from the same area, formed no distinct beach ridges; at least none have been observed by the writer. In Citrus and neighboring counties the marine Columbia sands seem to be composed of three members—a lower or red member (formed while the shore line was advancing inland), a middle or yellow member (formed mainly during the culminating period of the submergence), and an upper or white member (formed while the shore line was retreating). These rest upon an undulating land surface, rising in a distance of about eight miles, from sea level at Crystal River, to an altitude of about 180 feet A. T., near Lecanto, and again descending to nearly sea level in the Withlacoochee valley. No prominent beach ridges were formed *because the shore line did not remain at one level on the slope of the land a sufficient length of time.* This is only one of a number of similar cases which might be mentioned where the sea advanced upon and retreated from a sloping land surface without forming beach ridges.

In regard to the other objections against the lacustrine origin of the Missouri 'upland loess,' presented by Professor Todd, namely, that it is absent from certain areas in the eastern part of the State near the junction of the Mississippi and Missouri rivers and at a low level, I wish to suggest that it may have been there present originally as a very thin sheet which has since almost disappeared because of erosion. Past experience has taught me that when the loamy deposit which constitutes the 'upland loess' is very thin and patchy and approaches closely in composition and appearance to the residuary clays it is, by many geologists, scarcely recognized as a portion of the Loess formation. This suggestion is justified by the fact that I have observed in the region traversed by the St. L. and S. F. railroad, between Cuba and Pacific City, a loamy clay, usually free from pebbles, apparently separated from the residuary clay by a sharp line, and overspreading the surface of a hilly country like the 'upland loess' in northwestern Illinois. If this is a portion of the Loess formation it indicates that the lake or sea waters rose against the northeastern corner of the Ozark uplift to an altitude of 1,000 or more feet, or rather I should say that the land went down to that amount below these waters. The superficial silts of this region ought to be investigated. O. H. Hershey.

Freeport, Ill.

Scientific Literature.

Birds of the Galapagos Archipelago. By Robert Ridgway. Proc. U. S. National Museum, Vol. XIX., pp. 459–670, 2 pls. Cover title-page dated 1896, but not published till March, 1897.

It was in the Galapagos Islands that Darwin, during the memorable 'Voyage of the Beagle' in 1835, made the original observations which led him to discover and formulate the great principle of evolution—to the elucidation of which the remainder of his life was so successfully devoted—and it was the birds of these islands which first drew his attention to the derivative origin of species. Hence to naturalists, and particularly ornithologists, the Galapagos Islands will ever be classic ground.

Unhappily, the advent of man, with his retinue of goats, pigs, cats and rats, has already resulted in the extermination of at least one of the indigenous birds; others are threatened with the same fate. The extinction of an animal is always a matter of regret, and in the present case is a serious loss to science because of certain unsolved problems respecting the extraordinary and unique interrelations of many of the species. For instance, certain genera contain a large number of forms, alike in color and markings, but differing in proportions, particularly the size and shape of the bill. In one genus (*Geospiza*) the bill presents a series of types which at first would hardly be supposed to fall within the limits of a single family, —much less a single genus. This remarkable series comprises bills that in form and size resemble those of tanagers, small-billed sparrows and huge-billed grosbeaks. But for the existence of intermediate forms no one would think of placing such diverse kinds in a single genus. In one or two of the genera almost every conceivable stage and step of intergradation exists, so that it becomes extremely difficult—if not in some cases impossible—to draw the line between specific and individual variations.

Owing to the absence of information concerning the adaptations and limits of specific varia-

tion among these birds in life, and owing further to the fact that certain species are on the verge of extermination, while others doubtless still remain to be discovered, it is clearly of pressing importance that some competent ornithologist should visit the islands and study the habits and interrelations of the various forms before it is too late.

In recent years relatively large collections of birds have been made on some of the islands. Those obtained by the naturalists of the 'Albatross' in 1888 and 1891, and by Dr. George Baur and Mr. Adams in 1891, were brought to the U. S. National Museum, where they have been critically studied by Mr. Ridgway. The result is the present admirable paper entitled '*Birds of the Galapagos Archipelago*,' one of the most important ornithological publications that has appeared in many years. It is a comprehensive treatise 'intended,' as the author tells us, 'to embody practically all that it known of the avi-fauna' of the region. Still "it does not claim to be exhaustive, for a great deal has yet to be learned before anything like a complete exposition of the subject is possible."

Respecting the conflicting theories as to the origin of the Galapagos Mr. Ridgway states: "All writers are agreed that the Galapagos Islands are volcanic; nearly all, from Darwin to Agassiz, agree that they were uplifted from the sea by volcanic action, and that their upheaval therefore antedates the advent of organic life upon them. Dr. Baur, however, believes that these islands are the higher points of an extensive submerged area, whose subsidence took place after a fauna and flora had been acquired; or, to quote his own words: 'At a former period these islands were connected with each other, forming a single large island, which itself at a still earlier time was united to the continent, probably with Central America and the West Indies.'"

