under corresponding circumstances is 1:2:1; that is, there should be one pair of boys, to two mixed pairs, to one pair of girls. In other words, if the members of a pair of twins always developed from separate ova, we should expect to find twice as many pairs whose members differ in sex, as there are pairs of girls, or pairs of boys. I have been able to think of no factor which may reasonably be supposed to be acting in a constant direction to alter this ratio.

I have undertaken to compare with this hypothetical ratio the ratio found among births of twins in this country. My data number 3,334 twin births which occurred in the states of Connecticut, Maine and Vermont during the years 1899 to 1912. Of this number 1,118 are pairs of boys, 1,193 are boy and girl, and 1,023 are pairs of girls. This is almost a 1:1:1 ratio, showing the effect, however, of the predominance of male births. There is obviously a large excess of pairs similar in sex over what is to be expected on the supposition that twins originate in all cases from separate ova, an excess of more than 500 pairs of boys, and almost 500 pairs of girls.

This seems to point towards the conclusion that twins may originate from a single fertilized ovum. In the light of present knowledge this certainly is a possible explanation of the statistics. If the figures given will bear this interpretation, we may say that less than half (44.3 per cent.) of the twin births of similar sex, or less than one third (28.4 per cent.) of all twins, originate from one ovum, while slightly more than half (55.7 per cent.) of those of similar sex have developed simultaneously from two separate ova.

Margaret V. Cobb

Falls Church, Va.

Naturalist's Directory

To the Editor of Science: As you have given liberal space to criticize the book, you will doubtless be willing to give space in which I can explain the matter.

In the first place this book has not been issued for some eight years, and in getting out the new edition I decided that not a single name would be included unless I had a request that the name should be included from each party. If you find that there are a good many naturalists omitted from the directory, it was because they were too busy, or more likely too careless of such matters to take time to return the blanks which I sent them. Every naturalist of any consequence, and a great many collectors, received three notices each and none of the names were included in the book unless they replied.

Since getting out the work some of these noted scientists have taken time to write three or four criticisms of the book, while they would not take time before publication to even sign their names to the blanks I sent them. There are a few typographical errors in the book as there are bound to be in any work of this kind, and the transposition of two or three entries, to which you have taken great pains to call attention, was caused by the misplacement of one or two linotype slugs.

It is my intention to get out another edition of the Naturalist's Directory in a year from now, and I hope naturalists, generally, will be as free with their assistance in bringing the new edition up to date, as they have been in criticizing the edition just published.

S. E. Cassino

Salem, Mass.

Scientific Books

Die Variolation im achtzehnten Jahrhundert. Ein historischer Beitrag zur Immunitätsforschung. By Arnold C. Klebs. Giessen, A. Töpelmann. 1914. 8vo. Pp. 78.

Few physicians know that throughout the entire eighteenth century, and before Jenner's time, there was a vast wave of experimental research in the problem of preventive inoculation against disease, now almost forgotten. Starting in 1713, it passed into a period of twenty years' stagnation about 1727, with a revival in 1746 and a truly scientific phase during 1764–98. When a bibliography of some 600 titles, by the author of the above monograph, was shown to a highly educated physi-

cian, he said: "Yes, but all that is merely a fragment of the huge literature of vaccination!" not realizing that variolation and vaccination are distinct and separate episodes in medical history. Variolation is preventive inoculation against smallpox by means of virus taken from the human subject. In vaccination, the virus is supposed to be modified or attenuated by transmission through the body of the cow. The recent application of such terms as "vaccines" or "vaccinotherapy" to diseases other than smallpox, although now likely to remain current, is inexact and unscientific, since none of the non-Jennerian "vaccines" are passed through the cow.

