of known species in the fauna to 106. Contributions to the knowledge of the plankton are given by Dr. Geza Entz; he describes twenty-three species of Peridiniaceæ, and figures the seasonal variations of *Ceratium hirundinella*, which lives in the lake throughout the year, and is common from May to November.

The last part of the whole work, the bibliography, has been compiled by Dr. Julius von Sziklay. It enumerates all the independent works, with summaries of their contents, and has special sections for maps and for contributions in journals and serials.

The Hungarian Geographical Society is to be congratulated on this valuable contribution to natural science. The monograph on Lake Balaton will be of value to all students of the natural history and geography of Central Europe, and its summary of modern methods of research will be of use to students of lakes elsewhere. Moreover, the description of the country, revealing the quiet charm of its scenery and the many interests in the life of its people, should lead more visitors to this attractive district.

A 100-INCH REFLECTING TELESCOPE.

AS time passes and astronomical work advances there is a greater demand, year by year, for more powerful instruments of research. Fortunately, instrument makers have so far been able to fulfil the requirements for large refractors and reflectors, but a few years ago the time seemed to be reached when further progress appeared a long distance off. At the present day there are refractors in existence the object-glasses of which are as large as 30, 36, and 40 inches in diameter, while the greatest glass mirror that has been used measures 60 inches in diameter.

In the case of the largest refractor, namely, that erected in the Yerkes Observatory in America, it seems possible that the size of this form of telescope has nearly reached its limit. The reasons for this are that, not only is it extremely difficult and costly to cast and figure lenses of such dimensions, which to give the best definition must be practically flawless, but the mounting has to be so immense and strong, and consequently very expensive in proportion.

It must be remembered that in the refracting form of telescope the object-glass has to be placed at the *upper* end of a long tube, while the observer takes his place at the lower end; these ends have to be very rigidly connected together, and the whole tube mounted so as to be capable of being moved in any direction. Thus in the case of the Yerkes telescope the tube had to be 62 feet long (weighing six tons), and the whole mass of metal that required moving every time the telescope was required in a different position was twenty tons. This will give some notion of the engineering difficulties that are involved in large refractors. In reflectors, on the other hand, the mirror is placed at the *lower* end of a comparatively light tube, and as close as possible to the mounting on which it is carried. In fact, in the case of the late Dr. Common's 5-feet reflector a means was adopted of actually floating the mirror.

In considering, therefore, the construction of telescopes much larger than those that already exist, attention is naturally being paid more to the reflecting type than to refractors. Further, it is not necessary that the glass casting for a mirror should be so perfect as that required for an object-glass, for in the former case only a perfect reflecting *surface* is required, while in the latter the light has to pass through the whole mass of glass. It is obvious, then, that much larger discs of glass can be made which may be suitable for reflectors but useless for refractors. Aperture for aperture, a mirror costs about one-tenth the price of an object-glass, and this gives some idea of the extra work and risk involved in producing a good object-glass.

The expense attached to the mounting of a reflector is also considerably less than that of refractors when large instruments are in question.

Now, not only is the reflector the less expensive of the two forms of instruments, but it has many distinct advantages optically. Thus chromatic aberration is a thing unknown in reflectors. Again, light being totally reflected from the silvered surface of a mirror is not lost like it is in refractors, where it always has to pass through the object-glass, and is consequently partially absorbed.

Mirrors are, however, easily tarnished and affected by changes of temperature, but these disadvantages do not counterbalance the many points in their favour, to which reference has been made, when exceedingly large instruments are under consideration.

In the Proceedings of the American Philosophical Society (vol. xlv., No. 182, p. 44, 1906) Prof. E. C. Pickering communicated a paper entitled "An International Southern Telescope," and in it he strongly advocated the erection of a large telescope of the reflector type. His proposal was that the telescope should have a diameter of about 84 inches, and should be set up in some locality such as South America or South Africa, where the observing conditions are considered very favourable. Towards the end of the paper Prof. Pickering referred to the important work that could be accomplished by means of such a large reflector, and mentioned that the name of a donor "could in no way be better immortalised than by associating it with such a real advance in the greatest problem to the solution of which the mind of man has aspired—the study of the sidereal universe."

We learn now from the current number of the *Astrophysical Journal* (vol. xxiv., No. 3, October) that Mr. John D. Hooker, of Los Angeles, who on former occasions has rendered financial assistance to astronomy, has presented to the Carnegie Institution of Washington the sum of forty-five thousand dollars to purchase a glass disc 100 inches in diameter, 13 inches thick, and 50 feet focal length, and to meet other expenses incident to its construction. These latter will include the erection of a building in which the mirror can be ground, figured, and tested; the construction of a large grinding machine, with crane for lifting the mirror ($4\frac{1}{2}$ tons); the provision of a 54-inch glass disc to be made into a plane mirror for testing purposes, and other necessary items.

The large mirror is intended for use at the Solar Observatory of the Carnegie Institution situated on Mount Wilson, in California, and under the directorship of Prof. G. E. Hale. This observatory has already a 60-inch mirror in its optical shop, and at the present moment it is being tested. In the case of the new 100-inch reflector, we are told the St. Gobain Company expresses its deliberate opinion that such a disc, 13 inches thick, can be produced, and that the Company will be able to carry out the order which has been given to it.

The grinding and figuring will be entrusted to Prof. G. W. Ritchey, and no unsurmountable difficulty is anticipated by him in bringing such a mirror to a high order of perfection. The 60-inch mirror, now nearly completed, is the largest he has yet attempted, and this is now nearly ready for mounting.

At present no financial provision has been made for the mounting and housing of this 100-inch reflector, but as the mirror will take, as we are told, about four years to complete there is no immediate hurry.

