

vises his own economic profile to satisfy the imposed conditions. The method developed by the author is an excellent one for this purpose, leading to no complicated equations and having the advantage of constantly keeping before the computer the statical principles of stability and strength.

The fundamental assumption in these computations is that the compressive stress on the base of the dam uniformly varies from a minimum value at the back face to a maximum value at the front or down-stream face. This assumption cannot be a correct one, except in the case of a rectangular section, but it may be properly used in the absence of knowledge as to the correct distribution of stress, because its errors are on the side of safety. Strictly the base of the dam is under a shearing stress due to the horizontal water pressure as well as under a compressive stress due to the weight of masonry, and of the former no account is taken in practical computations. Probably the error in the fundamental assumption regarding the compression more than balances the opposite error, due to the neglect of the shear, so that masonry dams designed under the common theory undoubtedly possess all the needed element of security. This conclusion may be justified by the fact that masonry dams rarely fail; the author mentions but three instances of failure, two of these being constructions of the eighteenth century when the principles of design were not well understood, and the third being a case where the stone and cement were of so poor quality that leakage occurred.

Previous editions of this work were devoted entirely to masonry dams. The present edition gives additional information regarding recent structures, and also includes the description of dams of earth, timber and loose rock. For such structures few computations are needed, the size and shape being determined almost entirely by experience, while the details may vary according to local conditions and the judgment of the engineer. The numerous devices adopted in California to construct rock-fill dams without leakage are of especial interest. Movable dams of the needle, shutter, and bear-trap types are also fully described; although only a few of these have been built in America, they will

undoubtedly be extensively used in future river improvements.

The work forms the most complete treatise on the subject of dams that has yet appeared. With commendable industry the author has searched the annals of engineering literature in order that no important structure might escape notice, and his list of bibliography, covering five pages, will be of value to all engineers. From the descriptive point of view, the book gives nearly all needed information regarding the important dams of the world. From the theoretic point of view, it gives everything necessary regarding masonry dams which resist overturning by virtue of their weight alone, but it is somewhat lacking in regard to the theory of arched dams. This theory, it is true, is a difficult one, but, as the Bear Valley dam in California, and the Zola dam in France, depend for their stability largely upon the arch action, a numerical discussion of their stability would have been of interest and value. Without doubt a dam arched toward the current is stronger than a straight one of the same cross-section, particularly in the emergency of ice thrust or a high flood, and it is said that the instinct of the beaver leads him to so construct them. Even if a little more material be required, it is well for the engineer to make his masonry dam an arched one and thus render the structure one of beauty as well as one of strength.

M. MERRIMAN.

The Botanists of Philadelphia and their work.

By JOHN W. HARSHBERGER, Ph.D. Philadelphia. 1899. 8 vo. Pp. 457.

In this octavo volume of 457 pages we have a collection of brief biographical sketches, not only of all the people who have contributed to a knowledge of the flora of Philadelphia and the area included in a radius of sixty miles, but nearly all who have studied it afield. Commencing with such well-known pioneers as John Bartram, Humphry Marshall, Muhlenberg, Barton, Schweinitz, and Darlington, it comes down to the present members of the various botanical clubs of the city, the whole series arranged in chronological order. The Bartram Gardens, the collections of the Philadelphia Academy of

Science, the botanical department of the University of Pennsylvania, and the various field clubs are fully exploited, the pages being interspersed with numerous half-tone illustrations of points of botanical interest, in addition to many excellent portraits, the full-page illustrations amounting to forty-eight. The work is written in a pleasing style, is well printed, and forms an attractive volume. The portions relating to the earlier botanical workers who gave to Philadelphia its early botanical prestige are particularly interesting. Additional matter of general interest is found in the historical account of the scientific journals and serial publications that have been issued from Philadelphia. An interesting account of the historic trees of the vicinity closes the work.

The author is sanguine that Philadelphia 'is peculiarly fitted to be the botanical center of America,' and his references to 'the metropolitan life and publishing houses' of New York on the one side, and 'the libraries and scientific departments' of Washington on the other, illustrate well how near one can live to cities and yet fail to appreciate their most salient features.

LUCIEN M. UNDERWOOD.

The Maturation, Fertilization and Early Development of the Planarians. By WILLARD G. VAN NAME. From Trans. Conn. Acad., Vol. X., p. 263-300, pl. xxxvi.-xli. August, 1899.

The author has studied the early life history of *Eustylochus ellipticus* (Girard), and *Planocera nebulosa* Verrill with great care. The characteristic features of each structure are presented, so far as could be determined from the study of the material, which is not favorable for the solution of certain points. While the results obtained agree in the main with those of previous observers, light is thrown on a number of doubtful points. Especial mention may be made of the discussion of the centrosphere and its parts, as well as that on the interesting modifications in the form of the chromosomes. The paper is well illustrated. H. B. W.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 313th meeting of the Society was held Saturday, December 2d. W. H. Dall exhibited

a specimen of the fruit of a species of *Barringtonia* stating that it was used for capturing fish, the kernel being bruised and cast into small ponds or streams whereupon the fish became stupefied and rose to the surface, where those that were wanted were gathered. The effect upon the fish was only temporary, those not taken soon recovering.

Frederick V. Coville showed an entire and a bisected cone of *Pinus alternata* both covered with lichens. Mr. Coville stated that these cones remained on the trees from 20 to 50 years and seemed to open and release the seeds only when exposed to great heat, so that no seedlings of this pine were to be seen except where the ground had been swept over by fire.

L. H. Dewey spoke on 'Frost Flowers,' saying that this name is applied to peculiar formations of ice found on certain plants on frosty mornings in fall and early winter. They are most frequently observed on dittany, *Cunila origanoides*; frostweed, *Helianthemum canadense*; marsh fleabanes, *Pluchea camphorata* and *P. fetida*, and on the Pacific coast on the cultivated heliotrope. The first published record of the phenomenon appears to be that of Dr. Stephen Elliott, in 1824, who observed it on *Pluchea fetida* ('*Conyza bifrons*') and made a note of it in his 'Botany of South Carolina and Georgia.' It has since been observed, studied and written about by many botanists and physicists. It is apparently purely physical in character, due to capillary movement of water and the action of frost, but no thoroughly satisfactory explanation has yet been given why it should be found on only about twenty-six species of plants and not on others. Further observations in the field at this season are needed to determine whether frost flowers may be found on species other than those recorded, and also further studies are needed on the structure of plants exhibiting the phenomenon.

H. J. Webber presented a paper 'The Effect of Hybridization in the Origination of Cultivated Plants,' calling attention to the remarkable development of certain of our cultivated plants, due to the effect of hybridization. It was pointed out that this is particularly true in the grape where 57 per cent. of the sorts of known parentage are hybrids while only 29 per cent.