

uniform in color no marked difference is produced by the process. The abrasion begins soon after the autumnal moult and continues throughout the year, being effected by the general wear and tear on the plumage and by the action of the bird itself in cleaning its feathers by drawing them through its bill. The margin of the feather—that is the terminal portion of the barbs—seems to become brittle and break off at a slight touch, the point at which the fracture occurs being on the line where the color changes, in parti-colored feathers. In this way the color of a bird may be entirely changed without the loss or gain of a feather, for owing to the shingled arrangement of the plumage only the terminal portion of the feather is seen, and when this is worn off the central and basal portion, which is frequently differently colored, comes into view.

The series of snow-buntings collected in Greenland by the late Peary expedition, which have passed through my hands, taken in connection with winter specimens from Pennsylvania, show this method of plumage change very well. Taking the feathers of the back, for instance; in the winter birds we find them so broadly tipped with white and brown as to give a light-colored appearance to the bird; in the summer specimens, however, the light tips have been entirely lost and the back becomes solid black. The actual shape of these feathers has changed too, for while those of the winter birds were oval, those of the summer specimens are found to be pointed, with the sides somewhat concave. This was the shape of the black central portion of the feathers in the winter, and when the light margin has been worn off the black portion is, of course, all that remains. This change of shape in the feathers, due to abrasion, is best seen, however, in the curlews and other birds in which the back and rump feathers have peculiarly lobed black centres with light-re-colored margins. The breeding birds of these species will be found to have these feathers deeply sinuated along the margins due to the loss of the light portions, between the black lobes, in striking contrast to the oblong oval feathers of the fall plumage.

In birds which experience a loss of the tips of the feathers by abrasion, but which, owing to the manner of coloration of the feathers do not show any marked change in the general coloration of their plumage, as in the common Song Sparrow, the fall specimens can still be distinguished from spring ones at a glance; as the plumage in the former is long and blended while in the latter the feathers have the appearance of having been clipped with shears.

As has already been said, these two methods of changing plumage (1) by a complete moult, and (2) by abrasion, take place in all birds, but the time and extent of the changes differ in different species.

Our passerine birds may be grouped in three classes according to the changes which take place in their plumage during the year. The most usual system is (1) a complete moult in the autumn or late summer and (2) an abrasion of the tips and margins of the feathers in the spring accompanied by a more or less extensive renewal of the smaller body of feathers.

In some species the acquisition of new feathers in the spring is so slight that it is scarcely apparent and can only be detected by careful scrutiny while in other cases considerable patches of feathers are renewed.

In the Sharp-tailed Finch, of which I have examined a series of eighty specimens taken during every month of the year on the New Jersey salt marshes by Mr. I. N. DeHaven and myself, I find a considerable acquisition of new feathers taking place in April; in some individuals even the tail feathers are being renewed, which is not surprising as owing to the habits of the bird the plumage must become very much worn. Many male birds which require several years to attain their full adult plumage acquire some of the feathers characteristic of the adult plumage at this spring moult. The White-throated Sparrow, for instance, acquires additional white feathers on the throat and head, and yellow ones in front of the eye, and the Myrtle Warbler experiences an increase in the yellow feathers on the sides of the breast.

The second system of moulting consists of (1) a complete moult in the autumn or late summer and another moult in the spring, which is either complete or excludes the remiges and rectrices.

Such birds as the Scarlet Tanager, Indigo bird, etc., are examples of this class. Owing to the fact that many of them winter in the tropics it is difficult to obtain specimens showing the progress of the spring moult, and we are forced to a comparison of fall and spring birds. The Goldfinch, however, which can be obtained throughout the year in this latitude, shows the double moult very nicely, and specimens taken in April and September will be found respectively to be acquiring and losing the familiar bright yellow plumage, the gray feathers of winter appearing in the fall birds and disappearing in the spring ones.

The third system of moults seems the most complicated of the three, and was first pointed out by Mr. Frank M. Chapman in the case of the bobolink.

This bird has a complete moult in the late summer, then another complete moult in the early spring before it starts north from the tropics, and between that time and the breeding season an extensive abrasion, which again completely alters the appearance of the plumage. (See *The Auk*, 1890, p. 120.)

Specimens of the Rose-breasted Grosbeak which I have recently examined, taken in South America, seem to indicate that this species has a similar system of moulting to that of the Bobolink.

