pathological. My restoration will be found in the American *Journal of Science* for October, 1892, and in the *Geological Magazine* for April, 1893.

The third figure given by Mr. Lydekker is a reduced copy of my restoration of *Stegosaurus ungulatus*, published in August, 1891. This reptile he calls Hypsirophus, giving that name priority over Stegosaurus, but without citing any authority for such a statement. A single reference to the literature would have proved this to be a mistake, as Stegosaurus was published by me in 1877, as above stated (*American Journal of Science* (3), vol. xiv. p. 513), while the name Hypsirophus was given by Cope in 1878 (*American Naturalist*, vol. xii. p. 188). Another error of less importance is in regard to the specimen on which the restoration is based, although this was clearly stated in the description accompanying my figure. The type specimen of *Stegosaurus ungulatus* Mr. Lydekker apparently confuses with a second skeleton, of a different species, which was even more perfect when found.

The fourth restoration given is a reduced copy of my figure of the skeleton of *Triceratops prorsus*, which, like the preceding restorations, has already been published by me, both in the *American Journal of Science* and in the *Geological Magazine*. Here again Mr. Lydekker rejects my generic name Triceratops, and even puts that and another genus of mine (Ceratops) as synonyms of Agathaumas without giving any reasons for doing so. The type specimens of the literature would show any candid anatomist that the three forms named, and another which I called Torosaurus, are all distinct genera, separated by well-defined characters. These characters I have given in detail in the *American Journal of Science*, accompanied by accurate figures of the forms I have described (vol. xliii. pp. 81–84, plates ii. and iii., January, 1892).

The remaining restoration given in Fig. 5 represents a well-known skeleton of Iguanodon in the Royal Museum of Belgium. In regard to this figure I have at present nothing to say, except that I have carefully studied the original specimen and those found with it, having made several visits to Brussels for this purpose.

The omissions from this article are perhaps as noteworthy as what it contains. No reference is made to two restorations of American Dinosaurs which I have recently published; Claosaurus from the Cretaceous, and Anchisaurus from the Triassic, although each is based on a nearly perfect skeleton. Both of these restorations have appeared in the *American Journal of Science* and also in the *Geological Magazine* within the past year. Mr. Lydekker likewise omits the restoration of Megalosaurus, which he has lately given to the public, although many palæontologists would be glad to know more about it, especially about the remains on which it is based.

Mr. Lydekker begins his article by referring to the discouragements of palæontologists in the investigation of fossil vertebrates, but ends with some words of encouragement. He might have added that one discouragement to active workers who devote years to exploration and study is to have the results of their labour used without due credit, or disparaged by those who do not understand them.

O. C. MARSH.

Yale University, New Haven, Conn., August 15.

Insects Attracted by Solanum.

SIR JOHN LUBBOCK, in his "British Wild Flowers in Relation to Insects," remarks (p. 133) that *Solanum* is little visited by insects. Darwin, in "Effects of Cross and Self Fertilisation," has some observations (p. 387) to the same effect. It will therefore be useful to record that, however it may be with European species, an abundant *Solanum* of New Mexico is very attractive to insects. The species in question is *S. elæagnifolium*, Cav., which has deep lilac flowers not unlike those of the potato. I was especially successful in capturing interesting aculeate hymenoptera on this plant, as the following list will show. All listed were taken in Las Cruces, and all (except the *Megacilissa*, July 12) on July 13.

Hymenoptera taken on Solanum elæagnifolium, 1893.

Ammophila pruinosa, Cr. ♀.
,, *varipes*, Cr.
Anthophora urbana, Cr. ♀.
Halictus, sp. ♀.
Megacilissa gloriosa, Fox.
Melissodes menuacha, Cr. var.? ♀
Myzine frontalis, Cr. MS.
Mysson texanus, Cr. ♀.
,, n. sp.
Odynerus bravo, Sauss. (new to U.S. fauna).
Pelopœus servillei, Lef.
Plenoculus, n. sp.
Sphœrophthalma coccineohirta, Blake, ♂ var.
Stizus agilis, Sm.
,, *flavus*, Cam. (new to U.S. fauna).
Tachysphex, sp. ♀.
Tachytes elongatus, Cr. ♂.
Trypoxylon texense, Sauss.

For the identifications of the species I am indebted to Mr. W. J. Fox.

T. D. A. COCKERELL.

Agricultural College, Las Cruces, New Mexico, U.S.A. August 16.

Old and New Astronomy.

IN your notice of the "Old and New Astronomy," your reviewer has, I think, misunderstood the passage with respect to reflecting telescopes, on p. 45, which he refers to as indicating that Mr. Proctor supposed that the image in the principal focus of a reflecting telescope was affected with chromatic aberration or false colouring. Section 97, to which I conclude your reviewer refers, evidently refers to the magnified image which enters the eye of an observer when a "*real image* of an object is submitted to microscopical examination."

No one who knew Mr. Proctor could suppose him to make such a mistake; and that he was perfectly well aware that the image thrown by a reflector was not affected with chromatic aberration, would, I think, have been evident to your reviewer if he had read to the bottom of the page, where in Section 101 Mr. Proctor says:—"Newton supposed that it was impossible to get rid of this defect (*i.e.* chromatic aberration), and therefore turned his attention to the construction of reflectors," a clear proof that Mr. Proctor was in no doubt upon the subject, and only referred in the previous passage to the false colouring of an image formed by a lens.

