

FEATHERED FORMS OF OTHER DAYS.

OF all those great classes into which systematists and biologists have divided existing vertebrate forms, none stand out more sharply defined from all the other divisions than the class *Aves*, or living birds, meaning of course, as I do, birds as we now find them; for we shall see in the sequel that this has not always been the case. Anatomists have long appreciated, from their knowledge of the presence of certain well-known characters of internal structure, the firm foundation upon which this fact rests; it would be entirely foreign to my object or the aims of this article, however, to enumerate, much less discuss, any of these technicalities, though I would invite the reader's attention to one of the minor external characters—one which first impressions might lead us to think important, but which really is a light weight in the minds of taxonomists,—and that is the development in birds, and in birds alone, of feathers. A little later we shall have something to say upon the subject of feathers.

Finding one class, at least, apparently so completely isolated from all other animals, it is hardly to be wondered at that in early days, clouded as they were by popular superstition and the common belief in the immutability of all living things and the separate creation of species, the old-time naturalists thought and wrote as they did, and passed down to us the classifications in natural history that we find in their works. They did a great deal for us, and we must close our eyes to many of their shortcomings and apparent shortsightedness; for things that seem simple to us now have but in a comparatively short period of time been made so.

Until the time of our favorite Agassiz, or still later on, naturalists worked away in their closets and in the field, firmly believing that species had always been as they then found them; and most certainly, it never occurred to them that birds had not always existed as birds in their present lovely forms.

We must not presume to allow ourselves to think, however, that this long epoch was lived through without a gleam of the knowledge of the true inwardness of things. As early as the middle of the last century, doubts as to the soundness of the then accepted views of nature arose in the mind of the well-beloved naturalist of France, the Comte de Buffon. The illustrious Lamarck followed Buffon in 1801; then came the

published views of Geoffroy Saint-Hilaire in 1828; since which time first an ethnologist, then a biologist, then a botanist, and after them other special workers in the fields of science, added knowledge that in 1859 culminated in the "Origin of Species," by the immortal Darwin. What a flood of light has been cast over ornithology, the ever-favorite subject of all young naturalists, and fascinating to us all, since that time—since 1861, we may say, when Hermann von Meyer described the single feather of his *Archæopteryx lithographica*, which had been found in the lithographic slate of Solenhofen in Bavaria, a geological horizon belonging to the Upper Jurassic.

Two years later England's great anatomist, Professor Owen, gave to the world his celebrated memoir, wherein he accurately describes the fossil remains of a creature in a slab, to which perhaps the feather in the possession of Herr Hermann von Meyer belonged. This valuable relic, now in the British Museum, was thought by everybody who examined it, to belong to a curious bird, and Professor Owen changed its original specific name from *lithographica* to *macrura*, impressed as he was by the long tail of the specimen, the hinder parts of which were the only ones that had been at all well preserved, in the then only example existing in the world.

A dozen or more years rolled by, and the hope of ever finding a second specimen of *Archæopteryx* had nearly died out in the minds of scientific men, when the son of the physician of Pappenheim, Dr. Häberlein, who found the first slab described, discovered the leg-bones of a fossil that he at once believed to be another *Archæopteryx*.—I think from the same Solenhofen slate beds.

The trained hand of Herr Häberlein was accustomed to disengage the rarest of fossil treasures from their matrix, but what delicacy of stroke was needed here! The unerring blow was given, and the two halves of the slab fell asunder—at once proving the correctness of the doctor's suspicions and giving to the world another and almost perfect example of this the rarest of fossils.

Herr Häberlein afterwards cleared nearly the entire skeleton from its matrix, and, after passing through other hands, it was eventually sought for first by Germany, then by the museum at Geneva. A very large sum was at one time given for it, as it passed from one to



ARCHEOPTERYX LITHOGRAPHICA. (FROM A PHOTOGRAPH, TAKEN FOR "THE CENTURY," OF THE SLAB IN THE BRITISH MUSEUM.)

another, and the hope was entertained that Emperor William would secure the treasure for Germany, but he, like many a crowned head before him, could not appreciate its value. "Ah!" as Professor Carl Vogt exclaims, "if instead of a bird a petrified cannon or gun had been concerned!" It is from Professor Vogt's article in the "Ibis" of October, 1880, that I am enabled to give a drawing of this creature as it lies in the slab. The illustration in the "Ibis," however, is a reduced photograph taken directly from the specimen; so I did not pretend to copy the many delicate little excavations made by the skillful hammer and chisel of Herr Häberlein, though otherwise my drawing is correct, and gives a good idea of the specimen.

Three examples of *Archaeopteryx* exist, then,

or rather had been discovered up to our time: the single feather of Von Meyer; the British Museum specimen, which is the one described by Professor Owen, and which had attained a size about equal to that of our crow; and lastly, the one described by Professor Vogt in the "Ibis." The latter specimen I have since ascertained is now in the Museum at Berlin. It is about one-fifth smaller than the British Museum specimen, being about the size of a ring-dove.

The feature that first attracts the attention both of the layman and of the scientific man, as he views the picture of the fossil remains of this form for the first time, is the extraordinary tail. This remarkable appendage consisted of twenty vertebræ, or joints, each one of which bore a pair of perfect rectrices or

tail-feathers, that were directed outwards and backwards from the sides of every joint. So accurately has the soft paste of the slate in which the specimen was found taken the impression not only of these tail-feathers, but also of those of the outspread wings, that almost the minutest details in structure can be appreciated by the examiner.

The year after Vogt published his article in the "Ibis," Professor Marsh made a care-



FOSSIL ARCHÆOPTERYX, IN THE BERLIN MUSEUM.
(DRAWING BY R. W. SHUFELDT, AFTER AN ILLUSTRATION IN
THE "IBIS" OF OCTOBER, 1880.)

ful examination of all three specimens of the *Archæopteryx*, and presented us with the results of his labors in a paper, which he read before the British Association for the Advancement of Science at York, September 2, 1881. After reviewing the several important characters brought to light by his investigation, not previously known to us, this author sums up his observations by saying "that we have in *Archæopteryx* a most remarkable form, which, if a bird, as I believe, is certainly the most reptilian of birds."

