

objectives described in these tables are not given the forms determined by the astronomical telescope conditions—freedom from colour, central spherical aberration, and coma—but one of these is deliberately sacrificed to enable the crown and flint components to be cemented together. This leads to the consideration of six forms of objective, three of which have the crown lens before the flint and three with these lenses in the reverse order, two forms of each set of three being free from colour and from central spherical aberration, and one free from colour and from coma. Each of these forms is described in a separate group of tables.

With most of the glass combinations one of the forms with the crown lens placed before the flint has the two surfaces of the crown lens of nearly equal curvature, and a set of tables is included devoted to lenses in which these curvatures are exactly equal. Such lenses offer the very considerable advantage when rapid output and low cost is of importance, of requiring only two sets of tools for their production, one set corresponding to the equal curvatures of the crown lens and the surface of the flint lens which will be cemented to a face of the crown component, the other set being, of course, for the second surface of the flint lens.

To each group of tables giving the constructional details of its own particular type of lens is added a table showing the amount of the aberration—coma or spherical aberration, as the case may be—which has unavoidably been retained in consequence of the restraint imposed by the condition that the two components are to be cemented to one another. A glance at these tables shows which form of objective and what combinations of glasses are the most suitable to employ in various circumstances. The physical interpretation to be placed on these quantities is explained in a note which prefaces the tables. For convenience in reference all the tables relating to one form of objective are placed on a single opening of the pamphlet.

The fundamental tables relate to lenses in which the thicknesses are negligible. A second set of tables is added, showing the alterations in focal length produced by standard thicknesses, which are taken to be $1/40$ th of the focal length for the crown component and $1/80$ th of the focal length for the flint lens, and also the corrections to the curvatures which are necessary to give the thick lenses the same focal length as those of negligible thickness. For convenience in making such corrections the principal set of tables give the curvatures of each lens surface in addition to their radii of curvature. The foregoing particulars suffice to show that the pamphlet should not only be of immediate use to those for whom it has more especially been prepared, but should prove of permanent value to all who are engaged in the construction of small objectives. It may be obtained from the publishers, Messrs. Harrison and Sons, 45 St. Martin's Lane, London, W.C.; price 2s. 6d., plus postage.

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The laboratory authorities state that it is hoped later to supplement this publication by a further paper dealing with the corrections which may be necessary for object glasses of somewhat larger size. They may also undertake further optical calculations needed to perfect instruments required by the naval and military authorities if it seems to them desirable.

T. SMITH.

R. W. CHESHIRE.

JEAN-HENRI FABRE.

IT is more than half a century since Darwin quoted Fabre in his "Origin of Species" and called him "that inimitable observer." Yet he has been with us and working till the other day—a resolute veteran, in spite of his extraordinarily hard and strenuous life, from which he wrung out the joys of discovery and devotion. In this sense he lived a successful life, and he had other rewards—the appreciative esteem of expert entomologists; the admiration of those who have enjoyed his intimate descriptions of the life and work of insects and his singularly vivid style; the encouragement of good friends, such as John Stuart Mill and Mistral; but one cannot escape the regret that, through imperfections in contemporary social organisation, his genius, which was marked by a unique blend of observing power and sympathetic insight, was through a large part of his life unduly distracted and inhibited by the cares of keeping up the supply of daily bread. Perhaps on his own side he carried the spirit of independence to an extreme. In any case there is a pathetic ring in his own words, a short time ago, about his life, that it "had not been exempt from many cares, nor very fruitful in incidents or great vicissitudes, since it had been passed very largely, especially during the last thirty years, in the most absolute retirement and the completest silence." The ten volumes of the "Souvenirs Entomologiques," many of the best chapters of which have been translated into English, remain as Fabre's lasting monument. They show us an observer of insects, second only to Réaumur, who was able, in a way all his own, "instinct pursuing instinct," as has been well said, to get at the insect's point of view.

After a somewhat disappointing early struggle as a professor at Ajaccio and Avignon, Fabre recoiled from conventionalities and settled down on a little desert corner near Orange, in the lower Rhone, and subsequently at Sérignan, and gave himself up to entomology. His studies were occasionally anatomical and physiological, and he watched many life-histories; but he was pre-eminently the student of animal behaviour. His work is marked by strong vitalistic convictions, organism to him transcending all mechanism; by a belief in instinct as a big underivable fact, quite different from intelligence; and by a strong prejudice against Darwinism, even against evolutionism. "The facts that I observe," he said, "are of such a kind that they force me to dissent from Darwin's

theories." It is not evident that he studied these theories, or those that have developed from them, with the open mind and carefulness with which he approached his insects in the Orange wilderness, but he felt that they were all too mechanical, and perhaps he was not far wrong. He did not, however, criticise constructively, or take account, so far as we know, of evolutionist yet not Darwinian positions, such as that of Samuel Butler, with whom he would have found himself, in his recoil from the mechanistic, in hearty sympathy.