Mr. Ridgway modestly adds that he is "not competent to discuss the relative merits of these two opposite theories from the physiographer's standpoint; but if the apparent relationships of the fauna have any bearing on the question," he believes Dr. Baur's theory 'at least worthy of serious consideration.' He calls attention to the map accompanying Alexander Agassiz's report on the cruise of the 'Albatross' for 1891, which shows that the Galapagos and Cocos Islands stand on a submarine plateau covered by only 1,500 fathoms of water, and that this plateau reaches northeasterly to within 100 miles of the present coast of Central America, and is only a little more than 30 miles distant from the 1,500-fathom coast-line. These distances are too insignificant to form any barrier to the free passage of birds; hence, if it can be assumed that the present submarine plateau was ever above the level of the sea it would naturally have received its original bird population from Central America. Let us see how this accords with the facts of present distribution. Mr. Ridgway tells us that 38 genera of birds are believed to breed on the islands. Of these, 23 are wide ranging, 6* are peculiar to the islands, and 7 are tropical American. Eliminating the wide-ranging genera, 13 remain, of which 6 are peculiar and all of the others tropical American. Mr. Ridgway then takes up the 5* peculiar genera and discusses each with respect to its relationships and probable origin. After stating that two of these are clearly of American origin, that two resemble both American and Hawaiian types, and that the remaining one "has no very near relative among the known continental or West India birds, but in general appearance is very much like a smaller 'edition' of the Hawaiian genus *Oreomyza*," he sums up as follows: "Of the five peculiar Galapagoan genera of birds, only two (*Nesomimus* and *Nesopelia*) are of evident American relationship. The remaining three have so obvious a leaning toward certain Hawaiian dicæidine forms that the possibility of a former land connection, either continuous or by means of intermediate islands as 'stepping stones,' becomes a factor in the problem. It may be that the resemblance of *Cocornis*, *Cactornis* and *Camarhynchus* to the above mentioned *Hawaiian* forms is merely a superficial one, and not indicative of real relationship. I do not by any

* By a singular slip the number of peculiar genera given in the tables and on page 465 is 6, while two pages later it is reduced to 5. The latter number is the result of uniting *Cactornis* with *Geospiza* after the earlier pages were written. By an oversight this was not corrected in the proof.

means claim, on the strength of such evidence, a common origin for them, but merely present the facts as 'food for reflection.'"

In discussing the extraordinary conditions presented in the genus *Geospiza*, Mr. Ridgway states: "When it is remembered that the coloration is practically, if not absolutely, the same in all of the twenty-odd forms of the genus *Geospiza*, it will be seen that if any segregation of species is made at all it must be based upon measurements; and when it is further seen that there is a gradual transition from the enormous beak of *G. magnirostris* to the comparatively minute one of *G. parvula* and from the excessively thick one of *G. pachyrhyncha* (whose lateral outlines approximate an equilateral triangle) to the slender and curved one of *G. scandens* or the acuminate one of *G. acutirostris;* and that size of beak is not necessarily correlated with length of wing, tarsus, etc., the difficulty of defining species becomes obvious. * * * Having been perplexed by these difficulties I have carefully weighed all doubtful cases, and whenever there seemed to be a well defined average difference between specimens from different islands I have not hesitated to separate them as local forms. No other course, indeed, is practicable; for were 'lumping' once begun there could be no end to it, unless purely arbitrary limits were given to the species recognized, and if followed to a logical conclusion might easily end in the recognition of a single variable species, equivalent in its limits to the genus."

In an earlier paper Mr. Ridgway united the genera *Cactornis* and *Geospiza* because of intergradation; in the present paper *Cactornis* is retained in a subgeneric sense. Mr. Ridgway quotes a letter from Dr. Baur as follows: "You place the species of these two genera in one genus, *Geospiza*. I do not think that this is natural. Both have their peculiar representatives on the different islands, and if you place them together this peculiar differentiation of each is lost sight of. *Cactornis* is more slender than *Geospiza* and has many more black individuals. I would keep the two genera apart." Dr. Baur might have strengthened his position by adding that genera should be based on degree of differentiation rather than on the survival or non-survival of intergrades. The present case is unusually extreme, because a complete chain of intermediate 'species' is known to exist, connecting the slender-billed *Cactornis* type with the thick-billed *Geospiza* type. But in all cases of derivative genera the theory of evolution, conceived on these very islands, calls for the existence at one time or another of similar chains of intergrades. Whether such intergrades survive, bridging the extremes with living forms, or die off, leaving the extremes trenchantly defined, is a matter of zoological interest, but one in no way affecting the degree of differentiation of the extremes, on which alone, in my judgment, the question of generic distinctness should rest.