Dr. Klebs, who has gone into this subject more extensively than any one else, has, in his memoir, amplified the admirable paper, read at the Johns Hopkins Hospital in 1912, by an examination of literature covering over 1,200 titles.[1] Only von Pirquet has appreciated the importance of this vast literature, which he has declared to be too overwhelming and distracting for investigation. The object of Klebs's memoir is to show the importance of "historical medicine" in the illumination or interpretation of present-day problems. For instance, the extensive experiments in inoculation of smallpox which Councilman, Brinkerhoff and Tyzzer made upon anthropoid apes at Manila, did not throw any such light upon the subject as the thousands of successful inoculations made upon man in the eighteenth century. Dr. Klebs regards variolation as a remarkable example of the value of folk intuitions in etiology and therapy. Many important advances in practical medicine have undoubtedly come from the non-medical, but these can hardly be said to have arisen from the great mass of the people, rather, on the primitive minds, *adscripti glebæ,* whose mental development was a little higher than the average. The usual process in evolution is that out of a vast number of people of primitive minds, *adscriptus glebæ,* whose mental processes are nearly all exactly alike, there arises occasionally one in whom a more specialized type of mind is born, through suffering or other experience. Then, as Emerson says, "all things are at stake." The interesting thing about variolation is that, like the primitive chipped flints all over the globe, or the ever-recurring *themata* of folk-lore, it seems to have arisen spontaneously among different savage or semi-civilized races. In this monograph it is shown that variolation has been practised from a remote period in China and India and among such African tribes as the Somalis, Ashantis and Wagandas. Cotton Mather is said to have first heard of the practise from his African slave, Onesimus. Baas's statement that inoculation is mentioned in the Atharva Veda is, however, unverifiable. In Germany and Russia, the custom of "buying the smallpox" was known from the seventeenth century on, variolation being produced by bringing the scabs, purchased in open market, or the pus in contact with the skin. This was probably a phase of the ancient superstition of the sympathetic transference of disease. In 1713, smallpox inoculation was brought to European attention from Oriental sources by Emanuel Timoni, who had his daughter inoculated in 1717. Lady Mary Montagu followed with the inoculation of her infant daughter in April, 1721, and, on June 26, 1721, Zabdiel Boylston of Boston, Mass., began his long series of inoculations in which, by 1752, he had 2,124 cases, with only 30 deaths, while, in 1743, Kirkpatrick, in South Carolina, had nearly 1,000 cases, with 8 deaths. At this time the *modus operandi* was incision, with sometimes a dietetic and depletory "preparation," usually blood-letting and purging. In 1760, Robert and Daniel Sutton were inoculating by puncture, discarding the depletory regimen for the more sensible strengthening of the patient by dietetic and hygienic means, and had some 30,000 cases, with about 4 per cent. mortality. Attenuation of the virus was attempted by passing it through several human subjects (Kirkpatrick's arm-to-arm method), by using very small quantities, by dilution with water, calomel, etc., or by choosing the virus at the crude or unripe stage. The author

[1] A remarkably complete bibliography of variolation, down to Jenner's time, and of vaccination (1798–1861) was printed (not published) by Dr. Ludwig Pfeiffer (of "Pestilentia in nummis") about 1863.

cites experiments which would stand comparison with those carried out in modern laboratories, especially those tabulated from William Watson's series of 1768, in which it is seen that Jenner did not initiate experimental research upon the subject but rather devised or followed lines already established before him. The most scientific worker in the field was Angelo Gatti of Pisa, who obtained permission to inoculate in Paris by the rational method of puncture and preparation in 1769. Gatti maintained that smallpox is always caused by the introduction into the body of a foreign body, which is in the nature of a specific virus in that it reproduces itself and multiplies, the disease being communicated by contact, inhalation or ingestion. He waxed furious against the senseless practise of weakening the patient by bleeding and purging, adopted Sutton's open-air and hydropathic régime, and offered prizes in real money for any authenticated case of reinfection after inoculation. Such cases he regarded as eruptions from a mixed infection of other exanthems, such as scarlatina or measles, which he also thought capable of transference by inoculation. The main difficulty with variolation was that each inoculated person was a possible "carrier" of the disease, and this occasioned Gatti and his associates considerable trouble in Paris. In the meantime, Tronchin, Tissot, Mead and other eminent physicians were influential in spreading the practise, which became a common preventive measure in America during the Revolutionary War. In 1768, Thomas Dimsdale was invited to St. Petersburg to inoculate Catherine the Great and her son, receiving for his trouble a barony, $50,000 down, an annuity of $2,500, $10,000 for his expenses and handsome gifts of diamonds and furs. Jenner's experiments of 1796–8 soon swept variolation from the field, for the sufficient reason that there was little mortality and no possibility of transference of the disease by the vaccinated person. Variolation was declared a felony by Act of Parliament in 1840.

Dr. Klebs's memoir is well worthy of perusal by all who are interested in the history of preventive inoculation. Its permanent value is that it obviates the boresome necessity of investigating the huge literature of variolation, covering even the secular memoirs of eighteenth century celebrities. Its engaging style makes it eminently readable, revealing everywhere the spirit of its genial author.

F. H. Garrison
Army Medical Museum

A Primer on Alternating Currents. By W. G. Rhodes. Longmans, Green & Company. 1912. Pp. 145.

Although this book, according to the author, is primarily intended for students preparing for the alternating current part of the ordinary grade examination in electrical engineering of the city and guilds of London, it should be useful to those desiring a very brief elementary course on alternating currents and alternating current machinery. The book is primarily adapted to the use of evening classes in technical schools, and is written in such a way that no knowledge of mathematics is required beyond the elements of algebra. In order to avoid the necessity for the students in these classes to possess a multiplicity of books, such simple mathematical relations as are necessary for the development of the subject are proved in the first chapter of the book. For a similar reason, some useful constants and a short table of logarithms are given.

The early chapters of the book are devoted to developing the elementary principles of magnetism, induction and alternating currents. Alternating currents in circuits containing inductance and capacity are briefly considered. The rest of the book deals with transformers, synchronous motors, induction motors and rotary converters. In this part of the book use is made of simple vector diagrams. At the end of the book a few pages are given to the elementary principles underlying transmission of electrical energy and to simple power measurements. The usefulness of the book is increased by the addition of a number of examples with answers which are given at the end of each chapter.

This little book is well adapted for the purpose for which it is intended. One should expect to find in its 145 pages more than a most brief and elementary treatment of the