Britain would have just as much right to protest against the extermination, by the United States, of the buffalo and the beaver.

It has been suggested that the seals might be exterminated, but this would be sawing off the branch with the man on it, unless the proposers of this plan mean by it what I wish to suggest. This is that so many seals be killed on the Islands that there would not be enough left in the seas to make pelagic sealing profitable. It would seem possible to keep a small herd on the Islands and the killing of the small number would be very profitable, as the price of sealskins would doubtless rise. It looks to me as if we had the trump card in our hands and could offer Great Britain almost any conditions on pelagic sealing that we like.

P. C. H.

NEW YORK, November 27, 1897.

OBSERVATIONS ON THE PHYSIOGRAPHY OF WESTERN MASSACHUSETTS.

THE following notes on the character and elevation of the Cretaceous peneplain in western Massachussetts were made during a trip in the Berkshire region in the spring of 1897. The area covered lies between the Housatonic and Connecticut lowlands and south of the Boston and Albany Railroad.

From map-study alone the tendency is to locate the peneplain by the broadest tracts of level country to be found upon the map and to call what lies above monadnocks. It was found, however, that this estimate placed the peneplain altogether too low. The broad spaces proved on observation to be broad, shallow tracts of etched-out country, and most of what had been supposed from map-study to be monadnocks fell into a very good level skyline. The region contains but few monadnocks, and these of small size, their size and number decreasing from north to south.

In the township of Hinsdale the peneplain lies at a height of 2,050 to 2,100 feet; at Washington Centre it falls to 2,000 feet; and seven miles in a south-southeasterly direction, near Becket Centre, it is but 1,850 feet in height. Between Sandisfield Centre and New Marlborough, about seventeen miles due south of Washington, the height of the peneplain decreases to 1,750 feet; at Tolland Centre its elevation is about 1,550 feet; and at Blandford Centre, about eight miles to the northeast, the same. By comparison of these points the following conclusions were reached:

(1) The peneplain dips from about north-northwest to south-southeast.

(2) Its fall in twenty-five miles is about 550 feet, a rate of twenty-two feet to the mile.

An apparent consequence of this slope of the peneplain is the prevailingly south-southeast courses of the streams, great and small, throughout the area. Along the escarpments where the upland falls off into the Housatonic lowland or into the Connecticut lowland the streams naturally follow the steeper gradient and have cut east and west courses some distance back into the upland, though even these streams in their upper courses conform more and more to the habit of the other streams. The long axes of the lakes and ponds also lie prevailingly northwest and southeast, and the majority of the long, straight stretches of road follow the same direction.

ROLAND B. DIXON,
CHARLES D. DREW.

SCIENTIFIC LITERATURE.

The Dawn of Astronomy, a study of the temple-worship and mythology of the ancient Egyptians. By J. NORMAN LOCKYER. New York and London, The Macmillan Co. First edition, 1894; second edition, 1897. Octavo, pp. 432. Illustrated. Price, $3.

Sir Norman Lockyer first gave his attention to the questions treated in this book in the year 1890 and they are stated in his preface somewhat as follows: It is a matter of common knowledge that many of the churches of England are so constructed that their eastern windows face the point of sunrise on the day of the patron saint. For example, the churches dedicated to St. John the Baptist face nearly northeast. The question arises whether the Egyptian temples have a similar orientation to the sun or to some star. This can be completely determined by accurate surveys of the temple sites; by an investigation of the inscriptions, etc.; by a study of the mythology and history of the people; by the calcu-

lation of tables of the rising and setting of the stars for a period extending backward some 9,000 years, and by a painstaking discussion of the data so amassed. A part of the work described has been done by Professor Lockyer, and the results reached since the year 1890 (when some of them were first announced by him) are set forth in this volume. During visits to Egypt he executed surveys of a few temple-sites and the necessary calculations have since been made.

The French Scientific Commission which accompanied Napoleon in his Egyptian campaign, and the Commission sent by the Prussian government in 1844, have published a vast amount of accurate information regarding the sites, etc., of Egyptian monuments which bears directly on the problem in hand.

Professor Lockyer's general conclusion is that certain of the Egyptian temples are, in fact, oriented by the stars as well as others by the sun. The same conclusion was reached quite independently in 1885 by Professor Nissen, of Germany, though his work was unknown to Lockyer at the time. Such is the general problem. The particular developments are given in a stout octavo volume first printed in 1893 and now reprinted without change, I believe.

