed in South America during our season of winter, and this is also the case with several of our rarest sylvias. Even admitting that our birds do not migrate to the southern hemisphere, it is probable that some of the species, may breed in two distinct portions of North America. The stork, after it leaves Europe, is known to raise another brood in Africa. Audubon found the white headed Eagles, (*Falco leucocephalus*), and the Fish Hawk, (*F. Haliaetos*), having nests with their young full fledged and able to fly in the month of November in Florida. The Barn Owl, (*Strix flammea*), sometimes lays its eggs in the unoccupied buildings of this city in November, and I last year had a young bird, of the great horned Owl, (*Strix virginiana*), sent me on the 3d of December, which had been taken from a nest in this vicinity. Now this is a season when our northern countries are blocked up in frost and snow, and it is not improbable that many of these birds,

following the opening of spring, may raise a second brood in the more northern climates.

The Rail, (or Soree as it is called in Virginia) and the swallows have occasioned more speculations and created more superstitious ideas with regard to their winter residence than any other of our American birds. The erroneous opinions with regard to the Rail have probably arisen from the sudden manner in which it appears and disappears in the middle states, and the unphilosophical notions, with regard to the swallows have originated in Europe and from thence been transmitted to our country.

Rails, after having been absent during the whole summer from the middle States, suddenly make their appearance early in August in immense numbers along the Delaware, Schuylkill and James rivers. In a single night, their clamorous voices are heard in tens of thousands, on those reedy shores, where but the day before not one could be found. Here they remain till about the middle of October, when suddenly their well known cackle ceases and in the places where the day before many hundreds were seen, not a solitary one remains. They seem so heavy of flight that they are sometimes taken by hand and hence the oft repeated inquiry whence come and whither goes the Soree. Many believe that these birds, are scarcely capable of flight, and must find some retreat in hollow banks or perhaps under the ice or mud. The truth is they migrate altogether by night, and like the Woodcock, and other kindred species, fly admirably in twilight or in the dark. They breed very far north. An intelligent Indian trader informed me that he had found great numbers of their nests, whilst hunting for the egg of the wild goose, (*Anser Canadensis*,) along the reedy marshes of the most northern lakes. It is not generally known that when they leave the middle states, they appear in the rice fields and marshes of Carolina, where they remain a short time, before they migrate, still farther south and in the spring again visit us, as they are passing on to their northern breeding places. There is then nothing in the migrations of the Rail that cannot be accounted for on the principles of nature.

All the absurd theories with regard to the hibernation of Swallows have originated from the habits of a few species common to our country and to Europe. The chimney swallow of Europe, (*Hirundo rustica*,) resembling our barn swallow, (*Hirundo rufa*,) in every thing but its habits of building in chimnies so perfectly, that they cannot be distinguished from each other, and the bank swallow,

(*Hirundo riparia*,) which is a native of both continents, and our chimney swallow, (*Cypselus pelagius*, Temm.) have occasionally been found in holes on the banks of rivers, in the hollows of decayed trees, or in the recesses of old buildings, clinging together sometimes in great numbers, nearly in a torpid state. Hence it was asserted that these were their winter retreats and that here they remained in a state of torpidity, from the cold of autumn, to the sunny days of spring. This doctrine has been espoused by a number of intelligent naturalists of Europe from the amiable and observing White of Selborne, even to the great Cuvier, who makes use of the following language. "Some birds retire into remote places, to some desert cave, some savage rock, or ancient fortress." He evidently had no opportunities for a satisfactory examination. Dr. Good has also asserted of the chaffinch of Sweden, (*Fringilla coelebs*,) that many of the males indulge in a profound sleep in Sweden whilst the females migrate to Holland towards the winter and duly return to them in the spring.

From dissection, (the details of which it is unnecessary to give here) it has been ascertained that from the internal structure of swallows, and the same may be said of all birds, it is impossible for them to live beyond a day or two in a torpid state. In this declaration I am supported by the investigations of the celebrated John Hunter. I have seen the American chimney swallow as well as the rail placed under the water to try the experiment whether they could exist in that element, and they have invariably been drowned in a few minutes and no warmth or even electricity could afterwards revive them. The habits of swallows drinking from brooks and rivers, while they are on the wing and of their picking up flies and insects, whilst skimming the surface of the water, has no doubt given rise to the deceptions in persons, supposing that they had seen them going under the water as a winter retreat. When birds of this species have been found in nearly a dormant state, it was either in the autumn or early in the spring, generally the latter. These are the seasons of their migration. At night they sought those retreats, as usual, to sleep; here, they were overtaken by a cold change in the atmosphere, and here they would have died in a very short time, if the weather had not become milder. These birds have, I apprehend, never been found in this situation in winter. Besides, our senses can satisfy us where the swallows spend their winters. Of the six species of swallows that inhabit the United States, all of them but the cliff swallow which has but recently made its appearance in the country are seen

in thousands performing their annual migrations, along the environs, and even the very streets of our city. The green swallow, (*Hirundo bicolor*,) is found in Florida, during the coldest weather of that country, and was during the last winter (1832) seen every day with the exception of about two weeks, in considerable numbers in the neighborhood of Charleston. The barn swallow and purple martin, (*H. purpurea*,) leave us earlier and return later, the chimney swallow follows last in the train on its return from the south as it is the first to leave us in autumn. Thus we perceive that there is nothing mysterious, nothing unnatural in the migration of the swallows.