So much has been written in our time upon the origin and descent of organic forms, that the statement that living birds are descended from reptilian forms does not sound strange. In this highly probable specialization *Archæopteryx* of the Jurassic holds a mid-position. From the studies of Marsh, Vogt, and others, we learn that the skull of this ancient form has proceeded from that of the reptile ancestor, far birdwards. It had teeth in grooves similar to those of *Hesperornis*, a bird we shall introduce further on. These teeth were found in the upper jaw, but they probably also occurred in the lower jaw

(Marsh). This character is decidedly a reptilian one, no living bird having true teeth. On the other hand, Professor Marsh found that its brain-cast pointed evidently in the direction of the brain of birds. This author further tells us, after an examination of the arm, that "the main interest centers in the manus and its free metacarpals. In form and position these three bones are just what may be seen in some young birds of to-day. This is an important point, as it has been claimed that the hand of the *Archæopteryx* is not at all avian, but reptilian. The bones of the reptile are indeed there, but they have already received the stamp of the bird." Vogt tells us that two of the fingers were movable, and that the third was included in the integuments and bore the hand-feathers. There is no questioning the remarkable fact that the arm supported true feathers,—all the specimens prove this; and, moreover, these feathers constituted well-formed wings, rounded like those of a fowl. Its feet, on the other hand, were formed exactly like the typical feet of any of our ordinary living birds; take a sparrow-hawk for example. Not only this, but the thighs above were covered by a soft down, the impression of which is distinctly seen on the slate; and Professor Vogt seems to think that it may have worn a ruff of this down about its neck, as similar, though faint, markings of the same are found in that region, but we can hardly agree with him in this. No evidences of feathers are to be seen in any other part of the body, and we may safely conclude that its form was otherwise devoid of these appendages and that it was clothed in a smooth reptilian skin.

With such feet, and possessing fully formed wings, *Archæopteryx* undoubtedly led largely an arboreal life, and strange indeed must have been its appearance, with its lizard's body, its wings of a bird, and its long reptilian tail floating behind, lined on either side with its row of perfect feathers, and perhaps withal gorgeously tinted. Reptile it is not, nor is it by any means what is now known as a bird, though a type standing somewhere between the two. Its skin and appendages, its feet and legs, are bird, but the reptiles claim nearly all the rest of its organization; that is, if the line could be sharply drawn in any organization, living or dead. Much have I thought and read of this unique form—this oldest land-bird we have any record of; this go-between among birds and reptiles; this *Archæopteryx*, that became a part of the earth's crust in the mesozoic period. What manner of creatures formed the long line of his predecessors, why did he disappear, and who are his descendants? Such questions can be answered, if it is for men to know them at all, only by

patient study of Nature, and all that she offers us. In examination of my restoration of *Archæopteryx* I trust the reader will find that I have paid due attention to all those details of external structure that go to make up our present knowledge of this ancient bird. The head is in a stage of avi-reptilian transition; the teeth are in the jaws, and the setting of the eye is that of a lizard; the body is naked, for had there been feathers the delicate bed of its matrix would certainly have taken their impression, as it did that of the down on the legs; the tail, consisting of joints that undoubtedly had more or less movement one upon the other, is drawn with its double row of tail-feathers; and so on for all the other characters given us by the most prominent writers upon this subject. When Dr. Coues first saw my restoration, he proclaimed it, in his usual kindly way, "a very warm reach of the imagination"; and I am well aware of the audacity of the step, but I still trust that my *Archæopteryx*, considering all the pains bestowed upon it, conveys a fair idea of the form of this ancient ancestor of our birds.

From *Archæopteryx* we pass once more to the generous slates of Solenhofen, to find one more unique and sole existing example of what must have been a lizard-like bird, or perhaps, speaking more strictly in this case, a bird-like lizard; this is *Compsognathus*. This form is often alluded to throughout the literature that has to do with early extinct bird-like animals. The writer has never had the opportunity to examine this specimen; but Professor Huxley tells us that "it has a light, bird-like head (provided with numerous teeth), a very long neck, small anterior limbs, and very long posterior limbs." Now all through the mesozoic rocks, the strata of Triassic age, the Jurassic into the cretaceous beds, we find in different parts of the globe many, many forms that have now been arranged into groups, that show in their skeletons every imaginable shade in point of structure and distinctive character between reptile and bird. Some were of large size; others of mastodontic proportions; yet others were small; undoubtedly some were covered with feathers in their different stages of development; some had their beaks sheathed in horn, while their bodies were stamped with all the characters of the reptile; others had teeth;



RESTORATION OF ARCHÆOPTERYX. BY R. W. SHUFELDT.

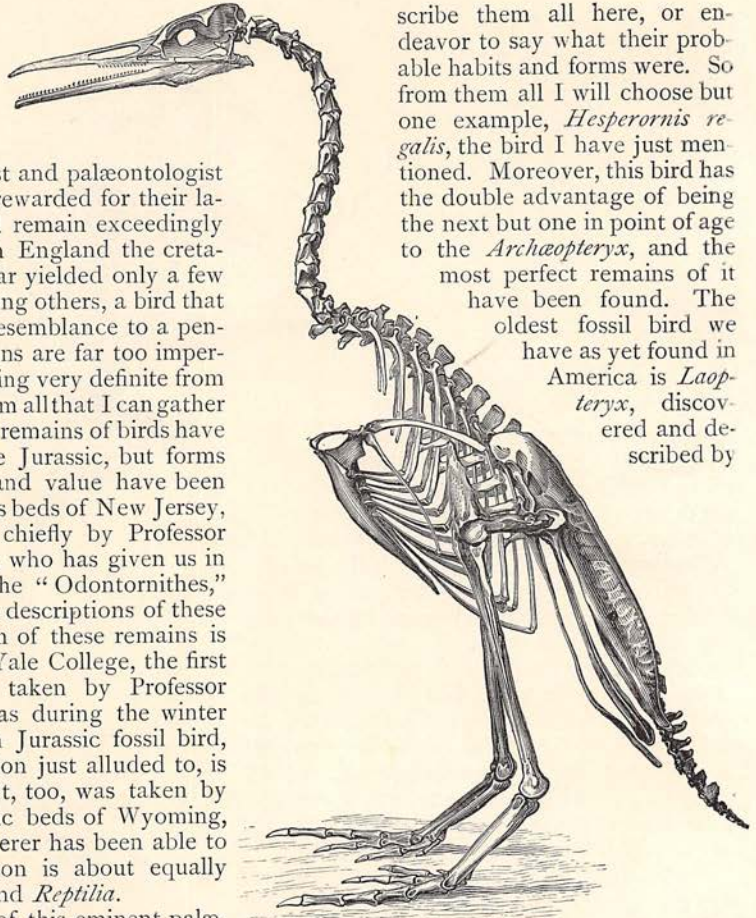
a few could fly; some lived on the land, some in the sea, while others were amphibious.

Is it a wonder, then, that we find such a masterpiece in classification as Professor Huxley has given us in the past few years? This profound zoölogist and philosopher swept away all our old landmarks, that for years had held a cordon about the class birds, and allowed them to take their proper place in the grand scheme of nature. This was effected by making one province, the *Sauropsida*, which is divided into the two classes, reptiles and birds; then these diversified forms gradually dropped into their proper orders and genera.

