

exceptions. It is asserted that the egg-laying time of fishes usually comes with the spring, but this is not the case with the Atlantic salmon, the dog salmon; the brook, lake, brown, and the blueback trouts; the lake whitefish and herring; the cod, tomcod, and others, which spawn in the fall or early winter. The habits of animals are said to depend on structure; it was the habit of creeping on the belly that modified the structure and lost the legs of snakes and many lizards. "Eyelids are present in all except the snakes, together with a third, known as the nictitating membrane"; various genera and families of the lizards have no eyelids, and few of the reptiles possess the third eyelid. The size of alligator eggs is likened to that of the goose eggs. The horned toads (lizards) are said to capture insects "by the aid of their long tongue." The turtles are said to "lay several perfectly spherical eggs"; some lay several hundred—few, if any, lay so small a number as several, and of some the eggs are not spherical. Quail and grouse also are said to lay several eggs; these birds are noted for large numbers of eggs. The duck mole is asserted to be the only egg-laying mammal, and to lay but one egg per year; Echidna also lays eggs, and two is the number laid by the duck mole. The brown or cinnamon bear "lives on berries and juicy herbs, while the grizzly prefers the flesh of animals which it kills"; a closer acquaintance with these animals will much reduce the value of this distinction. The following from "How Species Originate" exemplifies ease in establishing things that are, by means of things that may be:

"One bird may have a larger bill than another of the same brood which excels in length of wing. . . . Those best adapted to their surroundings will have the best chances of survival. . . . A premium is placed on length of wing or bill generation after generation, with the result that a long-billed species arises distinct from the long-winged which trace their ancestry back to the same parents."

*An Introduction to the Bacteriological Examination of Water.* By W. H. Horrocks. London: J. & A. Churchill. 1901.

The dominance of scientific thought in this country by German ideals and German methods has brought with it a certain neglect of the work carried on by English investigators. Professor Horrocks's clear and complete summary of British practice in bacteriological water analysis furnishes a wholesome reminder that in sanitary science, at least, England still holds a pre-eminent position.

The first thing which this book reveals is the fact that the London bacteriologist by no means imitates the provincialism of his confrère in Berlin, for it contains reviews of the most recent work, on the Continent and in America as well as at home. For the first time since the Franklands published their 'Micro-Organisms in Water,' the literature relating to the conditions controlling the life of bacteria in water, the effect of light, sedimentation, and food supply, and the normal bacterial content of waters from various sources, is brought fully up to date. The work of Sirotnin, Garré, Freudenreich, and Horrocks himself on the effects of antagonism is of especial interest.

The quantitative analysis of water does not appear to have been so fully developed in England as in this country. In treating of its methods the author outlines a needlessly cumbrous process of plating, but fails to lay emphasis on the urgent need for nutritive media of a known composition, and for a definite period of incubation under standard conditions as to temperature, moisture, and oxygen. It cannot be too often stated that the one and only essential in this work is constancy of conditions. It is by no means necessary to obtain the development of the largest possible proportion of the total bacteria present, but only to be sure that the same proportion will always develop when a similar water is tested. Towards this ideal the work of the American Public Health Association Committee has brought us measurably near in this country. Professor Horrocks does not dwell on this need for uniformity of method at sufficient length. His treatment of the interpretation of the results of the quantitative analysis is also vague and inconclusive. It is, of course, difficult to formulate any general standards. Bacteriological tests are too delicate to give the off-hand judgments which are often demanded of them; but it is certain that, in the hands of an expert, they furnish the only thoroughly safe criterion of the character of a drinking-water. For instance, a study of the bacterial analyses of well waters which, if protected from surface drainage, rarely show the presence of any intestinal bacteria, would have saved our author from the extreme statement that, "unless surrounded by at least an acre of virgin ground, shallow wells must be considered its dangerous sources of supply."

In the treatment of the most important branch of water bacteriology, the qualitative analysis, Professor Horrocks's work is admirable. The first chapter in this section includes descriptions of the bacteria normal to unpolluted waters, which are grouped under twelve headings. As the attention of bacteriologists turns away from the vain attempt to fix rigid species to the more fruitful task of studying the limited number of well-marked types, the question of grouping becomes of vital importance. Horrocks's groups of the green, fluorescent bacteria, the red chromogens and the blue and violet chromogens, correspond to the same classes in the Fuller and Johnson scheme usually accepted in this country. The English observer combines the yellow and orange chromogens in one type, and adds a group for *B. brunneus* and other forms which produce a brownish color in nutrient media. Horrocks's *B. aquatilis sulcatus* group corresponds to the Typhosus type of Fuller and Johnson, whose Proteus type (including *B. mycoides* and *B. mesentericus*), and Subtilis type, are combined by Horrocks in one. Similarly, the Cloacæ type, the Liquidus type, and the Superficialis type of the American scheme are placed together. In Horrocks's Group VIII, are included certain forms belonging to the Typhosus type and the Candicans type of Fuller and Johnson. Finally, he adds special groups for the Micrococci, the Sarcinae, and the Spirilla.