The course of the argument in detail is somewhat as follows: Egyptian chronology, the succession of kings, must be regarded as comparatively well known, considering the great difficulties of the subject. Making all allowances for errors, the dates of many temples are well fixed by their inscriptions. The mythology of Egypt has likewise been studied with remarkable success, and this mythology has, in general, astronomical relations, as indeed is the case in many countries. In Egypt, as in other lands, there were gods related to the sun, the moon, and a special goddess for the stars. Their zodiac is represented by existing sculptures whose figures have at once a mythologic and an astronomic meaning. The priests made sacrifices at dawn and at other seasons related to the sun's diurnal and annual courses. Inscriptions at Thebes show that the risings of stars were observed throughout the entire year; and the *heliacal* rising of Sirius was connected with the floods of the Nile. In Egypt, as in India, the pantheon was mainly composed of solar deities, but some of the personages had intimate relations to stars and planets.

During the course of the year the sun rises and sets at various points of the horizon of any place. It rises farther to the north during the summer, farther to the south during the winter season. A star, however, rises at (sensibly) the same point of the horizon for a century or so, though the stars, too, have a slow motion due to precession, which will, finally, produce great alterations in their points of rising. The rising of a star with the sun at a certain period of the year—its *heliacal* rising—would be a marked phenomenon, especially if the date coincided with a critical time of the agricultural cycle. Any recurring event of this nature may serve to mark off dates—the heliacal rising of a star; the rising (or setting) of the sun at the equinoxes or solstices; or the rising or setting of a fixed star. The orientation of a temple might well preserve the direction in which the semi-sacred appearance was visible and there is no doubt that many structures have been so oriented. From ancient times worshippers have chosen to face in a fixed direction during their devotion or sacrifice.

The existence of solar temples in many parts of the world is established beyond a doubt. Some Egyptian temples are oriented to the sun at its rising at the solstices (Karnak, Thebes, etc.); some to its rising at the equinoxes (Memphis, Gizeh, etc.) according to Professor Lockyer. The orientation is changed from solstitial to equinoctial in these cases, and Lockyer points out that so fundamental a variation in astronomical thought strongly suggests a change in the ruling race and religion. The rise of the Nile is related to the season of the summer solstice; that of the Tigris and Euphrates to the season of the spring equinox. Have we here, the author asks, an indication of two races which expressed ideas in the monuments? The suggestion is ingenious. So far as I know, it has not been very hospitably received by experts. It is interesting to note that the temple of the sun at Peking is oriented to the winter solstice; Stonehenge to the solstice of summer; the temple of Solomon similarly to the temple of Isis at the Pyramids;

St. Peter's at Rome so that the sun's rays at the vernal equinox illuminate the high altar, etc., according to Professor Lockyer. The inscriptions of some of the Egyptian temples prove, if proof is necessary, the intention of their builders. Speaking of a pair of obelisks at Karnak an inscription reads, "They are seen an endless number of miles away; it is a flood of shining splendor when the sun shines between the two;" and again, "The sun's disc shines between them as when it rises from the horizon of heaven."

It is to be noticed that if the orientations of the builders were exact, and if the measures and directions determined at the present day are accurate, it is a mere matter of calculation to fix the astronomical date at which a temple was constructed, provided their original intention is known to us. The dates of several of the solar temples can be assigned with considerable accuracy in this manner. If we should find, as in fact we do find, says Professor Lockyer, that the builders of set purpose have slightly altered the direction of the axis of a temple during its construction, this will be a sign to indicate that the celestial body related to the temple has changed its direction during the period, perhaps several centuries, of construction. It is upon facts of this kind that Lockyer bases his proof that some of the temples are related, not to the sun, but to stars. This is the key-note of the book. The change of direction of the axis is not to be explained by a change in the sun's direction, but demands another interpretation. The situations and arrangements of the principal stars were well known to the inhabitants of the Nile Valley. We have seen that many of the Egyptian temples are oriented to solar positions. There are many temples that cannot by any possibility be so oriented. They are built so that no ray of sunlight can pass along their axes at any period of the year. The question arises, are these temples oriented to stars? or, again, are they oriented at all? Are their directions assigned by chance? The topographic conditions of the sites seem to show, in a number of cases, that their builders had a set purpose in facing them as they are faced. If the direction of their walls had no significance they would, it seems, have been differently placed. The latter half of the volume under review is devoted to these questions, namely: Were such temples oriented to a star? to what star? and at what epoch were these monuments constructed?

Every detail of construction goes to show that this group of (stellar) temples was built to receive a horizontal ray of light along the axis just as the solar temples were. A striking fact in this connection is that the (stellar) temples frequently exhibit a change of direction of the principal axis, such as calculation shows would be necessary to allow for changes in the direction of stellar beams every few centuries. A solar temple does not require such changes of axial direction. "Once a solar temple, a solar temple for thousands of years; once a star temple, only *that* star temple for something like three hundred years." If after some three centuries the stellar light no longer penetrated the temple a change of direction of the axis would be required. It is just such changes of direction that have been found.