So far as I can ascertain, the adult male in fall assumes the striped brown dress of the female, but differs from it in having bright pink under wing-coverts and a marked pink suffusion on the breast. Opposed to this is the well-known black and white plumage of the breeding bird with its brilliant pink breast. Now the South American birds above alluded to are different from either of these. They possess the full plumage of the breeding bird, but every feather has a light brown or buff edging which gives the bird a "veiled" appearance and conceals to a certain extent the striking markings of the nuptial dress.

These specimens indicate pretty clearly that in addition to the annual fall moult the male Rose breast has a complete moult during the winter or early spring, assuming at this time a dress which differs decidedly from the breeding plumage, but which changes into it by means of extensive abrasion.

The lower orders of birds have as a general thing still more complicated moults than are found in the Passeres, and of most of them comparatively few of the details are known.

In consideration of these facts as well as the great interest that this study possesses, I cannot but recommend to all collectors to have this matter in view in making future additions to their collections and to look over the material which they already possess with an eye to the moult, feeling sure that they will be well repaid for their pains.

LETTERS TO THE EDITOR.

.. Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Comparative Longevity.

Among mammals the epoch of maturity is usually stated as reached in one-fifth of the animal's life. Thus the ages of maturity and periods of life of several forms are about as follows: horse, bull, four to twenty; sheep, two to ten; rabbit, one to five; but there are exceptions, such as the cat, which matures in one year and may live twenty.

It is assumed that man matures at twenty, and hence, by the rule, should live to be one hundred, as does the elephant, which matures in its twentieth year. But, I think that writers upon longevity, such as Hufeland, Flourens, Quatrefages, Thoms, etc., when commenting upon these relationships, have overlooked the fact that the general rule holds better for the lower races of men who mature sooner than the civilized, to whom the retardation of early development is an advantage, as it prolongs the plastic, receptive period.

The helplessness of the human infant at birth, and the length of time it needs parental care, in these respects differing from

other mammals, enables training of a progressive nature in succeeding generations, and whether this lengthened immaturity is a result, or cause, or both, it is a great advantage. We may be justified in regarding the immaturity as prolonged beyond that of other mammals rather than that man's longevity is proportionately less.

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Chicago, Ill.

BOOK-REVIEWS.

Handbook of Australian Fungi. By M. C. COOKE. London, 1892. 458 p. 36 pl.

Select Extra-Tropical Plants, Readily Eligible for Industrial Culture or Naturalization. By BARON FERD. VON MUELLER. 8th Edition. Melbourne, 1891. 595 p.

HE who nowadays would keep posted in regard to the progress of science must frequently turn to the southern hemisphere. In South America, in South Africa, and in Australia the devotees of science have been and are working. The recent organization of an Australasian Association for the Advancement of Science is an effort toward a union of scientific men such as already exists in North America, England, France, and Germany; and it will do much toward unifying the work of the numerous scientific bodies that have long existed in the various colonies. The vast extent of territory and the distances between the capitals of the several colonies is paralleled only by our own country, but here we have the advantage of a greater network of railways and more rapid means of communication. From Hobart, the capital of Tasmania, to Christchurch, New Zealand, where the meeting of the Association was held in 1891, the distance is about 1,000 miles. From Sydney, in New South Wales, it is over 1,200 miles; from Adelaide, in South Australia, the distance is over 2,000 miles; while it is even further than this from Brisbane, in Queensland. All of these places are included in the comprehensive Australasian Association.

To enumerate the scientific societies in Australia would require considerable space. We cannot, however, forbear alluding to some of the more important, as shown by their publications. There is, for example, the Royal Society of New South Wales, that has issued 24 volumes of proceedings; the Royal Society of Victoria, and the New Zealand Institute, also each with 24 volumes; the Linnæan Society of New South Wales, with 6 volumes; the Australasian Association for the Advancement of Science, 3 volumes, and the Royal Society of Tasmania, that has been publishing since 1863. Besides these there are innumerable irrigation, engineering, mining, and geological reports published by the governments of the several colonies. The agricultural side is represented by reports of the secretaries for agriculture of Queensland, New South Wales, etc., and by the grand publications of Mueller on the Eucalypts, and the well-edited agricultural journal of New South Wales. To mention all the official publications would be a task too great to be undertaken here. But from what has already been said, it must be manifest that the Australian colonies are not one whit behind the rest of the civilized world in their contributions to scientific and practical literature.

