very different from that of Rio de Janeiro (one of the nearest coast-towns where observations have been made) and that of Sabará (some 250 miles to the eastward, near the western margin of the mountainous area of eastern Brazil), and is somewhat greater than that of São Paulo (situated 35 miles from the sea, behind the first ridge of the maritime range).

	1880.		1881		1882.	
	Millim.	Inches.	Millim.	Inches.	Millim.	Inches.
January .	360	14.2	285	11.2	280	11
February .	333	13.1	226	8.9	405	15.9
March . .	109	4.3	138	5.4	180	7.1
April . .	181	7.1	27	1.1	120	4.7
May . . .	19	0.7	15	0.6	60	2.4
June. . .	2	0.1	3	0.1	70	2.8
July . . .	11	0.4	4	0.2	26	1
August . .	2	0.1	6	0.2	80	3.1
September,	70	2.8	12	0.5	97	3.8
October .	190	7.5	102	4	120	4.7
November.	274	10.8	142	5.6	100	3.9
December .	219	8.6	290	11.4	125	4.9
Total . .	1m.770	69.7	1m.250	49.2	1m.663	65.2

Note. — In reducing to inches, hundredths have been disregarded.

Orville A. Derby.

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.*]

Pairing of the first-born.

In Science of March 16, p. 167, Charles S. Minot estimates the chance of the first-born male pairing with the first-born female, where there are ten birds of each sex to pair, as one to one hundred. It is easy to see that the first-born male must pair with one of the ten females: he is, therefore, as likely to pair with the first-born female as with any other one; and hence the chance that the first-born male will pair with the first-born female is as one to ten, instead of as one to one hundred. J. E. Hendricks.

Des Moines, March 27, 1883.

Thermal belts of North Carolina.

The abstract of Prof. J. W. Chickering's paper on the above topic (Science, p. 147) has suggested to me the propriety of putting on record the results of observations made by me many years ago, on the 'frostless zones' of the flanks of the mountain spurs adjacent to the valleys in the Blue Ridge. My observations were made at Flat Rock, near Hendersonville, Henderson County, N.C., — a well-watered, fertile, mountain-plateau-like valley, which is about 2,200 feet above the sea-level.

My own observations, and the information elicited from residents, seem to indicate the following facts, which, if verified in other places, may have a bearing on the physical causes which give origin to the 'frostless zones'; viz., the zones in question are *not* exempt from frost during the whole of the cold season: in fact, during the winter, the ground in these belts is frequently frozen to a considerable depth; but during the spring months they are conspicuously and uniformly frostless. They *coincide* with the nocturnal and morning 'fog-belts' of the spring months. The uniform presence of these white, circumscribed belts of fog on the flanks of the mountain spurs, during the early morning hours, imparts a striking feature to the scenery of these valleys. When illuminated by the bright morning sun, they appear like girdles of cotton-wool of moderate width, encircling the peaks at the height of 200 or 300 feet above the adjacent valleys; and their cumulus-like whiteness, contrasted with the verdure above and below them, is no less striking than it is beautiful.

The latter circumstance seems to furnish an explanation of the physical cause of the so-called 'thermal belt;' for the constant fogs at night and in the morning not only prevent refrigeration by obstructing terrestrial radiation, but, during the condensation of vapor in the process of fog-formation, there must be developed an enormous amount of heat just at this zone. Why this condensation of aqueous vapor should be so persistently restricted to a belt of only a few hundred feet in vertical thickness, is a question much more difficult to answer.

The observations of intelligent residents of the mountain valleys, in the southern divisions of the Appalachian chain will doubtless verify or disprove the general *coincidence* of the 'frostless zone' with the 'fog-belt;' and this is the point which some of the readers of Science may be able to settle.

John LeConte.

Berkeley, Cal., March 27, 1883.

Flight of the flying-fish.

A note in Science of March 23, concerning the flight of the flying-fish, leads me to offer the results of my own observations. During a passage through the Indian Ocean in 1880, I had so numerous and excellent opportunities for observing the movements of flying-fish in all kinds of weather, that I determined to discover, if possible, whether or not the wings were of material aid in flight, beyond a mere buoyant action. In many cases the fish would continue its flight for a surprisingly long period, sometimes in the face of the wind. Again, the direction of flight would be changed in such a way as to render it improbable that the wind was the cause. When an object is passing over a rapidly changing surface, it is very easy to imagine it to rise or fall in unison with the latter; but so frequently did I notice a fish clear advancing waves, that I finally was forced to believe them to have the power of controlling their flight. I frequently called upon other passengers to confirm my own observations, with which their testimony was in general harmony. I may say, therefore, that I finally reached the same conclusions as those presented by Mr. Kneeland. D. P. Penhallow.