After the water bacteria, the sewage bacteria are treated, beginning with the colon bacillus. In considering the significance of this organism, Professor Horrocks points out clearly the two conditions which must

be fulfilled if it is to be used as evidence of the presence of sewage. First, the organisms present must show the reactions of the typical *B. coli* and must not belong to the so-called para-colon groups, and, second, the number of colon bacilli present must be carefully considered. The conclusion finally drawn is as follows: "I would say that a water which contained *B. coli* so sparsely that 200 c. c. required to be tested in order to find it, had probably been polluted with sewage, but the contamination was not of recent date." The author recommends in the case of such remote pollution the examination of large quantities of water concentrated by filtration through a Berkefeld filter. It seems to the reviewer very doubtful whether this concentration, or even the examination of samples as large as one hundred cubic centimeters, has any great practical sanitary value. If colon bacilli are found only in such small numbers, the chance that virulent typhoid germs are present must be almost infinitesimal.

The typhoid bacillus is treated by Horrocks in great detail, and he supplements an excellent account of its general cultural characteristics by a full discussion of the significance of the serum test. In treating of the isolation of the typhoid bacillus from water supplies, the author points out the very small chance of a positive result, quoting Wathelet, who found only ten colonies of *B. typhi* among six hundred colonies having the characters of the colon and typhoid groups, isolated from typhoid dejecta. Here should be mentioned also the results of Laws and Andrewes, who in 1894 failed to find the typhoid bacillus at all in the sewage of London, and isolated only two colonies from a long series of plates made from the sewage of a hospital containing forty typhoid patients. None of the positive isolations published prior to 1897 will stand, as the differential tests used were inadequate. Three recent cases are quoted, however, in which the evidence seems fairly conclusive—those published by Kubler and Neufeld in 1899, by Genersich in 1899, and by Fischer and Flatau in 1901. The last organism, from a well at Rellingen, was worked out with special care.

Three chapters which add notably to the value of Professor Horrocks's book, treat of subjects somewhat beyond its direct scope. In the section "Relation of a Quantitative Bacteriological Analysis to Filtration of Water through Sand" he considers the proper depth of filters, the rate of filtration, the frequency of scraping, the source of the bacteria in the effluent, and the significance of *B. coli* as a measure of purification. The brief chapter on nitrifying and de-nitrifying micro-organisms contains a good condensed review of the history of the subject. Finally, to an admirable treatment of the question of household filters, the author adds some observations of his own. Freudenreich, Schöfer, and other European observers obtained the most conflicting and obscure results as to the growth of water bacteria and typhoid and colon bacilli through Pasteur and Berkefeld filters. Woodhead and Wood, and Lunt, in 1897, went over the whole question with great thoroughness, and apparently established the fact that (1) all filter candles, if properly sterilized, give a sterile filtrate on the first day; (2) water bacteria grow through the filters and appear on the second or third

day of using; (3) typhoid and colon bacilli in tap water and sewage fail to grow through the filters even after a long period. Horrocks confirms these results for the Pasteur filters, and concludes that "if proper care be taken to prevent the direct passage of organisms through flaws in the material and imperfections in the fittings, the Pasteur-Chamberland filter ought to give complete protection from water-borne disease." With the Berkefeld filters, on the other hand, he found typhoid bacilli in the filtrate after nine to eleven days, when potable water was used as a medium, and after four days when broth cultures and sewage were filtered. He concludes that such filters must be sterilized by boiling water or saturated steam every third day.

It is to be regretted that the valuable citations all through the body of the 'Bacteriological Examination of Water' are not connected by reference figures with the titles in the bibliography, and still more that many of them are not represented by any titles in the bibliography at all. As a whole, however, the book is a credit to British sanitary science. On the qualitative side it could scarcely be improved; and for all working water bacteriologists and teachers of sanitary bacteriology it is simply invaluable.