There is, of course, a reason for this activity. The country is new, and is full of wonderful birds and animals and plants; and the men who left behind them in Europe an exhausted field, as far as novelties in science go, find in the colonies a virgin field. The vegetation, the animal life is so different from that of the northern hemisphere that we may look forward for years to come for additions to our knowledge of the productions of the wonderful island.

Two books that have lately been added to botanical literature from Australia are those mentioned at the head of this article. Both are from veterans in their respective fields, one a cryptogamist, the other a phanerogamist. Both have a world-wide reputation, and both have exceeded the three-score and ten years of allotted human life and are yet active workers. Although here brought into conjunction, the men themselves are residents of opposite sides of the globe. The names of Dr. M. C. Cooke and

Baron Ferd. von Mueller must live as long as the science of botany exists. Students of science are grateful that they have been spared long enough to give them two such valuable works.

The "Handbook of Australian Fungi" is a compilation of the descriptions of these plants that have at various times been published in widely-scattered volumes. The work was undertaken at the request of the Australian colonies, and is published under their authority. A limited edition only has been printed, some 500 copies, and the major part of it has gone to Australia. The total number of species given in the volume is 2,087, exclusive of varieties. This, in comparison with the total number of species recorded by Saccardo, some 36,000, seems small when the extent of country covered is considered. But it is of course very improbable that all the Australasian forms have been described. Indeed, scarcely a month passes but some new forms are recorded, and it is probable that they will continue to be sent in for many years to come.

The largest order represented is Hymenomycetes, with 1,178 species, more than half the total number recorded. This is probably due to the fact that the species are large, or at least conspicuous, and are therefore collected. Another order, however, also with conspicuous members, the Gastromycetes, is exceptionally well represented, as there are 174 species out of a total known from the whole world of 650 species. Among the interesting species of this family we note *Podaxis indica*, a plant bearing a surprising outward resemblance to *Coprinus cornutus*, but of course with a very distinct internal structure. There is also *Xyloporidium ochroleucum*, with a long stalk and a peridium marked with numerous angular projections.

The occurrence of a number of species in the two islands of Ceylon and Australia is noted as a curious fact in geographical distribution. The flora in general and the fauna as a whole is so distinct in these two countries that it is difficult to account for this fact. It is true that plants in many cases seem to overstep the bounds that have been assigned to them by botanists, and do not appear to follow the ordinary laws of distribution. Especially is this true of ferns and fungi, two classes having spores so minute as to be capable of transportation long distances through the air by winds. Some species thus become cosmopolitan, but at present we cannot account for finding some species of such conspicuous genera as *Lepiota*, *Hymenochaete*, *Stereum aseröe*, etc., only in Ceylon and Australia. It is of course possible that when the intervening islands of New Guinea, Java, Borneo, Celebes, Sumatra, and other smaller ones of the Malay archipelago are explored, that the same species may be found there. That would do away with the anomaly. Comparing the flora with that of Europe, Dr. Cooke finds that 332 of the Hymenomycetes are exclusively Australian, 472 are also found in Europe, and 370 are common to Australia and some other country. Of the Gastromycetes only 31 out of 173 species are European.

In the introduction Dr. Cooke gives condensed accounts of the principal groups, with tables of the genera. This, while not claimed to be complete in any sense, cannot but be of assistance to the student. The species will have to be identified from the descriptions. This is to some extent facilitated by the plates. Of the 36, 20 are colored, and on them are given 377 figures. A list of the authorities cited, and a full index are valuable portions of the book. The descriptions of the plates would have been more convenient for reference had the page where each species is described been given.

The second one of our titles is a new edition of an old book, but it is such a valuable book that it deserves to have general attention called to it. The early editions being exhausted, and there being much new matter in hand, the government of Victoria publishes this volume. To give an adequate idea of its contents would be to index it. We can only refer in a general way to its contents and perhaps mention a few of the more important and interesting facts presented. We have also been struck with Baron Mueller's remarks in both preface and postscript. In the former, after reviewing in a general way the contents of the volume, and mentioning the various editions of it that have appeared from time to time, he says:—

"The fact that this work through successive editions and ex-