Leaving the Jurassic formation, wherein

we find birds to be the rarest of all fossil remains, we pass into the superimposed strata of the mesozoic formation, the cretaceous beds. Here the geologist and palæontologist have been more amply rewarded for their labors—though birds still remain exceedingly rare in this horizon. In England the cretaceous epoch has thus far yielded only a few scattered remains,—among others, a bird that seemed to bear some resemblance to a penguin, while other skeletons are far too imperfect for us to learn anything very definite from them. In our country, from all that I can gather at the present writing, no remains of birds have yet been detected in the Jurassic, but forms of the highest interest and value have been taken from the cretaceous beds of New Jersey, Kansas, and Colorado, chiefly by Professor Marsh of Yale College, who has given us in his magnificent work, the “*Odontornithes*,” elaborate and exhaustive descriptions of these birds. A large collection of these remains is now in the museum of Yale College, the first specimen having been taken by Professor Marsh in western Kansas during the winter of 1870. The American Jurassic fossil bird, which forms the exception just alluded to, is the *Laopteryx priscus*. It, too, was taken by Marsh, from the Jurassic beds of Wyoming, and so far as its discoverer has been able to inform us, its organization is about equally divided between *Aves* and *Reptilia*.

From the researches of this eminent palæontologist, we learn that his *Odontornithes*, or birds with teeth, formed two very distinct types, widely separated from each other, though both living in the cretaceous epoch of this region. One of these groups contained, as far as we now know, small birds that were powerful fliers, with their teeth arranged in sockets, and having the joints of the spine biconcave, like fishes and many reptiles, differing in this particular from any existing bird. The remaining group contained wingless swimming birds of large size, with their teeth in grooves, and has yielded the most perfect skeleton, upon which the genus *Hesperornis* has been constructed. On page 356 we have a representation of the skeleton of this bird, carefully reduced by the author of the “*Odontornithes*” from his large plate. In all, Professor Marsh has described from the cretaceous beds twenty species of birds, representing nine genera. In some of these the remains are very fragmentary, so much so that it would be impossible to guess, with any degree of certainty, as to their form or affinity; and in any event it would be impossible for me to attempt to de-



RESTORATION OF THE SKELETON OF HESPERORNIS REGALIS
(AFTER PROFESSOR MARSH.)

scribe them all here, or endeavor to say what their probable habits and forms were. So from them all I will choose but one example, *Hesperornis regalis*, the bird I have just mentioned. Moreover, this bird has the double advantage of being the next but one in point of age to the *Archæopteryx*, and the most perfect remains of it have been found. The oldest fossil bird we have as yet found in America is *Laopteryx*, discovered and described by

Professor Marsh. This bird is alluded to in “*Birds with Teeth*,” an article not then published, which I was permitted to examine through the kindness of the author.

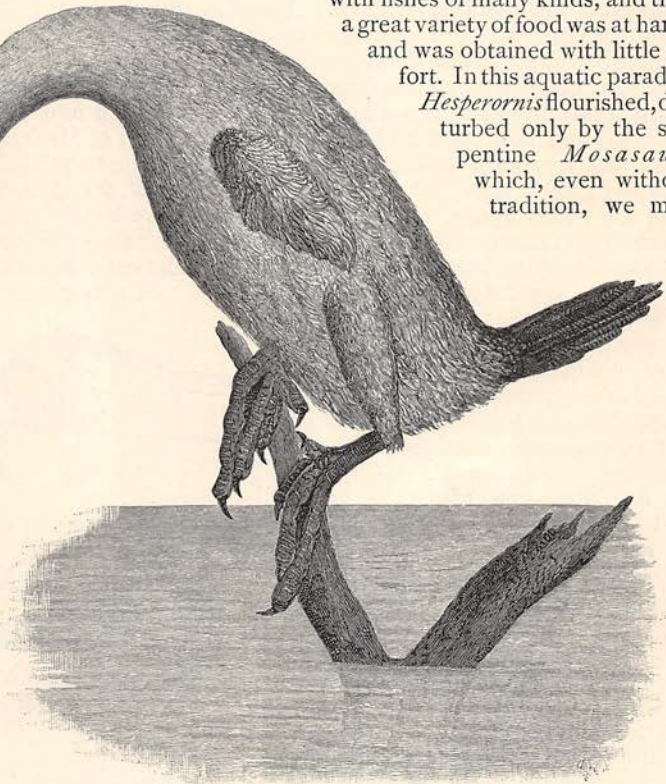
In Plate 20 of Professor Marsh’s “*Odontornithes*” we find a beautifully restored skeleton of *Hesperornis*, reduced to half its natural size. From measurements obtained from this, we ascertain that this strange extinct bird often attained a height of three feet or more. With this unsurpassed drawing, and aided by Professor Marsh’s own description as to what the probable appearance and habits of *Hesperornis* were, I have ventured upon a restoration of this ancient form (page 357). It is here represented in a position the bird must have often assumed,—a semi-erect attitude, with the body bent forward at an angle half-way between the horizontal and erect posture. He is seen to be resting for a moment after his exertions in his native element, for he was essentially a marine fowl, and is found with other fossil marine animals.

The behavior of this fish-eating *Hesperornis* in the water must have been very much like that of some of our larger and living divers, such as the loon, or perhaps the cormorant, to which group of birds its general form was doubtless not dissimilar; and such a contour has been bestowed upon it in my restoration. Being a capital diver and swimmer, its feet were placed far behind like those of the grebes or loons. Totally incapable of flight, its wings being only in a rudimentary stage of develop-

This author tells us that "the surrounding circumstances were evidently very favorable to *Hesperornis* for a long period. There was apparently during this time an absence of enemies in the air above, and an abundance of food in the water. *Hesperornis* was more than a match for the gigantic toothless *Pterodactyles*, which hovered over the waters here in such great numbers, and the other inhabitants of the air all appear to have been small. The ocean in which *Hesperornis* swam teemed with fishes of many kinds, and thus a great variety of food was at hand, and was obtained with little effort. In this aquatic paradise *Hesperornis* flourished, disturbed only by the serpentine *Mosasaur*, which, even without tradition, we may

ment, on the land, where it resorted for the purposes of incubation, it had no doubt much the action of the penguins, waddling about in a more or less erect attitude. In the time when it lived, the tops of the Rocky Mountains were but islands in the midst of a shallow tropical sea; here it was associated, among other extinct birds, with two of its near cousins, bearing the same generic name, one being larger and one smaller than our subject. Doubtless they all inherited their reptilian character of toothed jaws, and were all active and unrivaled fishermen.