Mountainville, N.Y., March 29, 1883.

THE NATURAL HISTORY OF OHIO.

Report of the geological survey of Ohio. Vol. iv. Zoölogy and botany. Part i. Zoölogy. Published by authority of the legislature of Ohio. Columbus, *State*, 1882. 8 + 1020 p. 8°.

This long-looked-for volume has appeared, and, notwithstanding its size, includes only the vertebrates of the state. Dr. Newberry, the head of the survey, holds out some hope of a future volume on the invertebrates and on the botany of the state; but the difficulty experienced in securing further appropriations for the publication of the fossil remains leaves their appearance rather doubtful.

The part devoted to the mammals (a hun-

dred and eighty-five pages), by A. W. Brayton, is largely a compilation, as the author states in his preface; but it contains a considerable number of notes upon the habits of various species, the dates of extinction, etc., which are original and valuable. Keys are given for the families and genera discussed, except in the case of the Muridae and a few other groups. Forty-nine species are enumerated, which are distributed as follows: Carnivora, 15; Ungulata, 3; Cheiroptera, 5; Insectivora, 5; Rodentia, 20; Marsupialia, 1. Of these, the following species are, or are supposed to be, now extinct in Ohio: the puma (Felis concolor), the lynx (Lynx canadensis), the pine marten (Mustela americana), the wolverine (Gulo luscus), the badger (Taxidea americana), the wapiti (Cervus canadensis), the beaver (Castor fiber), and the bison (Bison americana).

The paper may, perhaps, be criticised as not containing sufficient information regarding the distribution of species within the state, nor upon such topics as food, local variation, and similar topics, showing a lack of direct observation upon Ohio specimens.

Dr. Wheaton's welcome report on the birds covers four hundred and forty-two pages. Its introductory chapter treats of the physical geography of Ohio, and some peculiarities of its climate; of latitudinal variation in birds; of the general characteristics and affinities of the class Aves; and of the arrangement and definition of the orders of North-American birds. Most of this matter is compiled from high authorities on the several subjects.

In the main body of the work, also, the technical matter is chiefly taken at second-hand. The keys to the genera are from Dr. Jordan's Manual of the vertebrates of the northern United States; the definitions of the higher groups and the descriptions of species, 'almost without exception or alteration,' from Dr. Coues' Key to North American birds; and the nomenclature from Dr. Coues' Check-list of 1874, 'with such modifications as changes made since its publication require.' The name of each species is followed by 'references to all writers, whether general or local, who have mentioned that species as Ohioan;' and, in addition, the general synonymy of the species is given with sufficient fulness to 'enable changes in the nomenclature to be traced.' There is an appendix, also, which includes a Check-list of Ohio birds, with the dates of their appearance and disappearance, as observed in the vicinity of Columbus; a list of the birds which have been seen in the author's garden, in the heart of that city; a bibliography of Ohio ornithology; an essay on the relation between latitude and the pattern of coloration in Ohio birds; and a glossary of such scientific terms as require definition.

These technical matters have evidently been treated with care, and, in the main, wisely; but it is to the biographical portion of the work that we can accord the highest praise. The biographies are usually from Dr. Wheaton's own pen; and in all such cases they are done in a masterly manner. The author brings to his task an intense inherent love of his subject, a philosophical turn of thought well known to all who are familiar with his writings, and a mind trained to the most conscientious regard for scientific truth and accuracy. In addition, his writings have a literary finish by no means common in these days of hasty production; while the quaintness of occasional expressions, characteristic of a generation fast passing away, adds still further to their charm.

In short, while it would be possible to say ungracious things about this report, we may fairly characterize it, on the whole, as a work of high scientific accuracy, general as well as local utility, and universal interest. It is a pity that the ornithology of every one of the United States cannot be treated in an equally exhaustive and able manner.

The report on the reptiles and amphibians, by Dr. W. H. Smith, already favorably known to herpetologists as the author of a systematic review of the Urodela and Coecilia, occupies more than one hundred pages. Thirty-seven reptiles and twenty-three batrachians are described as native in Ohio, and numerous extra-limital forms are discussed. In general, the report seems worthy of high praise. The technical descriptions are pertinent, and the accounts given of the habits and peculiarities of the different species are full and interesting. Of many of the species mentioned, there is no better account extant. In view of the confused and unsifted condition of the synonymy of American reptiles, the value of the quotations would have been increased by the citation of works as well as authors. We notice a few unexplained, though perhaps justifiable, deviations from current classification; as, for example, the reference of Kennicott's 'Regina Kirtlandi' to Regina rather than to Tropidoclonium. There are also a few unnecessary violations of the law of priority in the nomenclature adopted; as in the retention of the name 'Menobranchus,' instead of the prior and now equally familiar 'Necturus.'