The foregoing summary is believed to represent with fairness the *method* adopted by Professor Lockyer, and to indicate, at least, his main conclusion, namely, that many of the Egyptian temples have stellar relations and were oriented so that the horizontal rays of Capella, *Gamma* Draconis, etc., etc., might fall along their axes at the time the buildings were constructed. The latter half of the book is given to a detailed proof of the stellar relations of the temples, and it deals not only with architectural measurements and astronomical computations, but with recondite questions of mythology, history and ethnology. To the writer of this review it seems that the chief merit of the book is to have called attention to a most important province of the history of the growth of astronomic notions (and thus of religious ideas) and to have set forth in plain and popular form the obvious method of research which must be resorted to. It seems that further research is called for. It may lead to certain and definite results. The present volume can hardly be said to have proved all its points. To judge it completely one should be historian, ethnologist and astronomer in one; but one need be no more than a

humble logician to point out various flaws in the argument.

I believe the Egyptologists do not accept the Zodiac of Denderah and the inferences of Biot as unreservedly as Professor Lockyer. The ethnologists will, I understand, raise many objections to Professor Lockyer's hypothesis of a change of race and religion. Mythologists will surely rebel against his treatment and interpretation of myths. Astronomers will point out how *many* stars there are and how few temples, so that it may not be so very difficult, given several hundred years of leeway, to choose a star to fit a temple. Plain people will ask how it is that a temple is, so to say, dedicated to one star and oriented by another. Sirius was the *star* related to Isis, Mut and Hathor. But the temples of these deities are not invariably oriented by Sirius. *Gamma* Draconis is a rather faint star. Why were not brighter ones selected?

After raising these objections and a crowd of others that might be brought forward, it remains that Professor Lockyer's book is a contribution of high value and merit. A question of importance has been plainly put. The method of solving it has been described in popular language. The data now available has been brought to the notice of everyone. If Professor Lockyer has done little more than this, and if his principal conclusions still call for further confirmation, he deserves the thanks of all concerned in these questions—and who is not?

Edward S. Holden.

Song Birds and Water Fowl. By H. E. Parkhurst. New York, Scribners. October, 1897. Illustrated by Louis Agassiz Fuertes. 12mo, pp. 286. Price, $1.50.

If there is any truth in the law of supply and demand, the present flood of popular bird literature must be taken as evidence of an extraordinary if not unprecedented interest in the subject of birds and nature. It is a healthful interest and one which awakens and develops some of the better elements in our natures which are apt to lie dormant.

Mr. Parkhurst's 'Song Birds and Water Fowl' is not intended as an aid to the identification of specimens, but belongs rather to the class of popular nature studies. A fair idea of the contents may be had from the chapter headings, which are as follows: A Boquet of Song Birds; Water Fowl; A Bird's-Eye View; Mistress Cuckoo; Sea Swallows; Bird's Nests; At the Water's Edge; Lake George; A Colony of Herons; Earliest Signs of Spring.

The book is illustrated by eighteen admirable full-page drawings by Fuertes.

C. H. M.

Birdcraft, a Field Book of Two Hundred Song, Game, and Water Birds. By Mabel Osgood Wright. New York, The Macmillan Co. November, 1897. With 80 full-page plates by Louis Agassiz Fuertes. 8mo, pp. 317. Price, $2.50.

The second edition of Mrs. Wright's 'Birdcraft' is a pleasant surprise. The cheap chromos of the first edition are replaced by a colored frontispiece and eighty full-page halftone plates from original drawings by Fuertes, the powerful young bird artist who has so suddenly sprung into fame. Most of these drawings have recently appeared in 'Citizen Bird,' by the same author and Dr. Elliott Coues (noticed in Science of November 5, 1897, p. 706).

Since the text of the second edition of 'Birdcraft' is printed in the main from the same electrotype plates as the first, it is only necessary to refer to the review of the former (Science, June 7, 1895, p. 635), with the additional statement that the principal errors there mentioned have been corrected. The book in its present form is attractive, interesting and helpful and should be in the library of every lover of birds.

C. H. M.

Magic Stage Illusions and Scientific Diversions, Including Trick Photography. Compiled and edited by Albert A. Hopkins, with an introduction by Henry Ridgely Evans. New York, Munn & Co. 1897. With four hundred illustrations. Large 8vo. Pp. 556. Price, $2.50.

The associations of the term magic are hardly suggestive of scientific processes or principles; they are more apt to call up an atmosphere of mystery and secret knowledge, a world of the