interested in the skin effect in the propagation of electric waves of high frequency. The properties of Kelvin's ber and bei functions and their generalizations are given on pages 81–82 and on p. 204, but many special formulae for these functions that are used by engineers are not given explicitly. For these it is necessary to go to the papers of Savidge, Airey, Russell and Whitehead and to the books and papers of Dwight and McLachlan. It may be mentioned in particular that for the numerical calculation of the functions for large values of the variable, Dwight recommends formulae somewhat different from Airey's formulae of p. 204. Tables for these functions are not included, and the author probably did not wish to enter into a lengthy discussion of matters that had been dealt with adequately by other writers.

In Chapter IV there is a useful discussion of the differential equations which can be solved with the aid of Bessel functions. This chapter and the following one contain many series that are often employed in physical investigations.

Chapters VI, XII, XIII and XIV on integral representations and definite integrals provide a mine of information. References to these chapters are given by countless authors of papers in pure and applied science. A valuable feature of these chapters is that the numerous integrals are established by rigorous methods.

The tables at the end of the book are particularly well chosen and form one of the most valuable parts of the book. It may be mentioned, for instance, that a recent formula for the radiative resistance of a cylinder obtained by H. Page, of Manchester University, involved the indefinite integral of the Bessel function $J_0(x)$ for which a table was available in Watson's treatise. In this connection it may be worth while to mention that ten place tables of the integrals of both $J_0(x)$ and $Y_0(x)$ have been published recently by A. N. Lowan and M. Abramowitz.

The expansions of planetary theory, which began with Lagrange's sine series for the difference between the mean and eccentric anomaly, involved Bessel functions of the form $J_{p\pm n}(pe)$ in which the order and argument were both large when p was large. For a discussion of the convergence of these expansions it was necessary to know the behavior of these Bessel functions for large values of p, and the early work of Carlini was followed by that of many other mathematicians. The history of this development is given in Chapter VIII and modern methods of dealing with the problem, such as the method of steepest descent, are clearly explained. The resulting asymptotic expansions are of great importance in physical mathematics, particularly in the theory of the propagation of waves, and Watson has made a notable advance in giving precise conditions under which certain formulae of approximation are applicable. In the most recent work the expressions in terms of the Airy functions are recommended and elaborate tables of these functions have been prepared by a committee of the British Association for the Advancement of Science.

The series of planetary theory are discussed in full in the Chapter XVII on Kapteyn series where a discussion is given of a general type of series which includes those of planetary theory and some series found by Schott and others in researches on the structure of the atom. The book contains also discussions of many other types of series.

The book closes with a very valuable bibliography which is nearly but not quite complete up to 1921. Among the omissions are some papers by Poisson, notably his memoir on the propagation of waves (1816) in which he gave an expression for the inverse distance of two points as an exponential integral involving $J_0(rt)$, and two papers by James Ivory (1832 and 1838) in which Bessel functions of an imaginary argument are used in the problem of astronomical refraction.

In the new edition the only notable change is in the valuable Chapter XV on the zeros of Bessel functions where a reference is made to the work of Siegel (1929) regarding the truth of Bourget's hypothesis that $J_n(z)$, $J_{m+n}(z)$ have no common zero except, perhaps, $z=0$ when m and m are positive integers. Some related theorems have been given by D. Prasad Banerjee in the *Journal of the Indian Mathematical Society* for 1935.

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THE CONTROL OF BILHARZIA

The Control of Bilharzia in Southern Rhodesia. By ALAN MOZLEY. 1944. 307 pp. Southern Rhodesia: Salisbury.

WITH the people of more than one half of the globe subject to the debilitating disease, bilharzia, or schistosomiasis, any discovered method of controlling this serious disease becomes of general interest.

Alan Mozley is a malacologist with wide field experience in both the Old and New Worlds who went out to Southern Rhodesia in the company of Sir Malcolm Watson, director of the Ross Institute of Tropical Hygiene, in order to find out what should be done to control bilharzia as one of the worst diseases of that country.

The aid of a malacologist was invoked since the schistosoma worm that causes the disease passes from the blood vessels of man into water and then into certain snails and thence, after eight or nine weeks,

back into water, where it has to find and enter the skin of man, within a few days, or else perish. In human blood vessels the minute worms mature in some two months and give off their eggs. This parasite has to alternate from snail to man (from the creation onward) or else perish.