In my restoration, *Hesperornis* has been clothed as my mind sees him and a study of his remains suggests. From beak to shoulder he wears a smooth skin, that perhaps was covered with the very finest of down, too fine to be seen in his portrait; this gradually became thicker and more evident, until it covered his body with a soft rudimentary growth of feathers, of a closer texture than the boots of *Archaeopteryx*. We must agree with Professor Marsh's most probable suggestion that *Hesperornis* bore a tail of straight feathers rather than a naked reptilian one—though, could it be positively known, a realization of this latter idea should not surprise us.



RESTORATION OF HESPERORNIS REGALIS. BY R. W. SHUFELDT.

imagine, caused its banishment, if not its destruction."

Before taking our leave of these cretaceous beds of the eastern slopes of the Rocky Mountains, we must at least give a passing notice to the most prominent contemporary of our *Hesperornis*, if no more than mention his name. This was a smaller bird, to which Professor Marsh has given the name of *Ichthyornis victor* (see page 358). *Ichthyornis* has been likened to our terns, gull-like birds that are found inhabiting our marshes or long lines of sea-shore during the most of the year. He was an active fisherman too, and highly endowed with the power of flight. His fragmentary remains prove him to have been a bird that was decidedly reptilian in his skull and still lower type of backbone;

the teeth were actually placed in sockets, and were reproduced just as they are now among the crocodiles. In the remainder of his organization he was preëminently like our modern birds, having perfectly formed wings and other structures of the class well specialized.

The eocene period of England and other parts of Europe, as well as the same geological horizon in our own country, through the many extensive explorations of so able an investigator as Professor Cope, has furnished a large number of birds. A region known as the Paris Basin yielded many others, some of which the illustrious Baron Cuvier described with greater or less exactness. Birds described still more numerous in the miocene, pliocene, and post-pliocene beds; and caves in various localities have afforded many remains of great interest belonging to this class.

Many of the forms, however, from these more recent formations are more or less closely allied to existing birds, and, as they have not as yet been carefully worked up, we will pass these groups by here, without further remark. What has been said must not be understood to apply to the exhaustive work bestowed upon many of these relics recovered from the Paris Basin by M. Alphonse Milne-Edwards.

Two of the three great orders into which birds are now divided are called the *Ratite* and the *Carinate*. The principal feature upon which this classification is grounded refers to the fact that the sternum or breast-bone of the *Ratite* is devoid of a keel, the reverse being the case in the *Carinate*. By far the greater number, and at the same time the most highly organized of our birds, belong to the latter order, the *Carinate*.

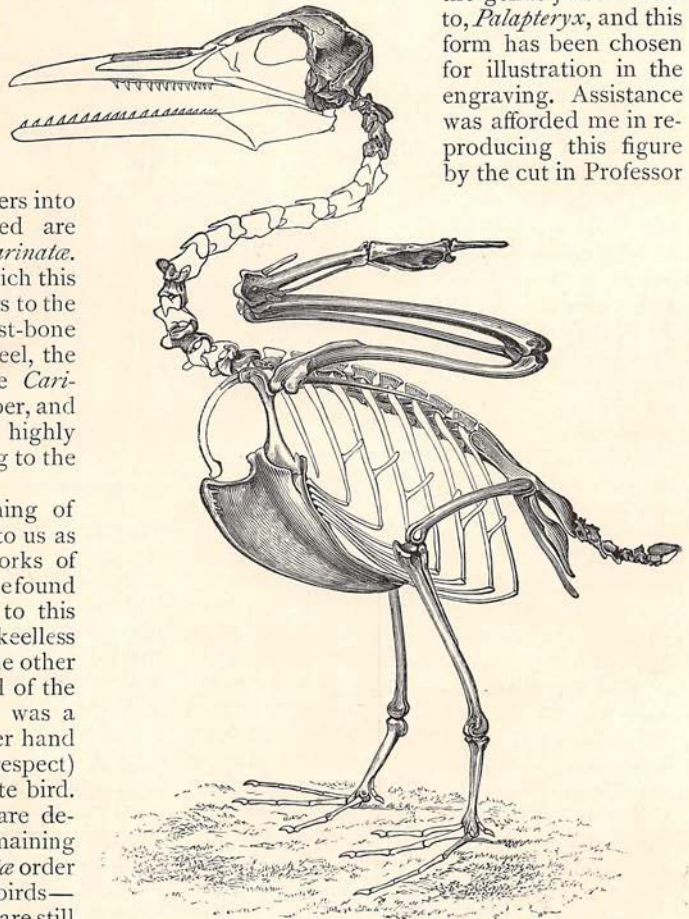
Now we all know something of the strange *Apteryx*, familiar to us as the Kiwi-kiwi in so many works of travel. These birds are still to be found in New Zealand, and belong to this great order of the *Ratite*, or keelless birds; they are, too, like all the other members of this order, devoid of the power of flight. *Hesperornis* was a ratite bird, while on the other hand the more specialized (in that respect) *Ichthyornis victor* was a carinate bird. The breast-bones of reptiles are devoid of a keel. All of the remaining groups that make up the *Ratite* order are ostriches, or ostrich-like birds—living representatives of which are still to be found in the South American

pampas, in Africa and Arabia, and in the casowaries of the East Indies and Australia, the emeu being confined to the latter continent.

These ostrich-like birds figure very prominently among the extinct feathered forms in a great many parts of the world; ostriches were at one time inhabitants of this country, and Professor Cope has described one of enormous dimensions from the eocene of Texas and New Mexico. The remains of an ostrich have been found in the tertiary of the lower ranges of the Himalaya mountains. But to seek the great center of the region where the remains of this class of birds were and still are found, we must turn our attention to New Zealand and the young continent, the great island of Madagascar.

The two chief extinct genera of New Zealand are *Dinornis* and *Palapteryx*. They were known as moas, because it was believed that they were contemporary with the Maoris, the early natives of these islands.

A very good type of these ostrich birds is the genus just referred to, *Palapteryx*, and this form has been chosen for illustration in the engraving. Assistance was afforded me in reproducing this figure by the cut in Professor



RESTORATION OF THE SKELETON OF *ICHTHYORNIS VICTOR*.
(AFTER PROFESSOR MARSH.)

