Several facts are added to our knowledge of the minor anatomy of the oyster, especially interesting being the demonstrated change in the primitive retractor pedis muscle whereby it becomes a dilator oris.

The paper is well illustrated.

H. F. Moore.

Washington, August 25, 1900.

Anatomie et physiologie végétale. For the use of students of natural science in universities and agricultural schools, etc. By Professor Er. Belzung. Ancienne Librairie, Germer Baillière et Cie. Paris, 1900. 1699 Figs. 8vo. Pp. iii + 1320.

Professor Belzung is the author of text-books on geology, zoology, animal physiology, and animal paleontology, in addition to two or three botanical works besides the subject of this review. Such breadth of authorship undoubtedly relieves him from any taint of narrow specialism. This experience secures for the book in question, however, no new points of view, since it is a purely formal presentation of the better known facts in botany compiled after the manner of an encyclopedia. Perhaps the freshest portion of the book is that taken up with the subject of fermentation, which is given a treatment not usually accorded this phase of botany in general texts. The final section of the work consists of the 'Conclusions' and is devoted to the general characters of protoplasm and plants usually given in the introductory chapters of such texts.

The book leads chiefly to the examination room, and only the most determined enthusiasm could carry through its use a genuine interest in the study of plants.

D. T. MacDougal.

Report of Competitive Tests of Street Car Brakes. By the Board of Railroad Commissioners of the State of New York. 1899. Albany, Brandon Printing Co., Department Printer, 1900. 8vo. Pp. 60; 67 sheets of diagrams.

The report of the electrical expert, Mr. C. R. Barnes, April 4, 1900, details the origin and progress of the work of the N. Y. State Board of R. R. Commissioners, conducted to ascertain the practicability of insuring greater safety in the operation of street cars moved by cable and by the electric current, comparing the newer forms of brake with the older. It is stated that 295 people have been killed and 1599 injured by the electric railways of the State of New York in three years, as shown by the records of the Board. These figures indicate a rapid increase in this form of mortality, due to rising weights of cars and increasing speeds. Cars are now in use weighing 23 tons and speeds exceeding 50 miles an hour have been attained on suburban lines.

In preparing for these trials Messrs. Barnes and Pierson, the electrical engineer of the Metropolitan R'y Co., designed and constructed an automatic recording apparatus for measuring lengths of run under action of the brake. The apparatus was calibrated on 275 feet of track assigned for the purpose by the railway company and the essential observations and data were derived by use of this instrument; the work being performed in New York on the Lenox Avenue line, in the half-mile between 135th and 146th streets. Sixteen brakes—4 air-brakes, 4 electric, 3 hand-power, 2 friction and 2 'track-and-wheel' brakes—were tried.

The reliability of the air-brake is reported to be thoroughly established and a number of them have come into use. But one electric brake, that of the General Electric Co., is in use to any extent. New forms of the older type, the hand-power brake, were tested. They act directly upon the wheels, as usual. The so-called 'friction-brake' is a friction device on the axle, usually disks rotating with the axle and engaging stationary disks, the two sets arranged to be forced strongly against each other, when in action, by means of ingenious mechanisms. The 'track-and-wheel brake' acts on the tracks as well as the wheel. Photographic reproductions of the autographic diagrams obtained from each brake are published, with appended tables exhibiting results numerically.

The usual experiences in such work with dilatory exhibitors, incomplete outfits and occasional miscarriage of the plans of the Board was observed in these trials; but a large amount of new data in a novel field of re-

search was obtained. The results were classified and an order of standing was determined under the four heads: reliability and simplicity; liability to act when not required; ease of operation; cost of equipment and maintenance.

The most remarkably wide range of prices is reported—$30 to $585, averaging about $200. Eleven of the list tested are authorized for use, and the Board determined that the common form of brake now in use should be replaced by one or another of these, or equally efficient, brakes.

President Vreeland, of the Metropolitan Co., his directors and the executive officers seem to have taken much trouble and to have met most of the expenses of these important pioneer investigations, and his electrical engineer, the master mechanic and the superintendents lent essential aid in the work.

The report can be had by applying to the Board at Albany.

The data may be summarized thus: At 8 miles an hour, a stop was made in from 3 to 8 seconds; at 12 miles in 5 to 9 seconds; at 15 miles, in 6 to 10 seconds; at 16 miles, in 6 to 11 seconds, without sand, and 6½ to 9½ with sand. The distances run ranged from 35 to 66 feet at 8 miles, 58 to 111 at 12 miles, 72 to 203 at 16 miles; averaging for all speeds, from 58 to 133 feet.

A conventional system of checking for 'skidding' wheels was adopted.

All in all, the work must be accepted as an earnest and faithful endeavor to effect, for the first time, a solution of an important problem—one which concerns all railway managements and all travellers on electric street cars very seriously. The report has been criticised as failing to give data relating to dimensions of parts, uncertainty regarding the comparability of brakes differently handled by their exhibitors, and regarding the automatic records. An examination of the apparatus employed, however, shows that the distances traversed were measured by a mechanism positively driven and which, therefore, gave reliable comparison of distances traversed, which measures are the sole basis of all comparisons and are evidently substantially correct. The technical journals generally approve the report as giving valuable and helpful information. Undoubtedly, later investigations will afford opportunities for improvements which this, as all pioneer efforts, indicates to be desirable notwithstanding its evident and admitted defects in time-measurement, the report must be accepted as important. Variations of the time-scale do not affect its conclusions. It is to be hoped that the work will be continued and perfected.

R. H. THURSTON.

Lehrbuch der Photochromie von Wilhelm Zenker; neu herausgegeben. Von PROFESSOR DR. B. SCHWALBE. Braunschweig, Friedrich Vieweg & Sohn.

This is a republication of a work which appeared in 1868, to which has been added a biographical sketch, and a résumé of recent work along similar lines.

It will doubtless surprise the general reader to find that partially successful experiments in photochromy, or the *direct* reproduction of color by photography, were made over a quarter of a century before the announcement of Daguerre's discovery in 1839. As early as 1810 Seebeck obtained colored impressions of the solar spectrum on paper coated with chloride of silver, but the matter attracted but little attention and was soon forgotten.

In 1841 the property which this substance possessed of assuming a color somewhat similar to the hue of the light falling upon it was rediscovered by Herschel, but the possible great importance of the subject does not appear to have been realized until Becquerel, stimulated by Daguerre's discovery, took up the work, and by a laborious series of investigations determined the conditions most suitable for a faithful reproduction of the colors of the original.

Up to the time of the appearance of Zenker's work the almost universal opinion seems to have been that colored compounds of silver (oxidation and reduction products) were formed by the action of the light. Zenker, however, offered a most ingenious physical explanation, as opposed to the chemical theory. He explained the colors as due to the interference of light reflected from thin laminæ of metallic silver, laid down in sheets half a wave length apart, by the action of stationary light waves,