While Fabre's aloofness from evolutionist interpretation must be regarded as a defect in his scientific work, there is surely truth in what has been said, that "in his sense of the dignity of facts; in his high standard of precision; in his appreciation of the trivial, Fabre came, in spite of himself, into fellowship with Darwin." Perhaps he occasionally read too much of the man into the insect—and he was himself as much a man of feeling as a man of science—but he made a big contribution to the interpretation of animate nature by his convincing evidence of its pervasive mentality and purposiveness. Fabre was a Chevalier of the Legion of Honour and a corresponding member of the Institute.

NOTES.

As an outcome of the recent Manchester meeting, the British Association has invited the following gentlemen to serve on a committee to consider and report upon the question of fuel economy (utilisation of coal and smoke prevention), from a national point of view:—Prof. W. A. Bone, of the Imperial College of Science and Technology, London (chairman); Mr. E. D. Simon, chairman of the Manchester Air Pollution Committee (secretary); Profs. P. P. Bedson (Armstrong College, Newcastle-on-Tyne), J. W. Cobb and J. B. Cohen (Leeds University), H. B. Dixon (Manchester University), Thomas Gray (Royal Technical College, Glasgow), H. S. Hele-Shaw (London), L. T. O'Shea and W. P. Wynne (Sheffield University), and Richard Threlfall (Birmingham), together with Dr. G. T. Beilby (Glasgow), Mr. Ernest Bury, and Dr. J. E. Stead (Middlesbrough and the Cleveland district). The committee, which is empowered to add if necessary to its members, has been selected so as to include representative chemists, engineers, and technologists from all the principal industrial areas.

We are informed that the council of the University of Manchester has received from an anonymous benefactor the sum of 1368*l.* to pay off the debt which remained on the new extension of the museum that was added recently for the housing of the Egyptian antiquities and of collections of minerals.

An exhibition of photographs in monochrome and natural colours, by Mr. H. Essenhigh Corke, will be open free to the public, on presentation of visiting card, at the Royal Photographic Society of Great Britain, 35 Russell Square, W.C., until Saturday, November 27, daily from 11 a.m. until 5 p.m.

The death is announced, in his eighty-six year, of Mr. Charles Fortey, who was for many years

honorary curator of the Ludlow Natural History Society's Museum. He is gratefully remembered by many geologists and palæontologists for the manner in which he made the unique collection of Upper Silurian fossils in his charge available for purposes of research.

THE death is announced in *Science*, in his eighty-second year, of Prof. W. Watson, from 1865 to 1873 professor of mechanical engineering and descriptive geometry in the Massachusetts Institute of Technology, and since 1884 recording secretary of the American Academy of Arts and Sciences.

In 1903, at the International Geological Congress, Mr. Emmons, supported by the late Prof. E. Suess, proposed the establishment of an institute for the study of geological physics. A preliminary meeting was held on October 14, with Prof. Benjamin Moore in the chair, at which it was decided to form forthwith a society for the encouragement and study of geological physics, commencing with the subject of segregation in rocks. Under the presidency of Prof. Moore the society hopes to do good work by the exchange of specimens, photographs, and literature between its members. An annual subscription of 2*s.* 6*d.* has been fixed for the first two years. Communications are invited by the hon. sec. *pro. tem.*, Mr. G. Abbott, 2 Rusthall Park, Tunbridge Wells.

We mentioned in our issue of July 8 (p. 514) the case of an officer who had sent to the Natural History Museum at South Kensington the skins of some small animals trapped by him in the trenches in northern France. Dr. Ugolini, of the Royal Technical Institute at Brescia, Italy, writes to tell us that one of his four sons serving in the Italian Army, a doctor of natural science, has been able amid the perils of war on the high mountains of the Trentino, to make valuable geological observations, and to collect and dry plants of particular botanical interest. The keen naturalist always makes use of opportunities of acquiring knowledge; and no doubt many other instances could be given of the persistence of this ruling passion under conditions in which scientific work would scarcely be expected.

THE death is announced, in the *Engineer* for October 15, of Mr. J. S. Graham, the general manager and a director of the Northumberland Shipbuilding Company, Ltd., of Howden-on-Tyne. Mr. Graham was born at Kingborn, Fifeshire, in 1864, and had varied experience in shipbuilding. A notable piece of work under his charge was the construction and delivery of the Havana pontoon dock. During the Spanish-American war he returned to this country, where he joined the Northumberland Shipbuilding Company in 1898.

THE Aristotelian Society will begin its session on November 1 with the inaugural address by the president, Dr. Wildon Carr, on "The Moment of Experience." At the second meeting on December 6, Lord Haldane will read a paper on "Progress in Philosophical Research." Some papers of specially scientific interest are announced, including one by Prof.