Sanborn Tenney's Zoölogy, who in turn has it after Professor Hochstetter's restoration. The king of all the moas, a ponderous ostrich-bird, likewise numbered among the extinct forms of New Zealand, was *Dinornis giganteus*. Against this formidable bird-giant the primitive natives waged constant warfare, and an old legend is still going the rounds of popular compilations in natural history of how a traveler was shown the very spot where the last moa was killed, after a frightful conflict, in which the natives lost several of their number. This giant attained a height of ten feet, and others say still more. That the last moa has perished there can now hardly be a reasonable doubt; but as to what manner of men surrounded this feathered monarch in his last struggle much doubt exists, and it probably will always remain a mooted question. Perhaps he fell not by the hand of man at all, for the same formation that held the remains of this *Dinornis* also contains the relics of a bird of prey, the *Harpagornis*, that when it lived was of sufficient size to make the heaviest of all the moas its quarry. It is a suggestive thing to think upon, this death of the last of its race. This thought was forcibly brought to my mind after the death of an old buffalo bull that had wandered away many a mile from the herd, in the treeless plains of Wyoming. Mortally wounded, and surrounded by a party of Indians, with whom I was, he made by no means a despicable struggle for his life. The thought came to me through all that long day, What if he were the last of his race! How and where died the last mastodon, and who will see the last elephant as his ponderous form falls, or the last of the giraffes, when his eighteen feet or more comes to earth, if that is to be the style of his death? Whence the assailants, and what may the fashion of their weapons be?

Such birds as the moas have long since been extinct in the island of Madagascar, but there was a time when there was reckoned among its ancient fauna a bird allied to the moas, that even towered above *Dinornis*, and must have been from twelve to fourteen feet in height. The sub-fossil egg that has been found of this huge creature has a capacity of one hundred and fifty hens' eggs. It has received the name of *Æpyornis maximus*, and its remains so far have yielded to us only a few fragmentary bones; one of these, the leg-bone, is fully a yard in length.

Some five or six authoritative works in my library tell us that this is the bird that is probably alluded to as the roc in the "Arabian Nights' Entertainments." But I must confess that, with the exception of the sole characteristic that both birds were of immense

size, the relationship does not strike me. Perhaps others may be more fortunate in knowing the origin of this statement. The giant ostrich of Madagascar was a flightless bird, and no doubt inhabited the more open plains and level parts of the country, while every allusion that comes to my mind in the "Arabian Nights" to the roc gives it just the opposite habits, being a bird of powerful flight, very prone to seize objects in its talons, and living in the highest of mountains. We find the roc spoken of in the story of Aladdin, where the magician's brother, disguised as Fatima, holds the conversation with Aladdin's wife, the princess, who is made to ask during the course of the dialogue:

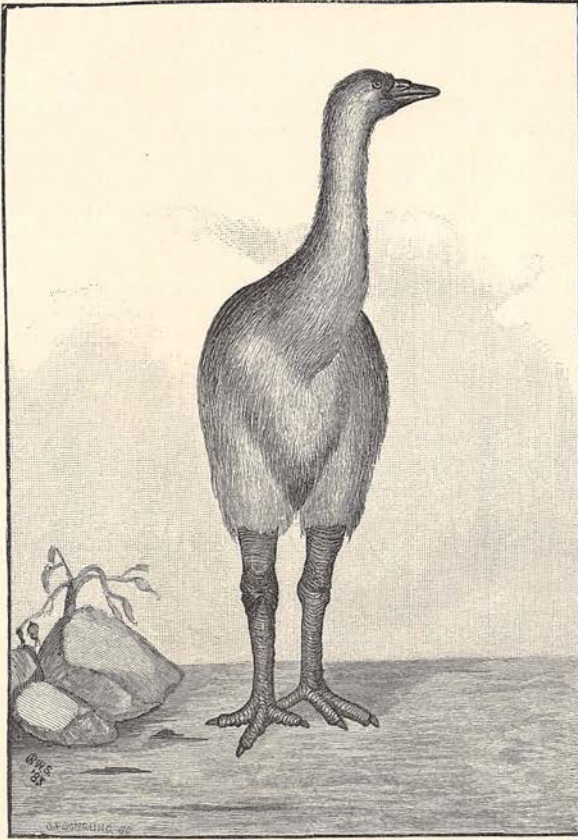
"My good mother, what kind of a bird is a roc, and where could the egg of one be found?"

"Princess," answered the feigned Fatima, "the roc is a bird of prodigious size, which inhabits the summit of Mount Caucasus, and the architect who designed your palace can procure you one."

In the second voyage of Sindbad the Sailor it is spoken of again, and a representation of it given in a figure, which looks more like a great vulture than any other bird with which the writer is acquainted. Here are mentioned the immense flights it was in the habit of taking, and that it made serpents of the most fabulous dimensions its prey. Sindbad has another adventure with rocs in his fifth voyage, where a pair of them are made to drop enormous rocks, which they carried in their talons, on the ship in which he is sailing with other merchants, in retaliation for their having destroyed their egg ashore, which was just at the point of bringing forth young.

We now come to the consideration of those birds that have disappeared from the earth within comparatively recent times—all of our foregoing history being confined to birds known to us only as fossils, or, as in the case of the ostriches, in a sub-fossil condition. Of all the birds extirpated within the last few centuries, none can claim an equal share of interest with the famous dodo, once the inhabitant of the island of Mauritius; and notwithstanding the fact that quite an extensive literature, several large portraits, and one or two exhaustive monographs are in existence elucidating all we are permitted to know of this bird, still this paper would be incomplete, were we to pass by without an allusion to the dodo.

We will do more than that for him; we will gather together, from books and elsewhere, all of the old grotesque and almost ridiculous pictures we possess of him, and endeavor to introduce him in a more life-like attitude (see page 360).

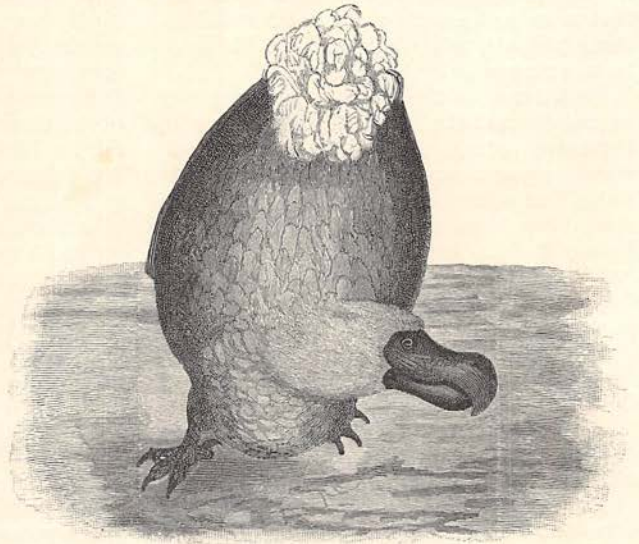


THE PALAPTERYX.
(FROM A DRAWING BY R. W. SHUFELDT.)