When the period of migration arrives, birds evince an uncontrollable restlessness of disposition, as if conscious that an important undertaking, was at hand. The Snow and Canada Geese, (*Anser hyperborea* and *A. Canadensis*,) which I have had for some years in a state of domestication, (although in other respects perfectly tame) make constant efforts, on the return of every spring, to obey the impulse of nature, and take their departure for the north. Although a joint from a wing of each has been removed, yet they make attempts at flying, and when at this season they are enabled to escape from their enclosure, they hurry off in a northern direction, as if determined to make their long journey on foot. Wilson gives a well authenticated anecdote of a female wild goose having been domesticated by Mr. Platt of Long Island, which, after flying off on the following spring, returned in the autumn with three of its comrades or young and the birds were all living several years afterwards. I have preserved in an aviary, robins, finches and orioles that had been procured when young at the north, and no sooner did the spring (the time of migration) arrive, than they exhibited by their constant fluttering a disposition to escape and the moment this was effected they flew off not to the south or west but as directly in the line of migration as if guided by a compass. These are facts of which the humblest individual may inform himself, but which neither our wisdom or philosophy can explain.

The manner in which birds perform their migrations is also deserving of notice. At the approach of autumn, when the cold is beginning to drive the insects to their winter retreats, when the earth begins every where to present the image of desolation and death, when many terrestrial animals are preparing for themselves a shelter from the cold, it is then and sometimes a few weeks earlier (as if in

anticipation of this season) that birds assemble, in troops, to set out on their annual aerial voyage to southern climes. The young in most species instinctively flock together as if disdaining to enquire the path of migration from the old. Some taught by an instinct of nature, which way to bend their course depart singly, and make their long and weary journey alone, others go in straggling flocks, sometimes you see the air almost darkened with the swallows and night hawks, (*Caprimulgus Virginianus*,) other species crowd into close columns during their flight. This is particularly the case with the wild pigeons, wax birds, (*Bombycilla Carolinensis*,) black birds, (*Icterus Phœnicus*,) the cow bunting, (*I. Pecoris*,) the wild geese, ducks and several species of Tringas or sand birds. Some species move slowly and seem only urged along either by the cold or by a scarcity of their accustomed food. Others pass rapidly and effect their migration in a very few days. Some flit along the earth's surface and rest, here and there, as if to take a glance at the fields, gardens and habitations of man, whilst others mount high in the air and soar almost among the clouds as if scarcely deigning to cast an eye on the cities and villages and the puny efforts of their inhabitants and on the mountains and vallies beneath them. These aerial voyagers, by an admirable instinct, seize upon a favorable moment in which winds and the weather are fitted for these migrations; they are not carried along by the wind, but are obliged from the construction of their feathers to fly against it. They have a foreknowledge of frosts and snows for weeks before they arrive and they have a mysterious but sure monitor within them to tell them the coming of spring. They require no chart and no compass to enable them to navigate the air and pass through the region of clouds, the thunder and the storm. They arrive at the end of their destined voyage, and there in the grove, the forest, the mountain, the field or the garden, they find food, shelter and a home prepared by the hand of providence; there in all probability, they revisit the very neighbourhood and probably build their nests in or near the same tree, or bush, or tuft of grass in which the year before they reared their young. This too may have been the scene of their infancy and here they may have caroled their earliest song. The disposition of birds to revisit, annually, the place where they have once bred is remarkable. A blue bird that was marked so as to be known, built its nest, for ten successive years, in a box that had been prepared for the purple martin. A pewee, (*Muscicapula fusca*,) has been known to revisit the same cave for nine suc-

cessive years. A robin, bred for a still longer time in the same apple tree, and a red tailed hawk, (*Falco borealis*,) which is distinguished from all others of the species on account of its plumage having accidentally become white, has for the last twelve winters, kept possession of a dead pine in an old field in Colleton district, (South Carolina.)

Whilst many species of birds perform their migrations during the day a great number travel by night. The lover of nature who in the seasons of the migrations of birds, sees flock after flock passing over his head, all day long, or witnesses the wrens, blue birds and creepers just stopping for a few moments to seize a worm or insect and then as if impelled by destiny, rising again on the wing and urging onwards; has also the evidence that many pass over him at night. He hears unusual sounds in the air. The single sharp note of the rice bird repeated all around him is succeeded by the crake of the snipe resembling the grating of a wheel repeated at long intervals, and the woodcock, (*Scolopax minor*,) wheels around him uttering notes like the loud tickings of a watch so rapidly repeated that they cannot be counted. He ascends higher and still higher in the air like the lark of Europe till he seems to have risen above the clouds, when suddenly his voice is hushed and in zigzag lines he descends rapidly to the earth and alights near the same spot from whence he arose. This is repeated for several successive evenings and at early dawn till suddenly, he commences his annual migration and is seen no more. The yellow crowned and the night herons utter their hoarse croak as they pass high and rapidly on, and at a still greater distance like unearthly sounds, is heard the not unmusical cry of the Canada goose. In the mean time the rails, owls, thrushes, warblers, and many other birds glide silently by him like spirits of the air; and without being superstitious, there comes over him a sensation of mingled admiration and fear and he feels the truth of the language of inspiration. "Great and marvellous are thy works Lord God Almighty."

