from currents of high frequency, the condition lasting for some time after the removal of the electrodes. While in this condition the finger could be pricked with a pin without any resulting sensation except that of dull contact. Sensitiveness to cold was also removed. The investigation has been continued and has shown the possibility of employing a sinusoidal current of high frequency as an anæsthetic. Full details as to the requisite frequency and intensity will be published later.

E. W. SCRIPTURE.

YALE UNIVERSITY,
NEW HAVEN, CONN., May 25th.

SCIENTIFIC LITERATURE.

The Sun's Place in Nature. By SIR NORMAN LOCKYER. London and New York, The Macmillan Company. 1897. Pp. 360. Price, 12 shillings.

The character of this latest work of its eminent author might, perhaps, be misunderstood from its title. It discusses the Sun's place in the order of evolution of the stars, and not in relation to the solar system. It is, therefore, to be classed as a book on stellar astronomy, and is to a considerable extent based upon a course of lectures recently delivered by the author at the School of Mines in London. The nature of the work may best be shown by quoting in full the conclusion: "I am not aware that any more crucial test than the foregoing can be applied to the rival schemes of stellar classification, and, as I hold that the result of its application is entirely in favor of the one which assumes the existence of some stellar bodies which are increasing their temperature while others are reducing it, the Sun's place in Nature must be regarded as near that occupied by Arcturus and Capella, and very far separated from that occupied by α Cygni, γ Cygni, and α Tauri. Nor is this all, the origin of the Sun in a nebula not exclusively gaseous, but only containing gases among its constituents, is greatly strengthened by the extended study of the classification problem which has occupied the last few chapters. Along all lines, then, the fundamental requirements of the Meteoritic Hypothesis have been strengthened by the later work."

The book may be regarded, then, as a sequel to 'The Meteoritic Hypothesis,' which appeared in 1890, and is intended to reply to the criticisms of the earlier work, as well as to present the author's view of the bearing on that hypothesis of the relevant discoveries in the intervening years. It is, therefore, not a book for the instruction of the general reader, unless he has a taste for argumentative reasoning, adduced in behalf of a theory which has not met with general acceptance. It is written in Sir Norman's easy style, and may readily carry the reader who is not critical along to the conclusions of the author.

An interesting account is given of the discovery of terrestrial helium and the investigations of its spectrum from various minerals, in which the researches of the author were early and important. Some seventy minerals were examined in his laboratory at South Kensington, and the D_3 line of helium was detected in the spectrum of sixteen of them.

It is an essential feature of the Meteoritic Hypothesis that nebulæ are meteoritic in their nature, and that they pass into the stage of 'stars' as the meteoric 'swarms' become more condensed. Accordingly considerable space is devoted to the chemistry and nature of the nebula and their relation to stars. Professor Lockyer has himself obtained very successful photographs of the Orion nebula, and he gives a list of 54 lines on a plate taken in 1890. If there is any connection between nebulæ and meteorites it would certainly be expected to reveal itself in some resemblance of their spectra. As a matter of fact, however, aside from hydrogen and helium, which are abundantly represented by lines, the only elements which Professor Lockyer identifies are calcium (three lines), iron, carbon and magnesium (one line each). Now Keeler's measures have demonstrated that the chief nebular line does not coincide with the magnesium line, and still less do the remaining lines agree in wave-length with the lines of the elements mentioned. Thus it appears that there is an entire absence of spectral similarity between nebulæ and meteorites, except that both contain the universally prevalent hydrogen.

The references made to the work of Dr. Huggins, especially in connection with the

spectrum of the nebulæ, can hardly be accepted as fair to that eminent investigator and pioneer in that line.

An interesting account is given of the appearances of the temporary stars, or '*Novæ*,' with their spectroscopic history, in which the observations of the author properly take a prominent place. Chapter XIV. is entitled 'How the hypothesis has fared,' referring more particularly to the bearing of the recent work on *Nova Aurigæ* upon the meteoritic hypothesis. The last quarter of the work discusses the problem of stellar classification. The principal contention of the author is that a spectral classification should provide both for stars that may be growing hotter as well as for those that may be growing cooler. The implication is that the adoption of this principle requires the acceptance of the meteoritic hypothesis, an implication recurring in other parts of this work. The necessity is, however, by no means obvious.

In the diagrams to show the difference in the spectra of stars considered by the author to be of increasing, and those of decreasing temperature, it would seem quite possible to exchange the labels under the cuts without seriously affecting the plausibility of the reasoning.

With that part of the final conclusion, already quoted, that locates the sun in close spectral proximity with Arcturus and Capella, no doubt all astronomers will agree.

The process illustrations of the book are not in keeping with its otherwise admirable typographical appearance, and are distinctly inferior to the excellent engravings in the earlier 'Meteoritic Hypothesis.'

Edwin B. Frost.

Astronomy. By Agnes M. Clerke; A. Fowler, A.R.C.S., F.R.A.S.; J. Ellard Gore, F.R.A.S., M.R.I.A. New York, D. Appleton & Co.

It is of supreme importance to a science that the popular writing representing it before the world of culture should be alike a graceful and an accurate exponent of the special subject. Astronomy seems in many instances to have been not too fortunate in the character of the literature promulgated as 'popular astronomy.' The unfortunate experience of this science leads one then the more nervously to examine the credentials of a new recruit, and the more gratefully to welcome into popular astronomical literature a book of the honorable purpose and generally praiseworthy execution of the present volume.

'Astronomy' is divided into four chapters. In the first Miss Clerke submits a concise résumé of the history of astronomy; then follows a chapter on spherical, practical and gravitational astronomy expounded according to simple geometrical considerations by Professor Fowler; the third, also by Miss Clerke, reviews concisely our present knowledge of the solar system; the fourth and last is a concise treatise on the sidereal heavens by Professor Gore.

The prime question naturally suggested by the tripartite authorship is whether a triple responsibility is really necessary in connection with a book whose aim is for the most part popular. A superficial examination would also incline one at once to challenge so ambitious a combination of authors in a book of but 565 pages. Closer examination, however, seems fully to justify the threefold authorship. As a volume of 'The Concise Knowledge Library' it evidently aims both at great conciseness, scientific accuracy and freshness; and hence with the vast domain of astronomical science to be condensed into a moderate-sized volume it was clearly an advantage to have the work thus apportioned among several writers, each facile in the descriptive art and each faithful to the cause of scientific astronomy.

Considering the scope of the facts to be presented and the plan adopted, it would be beyond expectation to find a performance of this sort altogether blameless. Attempt at the required conciseness, coupled with an assignment of special subjects to each author under strict limitations, has seemed to exercise too restraining an influence. Subjects like modern astronomical spectroscopy and celestial photography have, taking the book as a whole, scarcely infused their full inspiration. The extreme brevity of the reference to far-reaching topics like 'tidal evolution' is almost tantalizing. Perhaps the character whose absence one misses most is direct discussion of astronomical methods and results from the standpoint of the active ob-