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The experience gained by the form of mounting adopted for the 60-inch mirror will be valuable when the time comes for the erection of the 100-inch mirror, and funds will no doubt soon be found when the right moment arrives.

Already the United States is the possessor of the two largest refractors and silver-on-glass reflectors. This new monster will afford her another means of greatly extending astronomical knowledge, which has made such vast strides during the last decade owing to these increased aids to observation.

AN EXPERIMENT IN INSECT-EXTERMINATION.[1]

IN the year 1900 the sugar-cane planters of Hawaii were seriously alarmed by the appearance in considerable numbers in their plantations of an introduced hemipterous insect allied to the cicadas and commonly known as the cane leaf-hopper, but designated scientifically *Perkinsiella saccharicida*. Since that date the pest has increased to an enormous extent, with an estimated loss of many millions of dollars to the planters. Fortunately, the leaf-hopper has a certain number of enemies among the insects indigenous to Hawaii, since had it not been for the extent to which it was held in check by their attacks it seems probable that sugar-growing would by this time have become absolutely impossible in the islands.

These indigenous enemies were, however, utterly unable to cope in a thoroughly efficient manner with the swarms of the leaf-hopper, and it became apparent that unless some other means of diminishing its numbers were discovered the sugar industry of the Sandwich Islands would be practically ruined. Accordingly, the officials of the Entomological Division of the Planters' Association at Honolulu set to work with commendable energy and enthusiasm to endeavour to find an efficient and satisfactory remedy. It appears to have been soon decided that such a remedy would most likely be discovered in the form of insects which would prey upon the leaf-hoppers with greater vigour than any Hawaiian species; and in 1903 and the two following years expeditions were organised to North America, Australia, and Fiji with the view of discovering such insects.

In due course a number of species inimical to the cane leaf-hopper were brought to light, and the present elaborate bulletin (of which one part has been already briefly noticed in our columns) is devoted to the description and life-history of leaf-hoppers and their enemies, together with an account of the experiments which have been made in introducing and acclimatising certain of the latter into Hawaii.

The list of insects parasitic on leaf-hoppers is a very long one, and comprises representatives of several orders, although the great majority belong to the Hymenoptera. For our present purpose attention may be concentrated on the few species it has been found advisable to introduce into Hawaii. In the case of the introduction of such parasites four points are essential:—(1) Their effectiveness as destroyers of the pests; (2) the possibility of successful transportation; (3) the probability of their thriving in the new country; and (4) their rapidity of increase when introduced. The choice was soon narrowed down to certain minute Hymenoptera which feed upon the eggs of leaf-hoppers, namely, to species of Anagrus and Paranagrus in the family Myrmaridæ and to one of Ootetrastichus among the Eulophidæ. The members of the two first genera complete their life-cycles in about three weeks, breed at about the same rate throughout the year, and are largely parthenogenetic. Ootetrastichus, on the other hand, takes fully twice as long to complete its cycle, but produces twice as many eggs, and is wholly parthenogenetic. *Caeteris paribus*, the products of the myrmarids at the end of six months will, however, be a million times more numerous than those of the other genus. On the other hand, the ootetrastid is not only more hardy, but has the advantage that each individual is bred at the expense of the whole contents of the egg-chamber of the leaf-hopper instead of destroying only a single egg.

Of the four species introduced one of Paranagrus is at present the most effective, but the Ootetrastichus is slowly but surely increasing in numbers, and is eventually expected to prove the most effective. For further details respecting these interesting and to a great extent even at present successful experiments, our readers must be referred to the Bulletin itself.

R. L.

[1] "Leaf-hoppers and their Natural Enemies." Edited by R. C. L. Perkins. Bulletin No. 1 of the Experiment Station of the Hawaiian Sugar Planters' Association, Honolulu, 1905-06. 10 parts. Pp. xxxii + 499; illustrated.

THE FLIGHT PROBLEM.

THE real "flights," not "jumps," which Mr. Santos Dumont has been making at Paris with his new aëroplane have directed the attention of the whole aëronautical and motor world in the direction of the problem of flight. Further, tempting prizes have now been offered which will undoubtedly stir up other workers to take up the problem and so increase the chance of rapidly advancing the progress of aërial navigation.

In addition to the Archdeacon prize of 2000*l.* for a half-mile course and to the enterprising offer of the *Matin* of 4000*l.*, which was subsequently increased to 10,000*l.* by public subscription, for the first traveller who succeeds in covering the distance between Paris and London in 1908, the *Daily Mail* has now come forward with the offer, open to the world, of 10,000*l.* to the first person who shall fly by aëroplane from London to Manchester in twenty-four hours, including two stops to take in supplies of petrol.

Such large prizes will certainly go a long way towards giving a strong impetus to the manufacture of aëroplanes, and also to the motor industries to produce the lightest forms of petrol engines. In fact, a great number of people will almost immediately set about experimenting with aëroplanes in order to compete for the prizes. We read that already Mr. Santos Dumont has given an order for a lighter and more powerful engine, namely, a 100 horse-power motor which will weigh no more than 200 lbs.

Since Mr. Santos Dumont's successes were announced, several references have been made to the experiments which have been carried out by the brothers Wright in America, but very little is known about their results, since they have purposely avoided publicity; according to the views of Sir Hiram Maxim, as stated in the *Daily Mail*, they have a new motor to their aëroplane which is twice as effective as their previous one, and they hope to "fly with it 200 to 300 miles without stopping."

Up to the present time there has not been any great inducement for workers to come forward and demonstrate publicly the capabilities claimed for their machines. The rewards now offered will no doubt serve as an incentive to them, and possibly others, to enter the arena and prove in open competition the efficiency of their designs.

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