The elaborate report on the fishes, by Professor David S. Jordan, occupying more than two hundred and fifty pages, gives an interesting history of Ohioan ichthyology, with descriptions of all the species as well as of the principal genera and higher groups. It appears that the fauna has been increased from the sixty-six species known to Dr. Kirtland (1840–1846) to a hundred and sixty-five. A useful tabulated synopsis exhibits in four parallel columns the names admitted by Rafinesque, Kirtland, and Günther, as well as Jordan. The fauna is also disintegrated into its several elements, — the Lake fauna (26 sp.), the Ohio-river fauna (37 sp.), and the 'species of general distribution' (28 sp.) 'As an illustration of the character of the local fauna of the smaller streams of the interior,' a list of the species (68) occurring in the White River, near Indianapolis, is added, with notes as to their comparative abundance or rarity.

The typography, although good for a public document, could not be accorded much excellence were the work issued by a private publisher; and the press-work is very unsatisfactory. The synonymy of species is printed in much too large type in the division on the mammals, although afterwards changed. This inequality is unsightly; and numerous typographical errors occur.

GEIKIE'S GEOLOGICAL SKETCHES.

Geological sketches at home and abroad. By ARCHIBALD GEIKIE, LL.D., F.R.S., director of the Geological survey of the United Kingdom. New York, *Macmillan & Co.*, 1882. 370 p. 8°.

IN this pleasant volume, well illustrated by the author's pencil, Prof. A. Geikie has gathered together a number of sketches, essays, and addresses, picturesque, descriptive, and historical, published during the past twenty years in various journals, and all written with some reference to the science of geology, of which he has been so successful a cultivator. Some of these papers have little more than a local and popular interest, but are gracefully written, and well suited to give the unscientific reader a taste for geological studies. Others have a higher significance, and raise questions which are of importance to all students of geology, and would require for their adequate discussion more space than we can here command.

One of the most interesting of these papers is that entitled 'A fragment of primeval Europe,' in which we are introduced to the crystalline rocks of north-western Scotland and the adjacent isles. These ancient gneissic and granitoid strata, first critically studied by MacCulloch, were early recognized as the lithological and mineralogical analogues of the primitive gneisses of Scandinavia and parts of North America; and in 1855, after the name of Laurentian had been given to the latter, it was suggested that the name should be extended to the similar rocks of Scotland, which Murchison had called the fundamental gneiss, — a suggestion since adopted. The aspect of the region occupied by these ancient rocks is peculiar. "The whole landscape is one of smoothed and rounded bosses and ridges of bare rock, which, uniting and then separating, enclose innumerable little tarns. There are no definite lines of hill and valley: the country consists, in fact, of a seemingly inextricable labyrinth of hills and valleys, which, on the whole, do not rise much above, nor sink much below, a general average level." No peaks nor crags are seen; and "the domes and ridges present everywhere a rounded, flowing outline." The whole area is, according to our author, smoothed, polished, and striated, as if ice-worn, and presents, in fact, a typical glaciated surface. Over this 'tumbled sea of gray gneiss' rise conical mountains of nearly horizontal, dark-red sandstone, capped by white quartzites, the summits sometimes attaining 3,400 feet above tide-water. Two good woodcuts serve to illustrate the peculiarities of this curious landscape.

These uncrystalline, unconformable beds of Cambrian age, dipping gently eastward, are succeeded by fossiliferous limestones belonging to the same period, which, in the same direction, appear to pass below a series of flaggy gneisses and crystalline schists, the age of which has been a burning question among British geologists. The problem regarding them is identical with that which has been raised in New-England geology; namely, whether the crystalline schists, towards and beneath which the fossiliferous paleozoic rocks lying to the westward are seen to dip, are newer or older than these. Professor Geikie, for Scotland, holds to the former view, and supposes these crystalline rocks in the Highlands to be formed from a subsequent alteration of still younger paleozoic strata: but in Scotland, as in New England, the opposite view is now, by most geologists, held to be established; namely, that the crystalline rocks in question are pre-Cambrian, and in that sense a part of the 'primeval' world.[1]

Geikie shows that the sculpturing of the

[1] Geological magazine, February, 1883, p. 83.