Chronologic lists of the species found on each island by the various explorers, from Darwin in 1835 to Townsend, Baur and Adams in 1891, are given, and also an exceedingly convenient tabular statement showing in 16 columns the various islands on which each of the 105 species is known to occur. This is followed by the systematic part of the paper, comprising keys, maps and careful descriptions of the various genera and species. The map used is a skeleton, covering considerably more than a half page, on which range is indicated by heavy-face numerals. Since this map is introduced about 50 times the waste space at the top and bottom adds materially to the size of the paper. Two plates are given showing the astonishing variations in the size and form of the bill in the genera *Nesomimus*, *Camarhynchus* and *Geospiza*. The paper closes with a bibliography of 23 titles. The technical descriptions are models of thorough painstaking work, and the memoir as a whole easily takes a place among the classics of ornithology.

By an utterly unpardonable blunder, for which the author is in no way responsible, the cover-title-page is dated 1896, although not published until March, 1897. Accidents are liable to occur anywhere, but the number of papers bearing the cherished imprint of the Smithsonian Institution which are permitted to appear under ostensible dates that materially antedate the actual date of publication is not only an injustice to the author and an annoy-

ance to the bibliographer, but is hardly creditable to the spirit of scientific accuracy and fairness which American science has done so much to promote.

C. H. M.

The Mechanics of Pumping Machinery. By J. WEISBACH and G. HERRMANN. Authorized Translation by K. P. DAHLSTROM, M. E. Macmillan & Co. 1897. Pp. 300. 8vo. $3.75.

This work is a translation of the latest division of the Weisbach cyclopedic treatise on Engineering Mechanics. It is intended mainly as a text-book, and for use in advanced courses of instruction in engineering schools; while it is also thought that it may have value to the designer and constructor in his daily work. The translator has added some matter exhibiting the progress made in this field since the original publication of the book in Germany, and in this he has had the aid of Professor Klein's notes. The work includes discussions of early forms of water elevators and hydraulic machinery, of the theory and action of pumps, both reciprocating and rotary, and an account of other less well-known apparatus for raising water. The reputation of the author, Professor Herrmann, the distinguished technicist, is a guarantee of the reliability of these discussions, and this guarantee is confirmed by examination of the pages of this translation, in which these discussions have been faithfully brought over into the English and in satisfactory form.

The illustrations are numerous and helpful; the text is by them rendered admirably lucid. In general appearance and style the volume corresponds to its predecesors in the same series and, without being elegant, is creditably made up. Its price is moderate and it will probably find its place in the library of all who possess its companion volumes.

R. H. T.

SCIENTIFIC JOURNALS.

THE JOURNAL OF COMPARATIVE NEUROLOGY. VOL. VII., NO. 1.

THE issue for April contains three memoirs, besides editorials and reviews. B. F. Kingsbury writes on 'The Structure ard Morphology of the Oblongata in Fishes,' from the standpoint of the components of the nerve roots. Some 17 species of cartilaginous and bony fishes were examined, their nerve roots analyzed and the components traced to their respective centers, along the lines laid down by Strong's recent work on the cranial nerves of Amphibia. It will be remembered that Strong reduces the sensory nerves of the head to three types: (1) the general cutaneous system, innervating the skin and terminating in the 'ascending' or spinal fifth tract of the medulla; (2) the acustico-lateral system, innervating the lateral line canals and the ear and terminating in the tuberculum acusticum of the medulla; (3) the fasciculus communis system, innervating taste buds, certain specialized end-organs of the skin not belonging to the lateral line system, and the mucous and visceral surfaces in general, and terminating in the fasciculus communis of the medulla, or the cellular aggregates associated with it (lobus vagi of fishes).

Now in the fishes examined, Dr. Kingsbury finds these components present, and arranged in essentially the same way as in the Amphibia. The varied and apparently anomalous conditions found in the medulla of the fishes, which have so long puzzled the morphologists, have been reduced for the most part to variations in the relative development of these three factors. The lobus trigemini of the catfishes is regarded as a specialized portion of the fasciculus communis system. These conclusions have been reached by a study of the central relations only of the nerve roots. It may be added that researches now in progress at Columbia University, upon the peripheral distribution of these roots in the bony fishes, have fully substantiated most of his discoveries.

Dr. Kingsbury follows with a second paper entitled 'The Encephalic Evaginations in Ganoids.' The new and important points are two: (1) The presence in the adult Amia of the first epiphysial vesicle of Hill and its innervation from the left Habena; and (2) the existence in Amia and Lepidosteus of lateral cephalic and caudal extensions of cavity caudad of the velum transversum of Kupffer, constituting considerable diverticula.

'The Early Development of the Epiphysis and