paper on 'Some Relations of Botany to Agriculture,' and Mr. Kenyon Butterfield gave a talk on 'Some New Phases of Agricultural Education.'

On Friday afternoon a joint session of the Academy and the Biological Section of the Michigan Schoolmasters' Club was held in the University Museum. This session was largely devoted to the pedagogical aspects of the biological sciences. The papers given were as follows:

'Nature Study.' Presidential Address: Professor Charles E. Barr, Albion.

'How Shall a Young Person Study Botany?' Dr. W. J. Beal, Agricultural College.

'Outline for a Year's Work in Botany': L. Lenore Conover, Central High School, Detroit.

'Suggestion for a Year in Zoology': Miss André, Central High School, Detroit.

'Value of Supplementary Experiments': Dr. Lewis Murbach, Central High School, Detroit.

'Science in the High School': Miss Palmer, High School, Lapeer.

'Recent Work and Theories on Fertilization of Animals': Dr. S. J. Holmes, Ann Arbor.

'Recent Work and Theories on Fertilization of Higher Plants.' Illustrated by Lantern Slides: Dr. J. B. Pollock, Ann Arbor.

'The Proposed Topographic Maps of Michigan': Dr. Israel C. Russell, Ann Arbor.

Two evening lectures were given before the Academy. On Thursday evening, Professor H. S. Carhart of the University of Michigan lectured on 'The Place of Physics in a Liberal Education,' and on Friday evening, Professor F. H. Herrick of Western Reserve University gave an illustrated lecture on 'The Haunts and Habits of Wild Birds.'

At the business meeting Saturday morning a committee was appointed to confer with corresponding committees from other scientific societies of the State, with a view to the affiliation of the other scientific bodies of the State with the Academy. The Academy voted also to endorse the bill now before the Legislature for an archeological survey of Michigan. The following officers were elected for the coming year:—

President, Professor Victor C. Vaughan, University of Michigan; *Vice-President*, for Botany, Professor C. F. Wheeler, of the Michigan Agricultural College; for Zoology, Professor Hubert Clark, of Olivet College; for Sanitary Science, Hon. Frank Wells, Lansing; for Agriculture, Professor J. A. Jeffery, of the Michigan Agricultural College; *Treasurer*, Professor Wm. H. Munson, Hillsale College; *Secretary*, Dr. James B. Pollock, University of Michigan.

A considerable number of new members were elected at this meeting; the sessions were well attended, and great interest was manifested in the work of the Academy. Altogether the meeting was the most successful and interesting in the history of the Academy.

H. S. Jennings.

SCIENTIFIC BOOKS.

Traité d'astronomie stellaire. Par Ch. André. Directeur de l'observatoire de Lyon. *Première partie: Etoiles simples.* 1899. Pp. xvi + 344. *Deuxième partie: Etoiles doubles et multiples. Amas stellaires.* Paris, Gauthier-Villars. 1900. Pp. xxiv + 429.

This excellent work seems to have attracted less attention than it deserves. It has the distinction of filling a gap in the literature of the subject. It covers ground which is common to both astrophysics and astronomy of position, as treatises are now more and more compelled to do; for in spite of the increase of specialization, the distinction in results obtained by astrophysical and astronomical methods is becoming slight. What, for instance, is an essential difference between the two components of the actual linear motion of a star, although the one is determined purely by the processes of astronomy of position, while the other is measured by the spectroscope?

The opening chapter of Professor André's first volume deals with objectives and mirrors, a topic upon which he is especially well fitted to speak. The sections treat of the theory of optical images, of the effect of diffraction screens or diaphragms over the objective, and of images

of the sun and planets. Chapter II. gives a general description of the constellations and a discussion of the various star catalogues and charts since the time of Hipparchus. The next two chapters deal with stellar magnitudes, referring particularly to determinations of brightness made without instrumental means. The number and distribution of the stars, and a study of the Milky Way occupy two chapters.

The proper motion of the sun and the various methods of determining the apex of the sun's way are next considered, and this is naturally followed by the proper motions of the stars. An especially interesting table is that giving a comparison of the radial velocities with the proper motions on a great circle for fifty of the brightest stars. Chapter IX. treats of stellar parallaxes, giving the results obtained by many investigators. The volume closes with a chapter of 50 pages on variable stars.

The orbits of binary systems and the various methods of their calculation (Herschel, Kowalsky and Glasenapp, Zwiers) are discussed at considerable length, together with their number and dimensions, in the opening chapters of the second volume. A table is given containing the elements of sixty-six known orbits. The effect of the introduction of a linear element, the radial velocity, is treated in one of the sections, and M. André has calculated for the sixty-six well-established binaries the epochs at which a maximum radial velocity may be expected, and the value of that maximum on the assumption of a stellar parallax of 0″.2. 'Astronomy of the Invisible' is the title of a chapter of 37 pages, dealing chiefly with the orbits of *Sirius*, *Procyon*, ζ *Cancri*, and 70 *Ophiuchi*.

The methods of Rambaut and Lehmann-Filhès for computing the orbits of spectroscopic binaries are given in sufficient detail in a separate chapter. About one hundred and thirty pages are next devoted to 'photometric binaries.' This includes a full historical account of *Algol* and its investigation by Pickering, Harting, Vogel, Chandler and Tisserand, together with all available data as to seventeen other variables of the Algol type. Dunér's beautiful work on the orbit of Y *Cygni*, published last spring in the *Astrophysical Journal*, was unfortunately too late to be included.

Subsequent chapters treat of the clusters and nebulæ, in particular of the *Pleiades*, *Præsepe*, and the region of η *Carinæ*; of the distribution of these objects, and of their distance. Globular clusters have a chapter of their own, which includes Bailey's recent remarkable variables. A short chapter is also given to colored stars.

The two volumes contain over one hundred cuts, and three excellent plates, and are printed in the usual excellent manner of Gauthier-Villars. A rather large list of errata is given, and probably more will be found. The book abounds in examples of the characteristic French disregard of the correct spelling and initials of foreign proper names.

This somewhat detailed account of the scope and contents of the work has been given to justify the remark that it fills a gap in the literature of the subject. The book would seem to be very well adapted for a basis of an elective course for seniors in our colleges, and the subjects treated are surely of greater freshness and interest, and of no less value in mental discipline, than the customary courses on the orbits of comets and planets.

A third volume is promised to complete the work—on the methods and instruments of modern research, and on the formation and evolution of the universe.

EDWIN B. FROST.

The Steam-engine Problem. By S. H. BARRACLEUGH, B.E. (Sydney), M.M.E. (Cornell). Russell School of Engineering, University of Sydney, N. S. W. Sydney, Kealy and Phillip. 8vo. 1900. Pp. 47. Figs. 13.

In this little book of less than fifty pages, Professor Barracleugh admirably outlines the problem of the steam-engine as it is now coming to be enunciated by scientific engineers and by thermodynamists who recognize the fact that the thermodynamics of the ideal may not constitute all, and that the real engine offers a complex problem which involves the most abstruse studies in physics, mechanics and energetics. This outline originally appeared in substance in the *Australian Technical Journal*. It was