The complete destruction of either host would exterminate the parasite! Man prefers to exterminate the snails. That this is feasible was inferred from the facts that these snail hosts are not very numerous nor difficult to locate. There are here only two kinds of water snails that carry the parasite, and each carries but one of the two species of parasites which both live in man, with different preferences, the one infesting the intestines, the other the urinary organs.

Mozley's report is a thoroughly scientific record of three years of strenuous work (1939–42) during which some thousands of different localities were examined and a laboratory established for examination of, and experiments upon, the different snails.

In some localities 90 per cent. of the natives were infected and throughout the country 35 per cent. of natives and 8 per cent. of Europeans suffered from the worser form of the disease. All races of men and all members of society, both poor and well-to-do, were afflicted. Before the advent of civilized man perhaps the disease was held in check by ducks and fish that destroy the snails, but of late the disease is alarmingly increasing, and this seems due to the "White Man's Civilization." For while the snail that causes intestinal bilharzia (*Biomphalaria pfeifferi* (Krs.)) as being the host of *Schistosoma mansoni* may be found in clean, flowing waters, the worser snail (*Physopsis globosa* (Krs.)) as harboring the parasite *Schistosoma haematobium* is to be found in dirty water, contaminated or polluted.

The native habits of drinking from, and of bathing in, all sorts of pools was bad enough, but the European has increased the dangers by careless disposal of wastage and rubbish so that many places abound in trash and dejecta that aid the disease-bearing snails.

Strangely, man's great aid in civilization, the railroad, is strongly to be condemned as favoring the bad snails by giving them shelter through the making of fills, dams, culverts and bridges over waters into which human dejecta are allowed to fall.

The book gives in detail recommendations for coping with all aspects of the bilharzia problem except that left to the physician—the dosing of human patients. When these suggestions shall be carried out the bilharzia of Southern Rhodesia should diminish and not increase, even dwindle to the vanishing point.

Many experiments showed the ease with which the young parasite, called cercaria stage, that leaves the snail can be killed, but either the water is more or less injured or else the materials used are expensive.

The snails themselves are known to be easily killed by some salts of copper, but many of these are expensive. There were also found native plants whose bark, leaves or seed or pods were deadly to snails. Finally a number of good methods were selected for killing the snails without danger to the natives. To solicit the aid of the natives posters are distributed advising them to use these, to them well-known, plants or else "the medicine of the Government," which medicine "kills the snails within two days, but does not hurt a human being." "The Government's doctor has often drunk water into which this medicine has been put, and it has not done" him any harm. This "medicine," containing copper carbonate, is a cheaply obtained mineral, Malachite, which Mozley recommends as one of the most useful means of killing those snails in Southern Rhodesia. Details of its preparation and modes of distribution with many other practical suggestions are given for those who may make use of this most useful work which though needed most by the government of that part of the world has a meaning for all who have to do with the West Indies, Portugal or any part of the world south of these regions, all subject to bilharzia.

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SPECIAL ARTICLES

AN ANTIBIOTIC SUBSTANCE ACTIVE AGAINST MYCOBACTERIUM TUBERCULOSIS

RECENTLY Soltys[1] reported that culture filtrates of a strain of *Aspergillus fumigatus* showed antibiotic activity against *M. tuberculosis*. As far as we know, no isolation of a substance in a pure or even a crude form active against tubercle bacilli has yet been described.

[1] M. A. Soltys, *Nature*, 154: 550, 1944.
[2] A. Vaudremer, *C. R. Soc. Biol.*, 73: 51, 1912; 74: 278 and 752, 1913.

The strain of *A. fumigatus* investigated was isolated in this laboratory as a contamination. Grown at room temperature on Czapek-Dox medium containing 2 per cent. corn syrup, it produced substances active against gram-positive cocci, gram-negative bacilli and some acid-fast bacilli. The test organisms employed were *Staph. aureus* H, a *B. coli* and *M. tuberculosis* BCG17. After 15 to 18 days of growth the medium was, on the average, active against staphylococci in a 1:40 dilution. Activity against *B. coli*