to mind some very interesting observations which were made recently at the Jornada headquarters.

Numerous stories regarding the electrical phenomena which occur during sand storms are in circulation throughout this region. These accounts vary with the personal characteristics of the story-teller. Some versions are no more than drab, conservative statements. Others are displayed in a glamorous setting of colorful phrases and artistic profanity. All of them deal with a near electrocution of some luckless cowboy while placing the coffee pot on the camp stove during a sand storm, or with automobiles becalmed by static under similar climatic conditions.

The first tangible indications of proof observed by the writer that these accounts were not without foundation were obtained during a severe storm on April 4, 1928. On the afternoon of this day the sand storm reached its peak of violence between three and four o'clock in the afternoon. During this time the sky was cloudless. The first evidence of an electrical disturbance was observed in the vacuum tube lightning arrester on the office telephone. Between the carbons of this device, a strong electric arc would form and continue uninterrupted for a period of about thirty seconds. When the arc was broken it was immediately followed by another arc of the same general character.

The radio receiving set was the second object of concern. This instrument is equipped with a 75-foot multi-strand copper aerial which is elevated about twenty feet above the ground. Both the aerial and the telephone wires extend in a north and south direction, which places them at right angles to the strong west wind.

The receiving set was disconnected from the ground and aerial. The tip of the lead-in wire from the radio antenna was placed near the tip of the ground wire. An electric arc resulted immediately. By varying the distance between the wires it was found that three and one half centimeters was the maximum width of the gap over which an arc would form. With this arrangement of the wires, the arc was consistent and would continue for a period of thirty seconds without a visible break. The breaks were of short duration when they did occur. The path of the arc varied in its course, between the ground and antenna tips, much after the manner of chain lightning.

Subsequent observations made during the night revealed a much longer arc of about four and one half centimeters in length. This longer arc was of a filmy nature which made a glow rather than a light, as did the arc when the wires were closer together.

When the storm was strongest a spark would span the gap at about seven centimeters. Sparks jumped this gap at the rate of about one per second. As the storm lessened in violence the rate of spark formation slowed down and became erratic. The width of the gap which the spark would jump decreased rapidly as the storm abated.

The presence of so great an amount of electricity in the air may be the reason for the conspicuous unrest of men and live stock during sand storms. This condition is usually attributed to the discomfort caused by the wind and sand. However, the wind and sand do not account for the fact that the same feeling of unrest is, in a lesser degree, experienced by a person who is sheltered within a thick-walled, adobe house.

R. H. CANFIELD

JORNADA RANGE RESERVE

SCIENTIFIC BOOKS

Life and Work of Sir Norman Lockyer. By T. MARY LOCKYER and WINIFRED L. LOCKYER, with the assistance of PROFESSOR H. DINGLE. Macmillan and Company, London. 1928. xii + 474 pages.

As the title indicates, this book is divided into two parts, of which the first contains the general biography of Sir Norman Lockyer. These chapters are filled with many details about the events in the long life of this great pioneer in the field of astrophysics. Such a story can not fail to be entertaining reading for all who are interested in the development of modern science, because Lockyer's own scientific interests were wide, and he gave much attention throughout his life to all sorts of things connected with the advance of science in general.

He wrote no end of articles, and gave innumerable lectures before all kinds of audiences for the purpose of bringing scientific knowledge and facts to the attention of the whole English nation. With this end in view, in 1869 Lockyer started the general scientific magazine *Nature,* and was its editor for fifty years. During these years it achieved great success, due to his untiring efforts and the willingness of the publishers, Macmillan and Co., to wait patiently for the magazine to become a financial asset.

The activity of Lockyer during his entire career is amazing. As a young man, he did his astronomical work in his spare hours, and earned his living as a clerk in the War Office. It was while he was thus employed that he developed and put to the test of observation the method of using the spectroscope to view the solar prominences, which up to that time had been seen only during total eclipses. This discovery alone would have established his fame as an astronomer for all time. Toward the end of his life, he was greatly

disappointed by the transfer to the University of Cambridge of the Solar Physics Observatory of which he had been director for so many years. Although he was then seventy-five years old, he went energetically to work and with the help of friends founded a new observatory at Sidmouth, which he directed until his death seven years later. It is now known as the Norman Lockyer Observatory.