Upon the only skull of this bird that was at one time known in Europe, the astute Danish naturalist, Professor Reinhardt, clearly showed the dodo's relation to the great family of pigeons; and although this investigator's decision was made upon such meager material, the discovery of many additional remains since has been upon careful examination unable to shake it. The dodo was a bird about the size of a large swan, blackish-gray in color, and flightless, having only rudimentary wings and tail; but his most distinctive external characteristic was a beautiful collection of white plumes, that grew, as we see them in the engraving, in a bunch over the rump. From all accounts the dodo laid only a single egg, and never constructed a nest, simply depositing its treasure in some grassy spot

in the forest or other convenient locality.

These birds were by no means uncommon on the island of Mauritius and the off-lying one of Bourbon when the seafaring Mascarenhas brought his Portuguese explorers to the former in 1598; but in less than a century's time the fate of the dodo was sealed, and the last living one disappeared in that short period before the merciless advance of man, his domesticated animals, and all that follow in his train. It would be difficult to conceive of a being whose surrounding circumstances, added to its own feeble resources of defense, were better combined to insure its certain extirpation: living on an island, which it was unable to leave by resorting to flight or by swimming in the sea; conspicuous by its size; fairly good food; and awkward and stupid, for its very name is derived from a Portuguese one meaning a simpleton. The Mascarene Islands had never been the home of man until the period above mentioned, and we may safely assert that no such form would have developed as his contemporary. We shall see what the fate of the gare-fowl, or great auk, has been under somewhat similar conditions, farther on; but in that case the bird had the great advantage of being perfectly at home in the water, and so able to go to many unfrequented spots, and often thereby escape death.



THE DODO. (FROM A DRAWING BY R. W. SHUFELDT.)

The island of Mauritius was rather noted for its flightless birds, largely due, no doubt, to the fact that so few disturbing elements were present to molest them, as man and such of the mammalia as prey upon birds. It followed as a natural sequence, then, that those birds, whose native instincts rather inclined them to seek the ground as the more frequent place of resort, having on that island comparatively little use for their wings, if they really originally possessed them, these members in time gradually atrophied and became rudimentary. So, as we might be led to expect, as a consequence the dodo was not the only victim in these islands, of his kind, that succumbed to civilization's onward march; nor are we disappointed in our conjecture, for not only its little sister isle of Bourbon, but the more remote island of Rodriguez, lying off far to the eastward, have both afforded remains of birds that are now extinct, and very remarkable and interesting forms they were too.

When the writer some two years ago was engaged in rearranging the material that went to make up the section of avian osteology at the Smithsonian Institution, he had the good fortune to find, in addition to such treasures as some of the material Darwin had used in demonstrating some anatomical facts in one of his great works, and some fossils from Professor Alphonse Milne-Edwards, from the Paris Basin, a fairly well-preserved lot of remains of the now extinct solitaire. This was one of the members of the Rodriguez *avifauna*, and the only good account we have in our possession of him is by the Huguenot exile, Monsieur Leguat, who spent two years on that island towards the close of the seventeenth century. The solitaire was a taller, trimmer, though heavier bird than its more rotund and related ally, the dodo of Mauritius. Leguat's account is said to be a very accurate one, and delightful reading, but his figure of the bird that accompanies it is a woful attempt at art, and grotesque in the extreme.

Several species of parrots, doves, an owl, a peculiar starling, all among the land-birds, and several interesting water-birds have now completely vanished from one or the other of this group of islands. Their *avifauna* have indeed suffered since man made his appearance among them, and the forces of civilization have been brought into play.

Before bidding final adieu to the Mascarenes and the shades of their departed bird-life, we



THE GIANT RAIL OF MAURITIUS.
(FROM A DRAWING BY R. W. SHUFELDT.)

must introduce the "giant" (*Leguatia gigantea*) of Mauritius. This great rail-like bird was more than six feet high, and no doubt was found on the island about the same time as the dodo. With these extraordinary forms was associated another wingless bird, allied

to the rails, that disappeared from the isle of Bourbon towards the close of the seventeenth century. It is said of it that it ran with surprising swiftness.

As the instincts, feelings, and aspirations of all true naturalists have in all probability suffered no change since the days, two centuries ago, when the hardy Portuguese and Dutch explorers first put foot on these solitary islands, what must have been the sensations of the artists and naturalists that sailed with them—for we are told that such were along—when they were first confronted with such shapes? They met no men in this tropical Mauritius, as did Columbus, a century before, on the beach of San Salvador; but to the lovers of the great unknown in nature a far more diversified picture was presented here, and only such a one as the tropics can give us. On the forest's edge may have been seen a group of ponderous and clumsy dodos; there, stalking along by the marsh-land below, making tremendous pace, great, slim-proportioned rails, six feet in height; these wonders and others in a setting of the grandest of landscapes.

The last thirty years has seen two birds disappear from our own American fauna; and our naturalists will tell you that this gap has been made by the extirpation of the great auk (*Alca impennis*) and the duck of Labrador, or the pied duck, as Audubon gave him to us. The disappearance of the former had long been predicted, but the doom of the latter had never been anticipated. The great auk, or the gare-fowl as it is more commonly called in Europe, has with us still several, though much smaller, existing relatives; these latter, however, have the power of flight, which the gare-fowl did not. It was owing to this circumstance that their extinct relation came by the name of penguin—a bird they, upon casual inspection, closely resembled, and whose habits were not at all dissimilar; in fact, the great auk filled the penguin's place on the Newfoundland and Labrador coasts. The chief factor in the extinction of this water-fowl was the fishermen who visited its otherwise secluded resorts. These people killed them in large numbers, and the young, we are informed, were used for bait.

From his own statements in his unrivaled work, it seems that Audubon never saw, even in his day, a specimen of this bird on our coast, and this author tells us that "the only authentic account of the occurrence of this bird on our coast that I possess was obtained from Mr. Henry Havell, brother of my engraver, who, when on his passage from New York to England, hooked a great auk on the banks of Newfoundland, in extremely

boisterous weather. On being hauled on board it was left at liberty on the deck. It walked very awkwardly, often tumbling over, bit every one within reach of its powerful bill, and refused food of all kinds. After continuing several days on board it was restored to its proper element."

Great auks were captured either in Iceland or some of the off-lying islands of the continent, including Great Britain and Ireland, as late as the year 1844; and our friends across the water have been far more fortunate in the number of specimens and other relics than we have. In this country I know of but three examples in museums, while abroad some seventy specimens have been preserved, and sufficient other material to have enabled Sir Richard Owen to give us one of his magnificent royal quartos treating of its osteology.