## BOOKS OF THE WEEK.

- Albee, Ernest. A History of English Utilitarianism. Macmillan. \$2.75.  
 American Newspaper Annual, 1902. Philadelphia: N. W. Ayer & Son.  
 Baldwin, J. M. Development and Evolution. Macmillan. \$2.60.  
 Bardeen, C. W. A Manual of Civics for New York Schools. Syracuse: C. W. Bardeen. \$1.  
 Barnett, J. M. Mother Goose Paint Book. The Saalfield Pub. Co. \$1.25.  
 Briggs, C. A. The Incarnation of the Lord: A Series of Sermons. Scribners. \$1.50.  
 Capes, W. W. The English Church in the Fourteenth and Fifteenth Centuries. Macmillan. 7s. 6d.  
 Chambers, R. W. Outdoorland: A Story for Children. Harpers. \$1.50.  
 Chefs-d'œuvre of the Exposition Universelle, Parts 18 to 25. Philadelphia: George Barrie & Son. \$1 each.  
 Clerke, Agnes M. A Popular History of Astronomy during the Nineteenth Century. 4th ed. London: Adam & Charles Black; New York: Macmillan. \$4.  
 Coit, Stanton. The Message of Man. London: Swan, Sonnenschein & Co.; New York: Macmillan. 7s. cents.  
 Complete Art Reference Catalogue. Boston: Soule Art Co.  
 Connolly, J. B. Jeb Hutton. Scribners. \$1.20.  
 Cooley, C. H. Human Nature and the Social Order. Scribners. \$1.50.  
 Craddock, O. E. The Champion. Houghton, Mifflin & Co. \$1.20.  
 Cunningham, D. J. Text-Book of Anatomy. Macmillan. \$9.  
 Customs Tariff Act of 1897, Revised to July 1, 1902. R. F. Downing & Co.  
 Cuyler, Rev. T. L. Recollections of a Long Life: An Autobiography. The Baker & Taylor Co. \$1.50.  
 Dahn, Felix. A Captive of the Roman Eagles. (Translated by Mary J. Safford.) Chicago: A. C. McClurg & Co. \$1.50.  
 Davies, G. S. Frans Hals. London: George Bell & Sons; New York: Macmillan. \$14.  
 Douglas, Langton. Fra Angelico. 2d ed. London: George Bell & Sons; New York: Macmillan. \$6.  
 "Githcoley, Lord." Son! Frederick A. Stokes Co. 80 cents.  
 Hadley, S. H. Down in Water Street. Fleming H. Revell Co. \$1.  
 Hornung, E. W. The Shadow of the Rope. Scribners. \$1.50.  
 Jerome, J. K. Paul Kelter. Dodd, Mead & Co. \$1.50.  
 Linn, W. A. Rob and his Gun. Scribners. \$1.  
 Lounsbury, T. R. Shakespeare and Voltaire. Scribners. \$2.  
 Martin, E. S. Poems and Verses. Harpers. \$1.25.  
 Mason, Caroline A. Lux Christi: An Outline of Study in India. Macmillan. 30 cents.  
 Meldrum, D. S. The Conquest of Charlotte. Dodd, Mead & Co. \$1.50.  
 Millar, J. H. The Mid-Eighteenth Century. Scribners. \$1.50.  
 Miyamori, Asatarō. A Life of Mr. Yukichi Fukuzawa. Tokyo: Z. P. Maruya & Co.  
 Morris, H. C. The History of the First National Bank of Chicago. Chicago: R. R. Donnelley & Sons Co.  
 Norman, Henry. All the Russias. Scribners. \$4.  
 Payne, Will. On Fortune's Road. Chicago: A. C. McClurg & Co.  
 Rawnsley, H. D. A Rambler's Note-Book at the English Lakes. Glasgow: James MacLehose and Sons; New York: Macmillan. \$2.  
 Report of the New York Produce Exchange from July 1, 1901, to July 1, 1902. Published by the Exchange.  
 Singleton, Esther. London: Its Life and Sights, Described by Great Writers. Dodd, Mead & Co. \$1.40.  
 Sunday Reading for the Young, 1902. E. & J. B. Young & Co. \$1.25.  
 Tennant, F. R. The Origin and Propagation of Sin. London: C. J. Clay & Sons; New York: Macmillan. \$1.10.  
 The Guardian of Marie Antoinette: The Secret Correspondence of Maria Theresa and the Comte d'Argenteau. 2 vols. Dodd, Mead & Co. \$6.50.  
 The Story of Lizzie McGuire, by Herself. Henry A. Dickerman & Son.  
 Thoreau, H. D. Walden. Houghton, Mifflin & Co. \$3.  
 Upton, G. P. Musical Pastels. Chicago: A. C. McClurg & Co. \$2.  
 Watannu, Onoto. The Wooling of Wistaria. Harpers. \$1.50.  
 Winters, Lawrence. Rugs and Carpets from the Orient. The H. B. Clafin Co.  
 Wiel, Alethea. The Story of Verona. (Medieval Towns Series.) London: J. M. Dent & Co.; New York: Macmillan. \$1.50.

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