The arrival and departure of birds affords a pretty sure indication of the state of the weather and the advance of the seasons. Living constantly in the air and exposed to all its variations, they become, either from instinct or habit, acquainted with the changes of the atmosphere, with the winds, the weather and the seasons. Captain Parry and Dr. Richardson inform us of the anxiety with which the northern Indians watched the approach of the first bird, the harbinger of spring. On the 12th of April, says Dr. Richardson, the

arrival of the swans, geese and ducks gave certain indications of the return of spring. On the 14th a robin appeared; this bird is considered by the natives as an infallible precursor of warm weather;" and Capt. Parry says "the snow bunting was the first precursor of spring that appeared. When the well known notes of the whip-poorwill, (*Caprimulgus vociferus*, and *C. Carolinensis*,) are heard, the farmer is reminded that the time for the planting of corn is at hand. The fish hawk's return to the rivers of the north is regarded by the fisherman as a proof that the season for the taking of shad has arrived. When the swallow appears, the danger of frost is believed to be over; and if the Cuckoo of Europe is hailed by the old and the young as an evidence of the return of spring, and if we have in common with them admired the beautiful sentiment of the poet,

"Sweet bird thy bower is ever green,
Thy sky is ever clear;
Thou hast no sorrow in thy song,
No winter in thy year,"

the inhabitants of the middle and northern states of our country feel equally interested and pleased when they hear the soft and melodious note of the blue bird, the robin and the wood thrush, (*Turdus mustelinus*,) reminding them that "the winter is past and gone and that the time of the singing of birds has come."

Previous to a storm, the birds give indications of its approach. Our vultures, in great numbers, rise in circles till they are almost lost in the region of the clouds, the stormy petrels, (*Thlassidroma Wilsonii*, Bon.) crowd in great numbers around vessels and follow in their wake as if seeking the protection of man, the sea gulls and terns make the shores reecho with their hoarse clamorous notes, the loon, (*Colymbus glacialis*,) is excessively restless and his screams are heard at the distance of more than a mile and the barred owl, (*Strix nebulosa*,) utters his funeral cries even in the day. But when fine weather is about to return the whole scene is changed, and every hedge and copse and grove is rendered vocal and the whole feathered tribe seem to rejoice at the prospect of the cessation of the storm and the anticipation of bright skies and sunny days.

But although our subject is far from being exhausted I am admonished that it is time to bring these desultory remarks to a close. If I shall have fortunately succeeded in throwing even a ray of light on that which has hitherto appeared mysterious in nature; or if I have been enabled to awaken in a single mind a sentiment of admiration

and gratitude to that superintending providence who teaches "the stork in the heavens to know her appointed time, and the turtle and the crane and the swallow to know the time of their coming." I shall be doubly recompensed for those pleasing studies of nature which have enabled me to offer these remarks.

The farther we pursue this subject the more we shall be convinced that there is a wise arrangement in nature which governs instinct and action and creates being and beauty and happiness. The laws by which the whole system of nature is governed are equally simple and majestic and are equally visible in the minutest as well as in the most stupendous of Gods works. From the beauty and harmony of that system of nature by which we are surrounded, the mind is insensibly led to admire and adore that mighty cause the fountain of wisdom and perfection, who though unseen, is ever present who is "the source of all matter and mind and modes of existence."

The temple of nature, wide and wonderful as it is stands ever open, inviting the ignorant as well as the wise to enter and learn those lessons which are calculated not only to enlighten the mind but to improve the heart, and the chief object of science and Philosophy should be to lead us to the Altar of the benevolent Author of all things, and to make our experience and knowledge subservient to his grand designs.

ART. X.—*Chemical examination of the water of the Gray Sulphur Springs of Virginia*; by CHARLES UPHAM SHEPARD, Professor of Chemistry in the Medical College of the State of South Carolina.

IN consequence of an opportunity afforded me by a gentleman of this city, I have been led to a chemical investigation of the water of the Gray Sulphur springs of Virginia; and having recognised several ingredients in their constitution not before detected, I am induced to believe that a brief sketch of my examination will not be unacceptable to some of the readers of this Journal. Not having visited these springs, I must premise, that the topographical and other details, aside from the chemical research, are derived from the person who placed the water at my disposal.

The Gray Sulphur Springs are situated among the spurs of that portion of the Alleghany mountains which passes through Virginia