The pied duck was never dreamt of as being on the road towards extinction even in the very latter days of Audubon's writing, and its disappearance was quite sudden. This duck never was known to carry its migrations far inland, but was confined along the Atlantic coast to Labrador and northward, rarely being seen south of New Jersey. It bred off the mouth of the St. Lawrence, on the rocky islets, and English ornithologists say not much north of this, citing this as one of the causes of its extermination, for persons visiting these resorts for its eggs killed large numbers of the ducks besides. There were no other evident causes why such a bird should become so suddenly extinct, for it was a strong flier, not brilliantly plumaged, nor particularly sought after for its flesh. A specimen of the pied duck was killed in Halifax harbor in the year 1852; but even at that time no foreboding had been expressed by ornithologists as to its probable early extinction. Quite recently two hundred dollars was offered in England for a well-preserved pair of these birds.

Audubon drew the beautiful pair of these birds, in the plate in his princely work, from two he had received from the "Honorable Daniel Webster of Boston, who killed them himself on the Vineyard Islands, on the coast of Massachusetts."

The pied duck was a few inches smaller than the common Arctic eider, to which it was nearly related. There are good specimens of it in the Smithsonian Institution, but so rapid and unexpected was its departure that the writer is unable to say how well the museums abroad are favored in this respect.

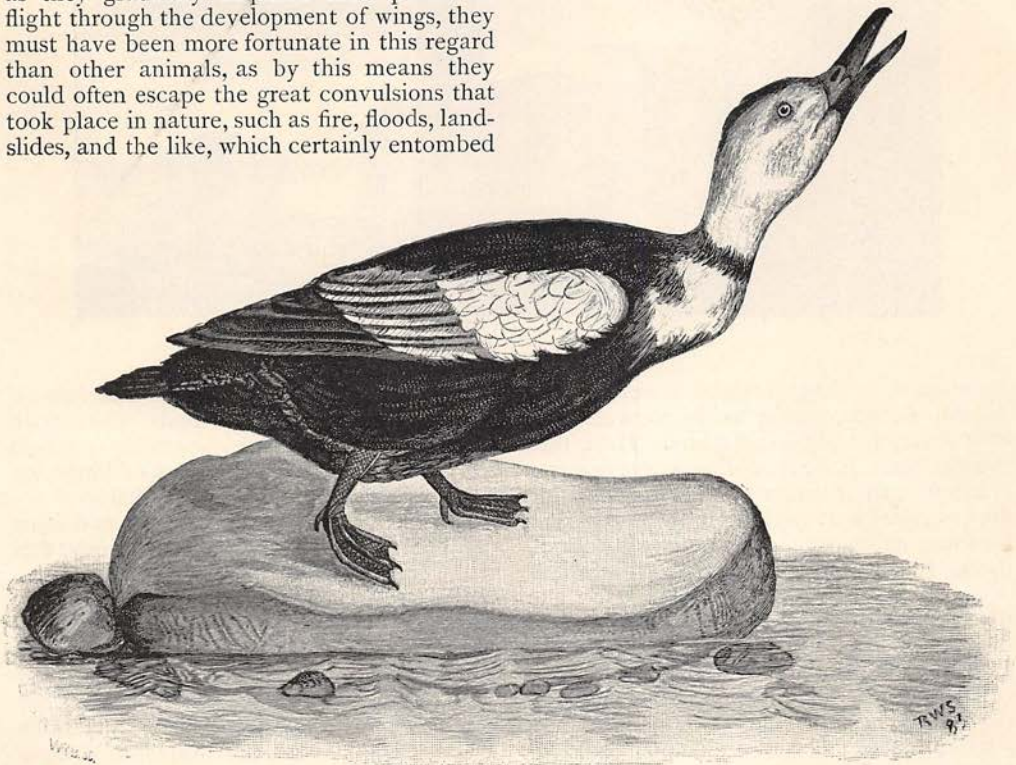
We learn that a bird quite recently has been eliminated from the fauna of Philip Island in the South Pacific; this time it is a parrot,

known during its life period to naturalists as the long-billed parrot (*Nestor productus*), standing between the true parrots and the cockatoos. The causes of its destruction are unknown to me.

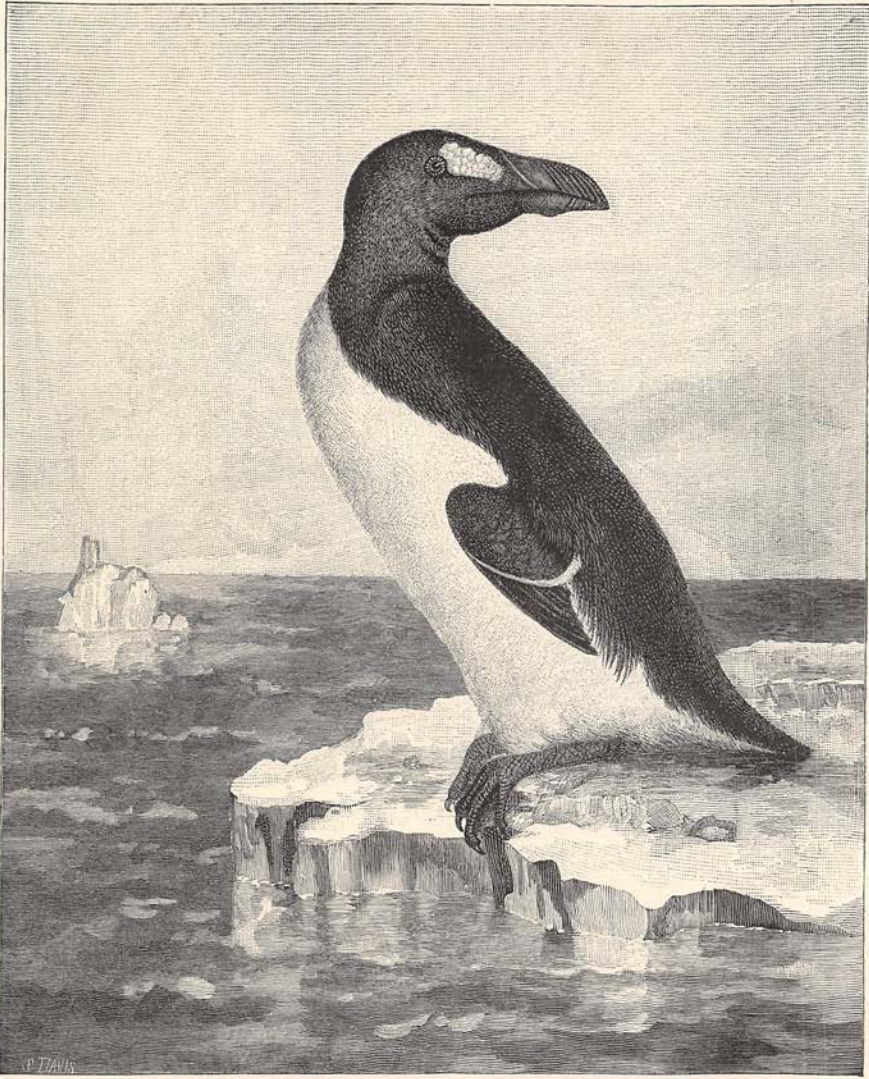
And thus we see how it is: different species of birds are being eliminated in all parts of the earth, just as their predecessors were during the various geological epochs, and this elimination is constantly and unceasingly at work. The island that we now call England, Scotland, and Wales once reckoned among her avifauna ostrich-like birds of no small size; and as ages have rolled over her head, and all manner of forces have been acting and reacting, that have slowly changed the surroundings of her fauna, we find many of her types disappearing, while others have become more prevalent. In more recent times gamekeepers and legislation are two elements that have been at work, and taken no small share in some of these changes, as instances of which we find that certain game birds and birds of prey have been completely extirpated in Great Britain. Who has a doubt in this country what the fate of our wild turkey is to be? In more remote times it was physical causes among others that acted to destroy certain types of birds, though, as they gradually acquired their power of flight through the development of wings, they must have been more fortunate in this regard than other animals, as by this means they could often escape the great convulsions that took place in nature, such as fire, floods, landslides, and the like, which certainly entombed