Lockyer seems to have been always ready to add one more to his list of activities. It is easy to believe the remark quoted from him: "The more one has to do, the more one does." The enumeration of the great number of lectures he gave and of the numerous gatherings he attended becomes rather overwhelming, especially in the chapters dealing with the later part of his life. The reader would be more impressed by the really important events if fewer details of the lesser happenings had been included.

The second part of the books consists of thirteen chapters dealing with various phases of Lockyer's scientific work. With the exception of one chapter, containing an address given by Lockyer, these chapters were written by well-known scientific men who are qualified to judge of the importance of Lockyer's contributions to science. They give the reader a very clear idea of the relation of his work to modern investigations. It is impressive to see "how much the recent progress in astrophysics runs on the lines initiated by Lockyer."

The chapter in which is reprinted one of Lockyer's addresses tells the story of helium. It is most interesting to read in Lockyer's own words this story from the time in 1868 when he observed in the solar spectrum "the yellow line near D" until the time twenty-six years later when the line was produced in the laboratory. During all those years, Lockyer persevered in his belief that this line was due to a new element, although he was almost alone in this opinion. In the end his theory was vindicated, as happened in other cases where he felt that the observed facts required explanations opposed to the ideas then generally accepted. Another such example is his theory about the evolution of the stars. He held that in the course of a star's evolution the temperature first rose and then fell, instead of decreasing from the very beginning of the star's life as other astronomers thought at that time. The theories of to-day agree in general with Lockyer's idea.

The last chapter gives some personal recollections of Lockyer by Professor A. Fowler, who was Lockyer's assistant in the laboratory for many years and who succeeded him when he retired from his post as professor at the Royal College of Science. In this chapter, better than anywhere else in the book, there is presented a real picture of the forceful and versatile personality of this most enthusiastic scientific worker. All who read these pages will surely hope with Professor Fowler "that means may be found to perpetuate his memory by the provision of funds to place the observatory (at Sidmouth) on a permanent basis."

IDA BARNEY
YALE UNIVERSITY OBSERVATORY

Lebenslinien. Eine Selbstbiographie. Von WILHELM OSTWALD, Berlin: Klassing & Co. 3 volumes.

OSTWALD has written his autobiography, and every chemist will want to read it because in it we find the reactions and the reflections of a man who took an active part in building up a branch of the science. His early struggles in Riga and in Dorpat as an unwilling subject of the Russian empire; his Leipzig tenure and the subsequent development of a great school of physical chemistry under his leadership; his championship of Arrhenius and van't Hoff; his writings, and to a less extent, his researches; his disputes with colleagues in and out of the university, and his final retirement to private life to devote his remaining energies to art and to philosophy are all vividly described, as one would expect from the pen of one of the foremost writers on science.

Ostwald is refreshingly frank in expressing his thoughts. One feels that no restraining hand was at work when he sat down to say what he had to say about the men with whom he came in contact. And yet, one would be apt to close the book with more liking for the man if there were some self-criticism interspersed between the pages of his three volumes. One is left with the general impression that many men wronged him; one nevertheless carries away the impression that he was not always in the right, if only because of his repeated assurances that the others were the wrong-doers. One also carries away a very distinct impression that everything was measured with a mental meter-rule planned and perfected by Germans who, in turn, were impregnated with the germ "Deutschland über alles." His somewhat caustic comments on American universities and university men and on America itself seem not so much the result of objective criticism as of nationalistic self-conceit. Even his bitter comments on the attitude of Ramsay and others towards German science—an attitude resulting from the late war and, as we realize to-day, a highly unjustified one—awaken but little sympathy, because he himself has such little sympathy for things other than German.

I may be somewhat unjust to Professor Ostwald, but such is the general impression the book leaves me with. Nevertheless, as a scientist, and, more particularly, as an "organizer" of science, Ostwald will go down in chemical history with the group of immortals.

BENJAMIN HARROW