other creatures or utterly destroyed them. The power of flight, however, did not exempt birds from that still more important force, so incessantly at work, the mutual reaction of one organism upon another, which through all time has operated to the improvement of some, and beyond all doubt to the extinction of many a form of exquisite beauty.

In the United States to-day, the birds that make up our fauna, so far as we now know them, number nearly nine hundred species. Many of these species have their millions of representatives, and an instant's thought will afford an idea of how immense the entire host must be; and yet let me ask you, inveterate rambler, how often do you find the body of a dead bird in your path? The writer has been a collector and observer of birds from Mexico to the peaks of the Rockies for about twenty years, and can cite but comparatively few instances, a number so small that, if compared with the living, need not be taken into consideration at all, or, as they say in mathematics, it would be an unassignable quantity. Yet from all causes millions of birds do die every year, and when they die what becomes of them? Eliminating those that perish as objects of prey, we find that such birds as are blown into sheets of fresh water, by storm



THE PIED DUCK. (DRAWN BY R. W. SHUFELDT, AFTER SPECIMENS IN THE SMITHSONIAN INSTITUTION AND THE AUDUBON PLATE.)

THE GREAT AUK (*ALCA IMPENNIS*).

or otherwise, and are drowned, invariably float on the surface, owing to their exceedingly light skeleton and their feathers. Here they eventually reach the shore-line, where in a very little while their tender bodies macerate, and the bones are scattered far and wide, or some prowling animal makes still quicker work of them. In salt water the preservative qualities of that fluid, no doubt, allow them all to reach the shore-line with greater certainty, but here sun, moisture, and the carnivora of earth, air, and sea soon put them out of sight.

Animals, on the other hand, often sink to the bottom, and, if the place of deposit be in a river, may soon be covered up, after lodgment, by the sediment, and thus be preserved

for ages; but, as we have just seen, this rarely happens with the bodies of birds, which float upon the surface and are dispersed.

As the more modern forms of birds for many ages have not been in the habit of resorting to caverns for any purpose, and have rarely been dragged in by beasts of prey, this fruitful source of preservation of many of the dead mammalia and reptiles need hardly be alluded to in the case of birds. The peat-mosses, wherever they occur in any country, owing to their antiseptic qualities, have preserved many a form for the students of all ages; but these have only allowed the heaviest of birds to sink into them, as the *Mare aux Songes* did the dodo in Mauritius, whereas the lighter

forms would escape any such entombment. So it is that the remains of our feathered forms have been rendered so rare, and comparatively so few examples have been discovered through all these long ages. This absence of aviarian fossils furnishes us with a very good reason why this class has cut such an insignificant figure in the study of the physical history of our earth. Some idea may be formed of the meagerness of this material, from the fact that in this article nearly all the examples known to science, through all time, are mentioned, and my illustrations present figures of all the more important of the feathered forms that are now extinct. If a catalogue of all the extant specimens were printed in ordinary type, the volume that contained the record would be of no very great size; and think of the countless millions of birds or animals with feathers that during these long, long ages have lived and subsequently perished. Regarding the history of our feathered races in the past, read from the fossil records that have come to us, as a history of the class and nothing more, irrespective of anything we may learn of it that bears upon the physical history of our planet, we find that, starting from their present representatives as an isolated and lovely group of animated beings, their most recently extinct forms differ in no essential particular from the living ones; for instance, if the pied duck

could be reproduced, he would not figure in our fauna as an oddity, as the dodo certainly would. As we sink deeper and deeper into this record, we find that the birds differ more and more from the present types; that a greater number of flightless ones are discovered, this disability constituting one of the factors, and an important one, in their extirpation; that as we continue our research in this mutilated record, with its many missing pages, we fall into the cretaceous beds. Ah! what a lapse of time, and how vast the change; we have to refer but to the record of *Hesperornis* to appreciate this — teeth, a questionable covering of feathers, and a keelless sternum. Another leap into the depths of time, when we find the *Archæopteryx*, whose organization must indeed have been a lowly one. It seems, too, the further we go back into geologic times, the less specialized do bird forms become, and the nearer they approach the reptilian types. Although extinct feathered forms can teach us little more, we may be happy in the thought that so immutable is the primeval code of laws, that they have never ceased to operate in the same manner now as they did in the beginning; and as with all beings, so has it been from the reptile of mythical Eden to the snow-white dove of our day, the tendency is ever onward and upward in the line of improvement.

R. W. Shufeldt.

LOVE THAT LIVES.

DEAR face — bright, glinting hair —
 Dear life, whose heart is mine —
 The thought of you is prayer,
 The love of you divine.

In starlight, or in rain;
 In the sunset's shrouded glow;
 Ever, with joy or pain,
 To you my quick thoughts go

Like winds or clouds, that fleet
 Across the hungry space
 Between, and find you, sweet,
 Where life again wins grace.

Now, as in that once young
 Year that so softly drew
 My heart to where it clung,
 I long for, gladden in you.

And when in the silent hours
 I whisper your sacred name,
 Like an altar-fire it showers
 My blood with fragrant flame!

Perished is all that grieves;
 And lo, our old-new joys
 Are gathered as in sheaves,
 Held in love's equipoise.

Ours is the love that lives;
 Its spring-time blossoms blow
 'Mid the fruit that autumn gives;
 And its life outlasts the snow.

George Parsons Lathrop.