S. D. PROCTOR-SMYTH.

8 Duncairn Street, Belfast, August 23.

MRS. PROCTOR-SMYTH is in error in supposing that my note referred to Section 97 of "Old and New Astronomy." I referred to Section 100, in which the author says "the pencil of light proceeding from a point such as P, Figs. 14, 16, and 18, consists of rays of different refrangibility, and therefore *not converging to a focal point such as p but to a focal line in the axis of the pencil.*" (The italics are mine.) Fig. 18 is a diagram of the formation of a real image by a reflector. The reference to Fig. 18 may have been a slip; if so, it should have been corrected in the completed volume, as otherwise the student, reading the subsequent paragraphs, to which Mrs. Proctor-Smyth refers, is confused as to what the author really means, and is doubtful whether the reflector does or does not suffer from chromatic aberration.

THE REVIEWER.

Suicide of Rattlesnake.

ANOTHER question raised by the late snake story is, How long does it take to drown snakes? Some of the non-poisonous kind at the Zoological Gardens, in certain states of the weather, are fond of hanging themselves over the edge of their tank, with their heads immersed in the water, for as long as an hour together.

E. L. GARBETT.

August 29.

THE EARLY ASTERISMS.

I.

NOT very many years ago, when the literature of China and India was as a sealed book, and the hieroglyphics of Egypt and the wedges of Babylonia were

still unread, we had to depend for the earliest traces of astronomical observation upon the literatures of Greece and Syria, and according to these sources the asterisms first specialised and named were as follows:—

The Great Bear	Job (xxxviii. 31), Homer.
Orion	Job (ix. 9), Homer, Hesiod.
Pleiades, Heiades	Job (xxxviii. 31), Homer, Hesiod.
Sirius, the Great Dog ...	Hesiod (viii.), the name; Homer called it the Star of Autumn.
Aldebaran, the Bull... ...	Homer, Hesiod.
Arcturus	Job, Homer, Hesiod.
The Little Bear	Thales, Eudoxus, Aratus,
The Dragon	Eudoxus, Aratus.

It follows from the investigation into the orientation of Egyptian temples that the stars α Ursæ Majoris, Capella, Antares, Phact, and α Centauri were carefully observed, some of them as early as 5000 B.C., the others between 4000 and 3000 B.C. Further, that the constellations of the Thigh (Ursa Major), the Hippopotamus (Draco), the Bull, and the Scorpion had been established in Pyramid times.

It becomes important therefore, if we recognise this as the dawn of astronomy in Egypt, to see if any information is extant, giving us information concerning Babylonia, so that we may be able to compare the observations made in the two regions, not only with a view of tracing the relative times at which they were made, but to gather from these any conclusions that may be suggested in the course of the inquiry.

The inquiry must be limited to certain detailed points; we know quite well already, as I stated in the introduction, that the omen tablets of Sargon I., who reigned in Babylon 3700 B.C., prove unquestionably that astronomy had been cultivated for thousands of years before that date.[1] But to institute a comparison we must leave the general and come to the particular. I will begin with the northern constellations, as it follows from my researches that very early at Denderah and Thebes, and in all probability at On, temples were erected for their worship—the worship of Anubis or Set, as I have shown, that is α Ursæ Majoris and γ Draconis.

According to Maspero, Set formed one of the divine dynasties at On, and the northern stars seem to have been worshipped there. I suppose there is now no question among Egyptologists that the gods Set, Sit, Typhon, Bes, Sutekh, are identical. It is also equally well known that Sutekh was a god of the Canaanites[2] that the hippopotamus, the emblem of Set and Typhon, was the hieroglyph of the Babylonian god Baal,[3] and Bes is identified with Set in the book of the dead.[4]

It is also stated by Maspero that at Memphis[5] [time not given] there were temples dedicated to Soutekh and Baal. In the article on the circumpolar stars I have suggested that they were taken as typifying the powers of darkness and of the lower world, and I believe it is conceded by Egyptologists that Anubis in jackal form preceded Osiris in this capacity.

In the exact centre of the circular zodiac of Denderah we find the jackal located at the pole of the equator; it obviously represents the present Little Bear.

Do we get the jackal constellation in Babylon astronomy? Of this there is no question, and in early times. Jensen refers[1] to the various readings "jackal" and "leopard," and states that it is only doubtful whether by this figure the *god* ANU or the *pole of the ecliptic* ANU is meant. Either will certainly serve our present purpose.

I know not whether the similarity in the words Anu and Anubis results merely from a coincidence, but it is quite certain that the seven stars in Ursa Minor make a very good jackal with pendant tail, as generally represented by the Egyptians, and that they form the nearest compact constellation to the pole of the ecliptic.

It seems extremely probable, therefore, that the worship of the circumpolar stars went on in Babylonia as well as in Egypt in the earliest times we can get at.

A very wonderful thing also is that, apparently in very early times, the Babylonians had made out the pole of the equator as contradistinguished from the pole of the ecliptic. This they called Bīl. With this Jensen finds no star associated,[2] but 6000 B.C. this pole would be not far removed from those stars in the present constellation Draco, out of which I have suggested the old Egyptian asterism of the hippopotamus was formed.

Now I gather from Prof. Sayce[3] that Anu and Bīl ranked as two members of a triad from the commencement of the Semitic period, the third member being probably a southern star symbolised as we shall see in the sequel.

The whole triad was stellar and two-thirds circumpolar; it was only in later ages that we get a triad consisting of sun, moon, and Venus,[4] Venus being replaced at Babylon by Sirius.[5]

To these two northern divinities temples were built, both were worshipped in one temple at Babylon,[6] which must therefore have been oriented due north, and the pole of the equator, the altitude of which (equal to the latitude of the place) was probably in some way indicated. Here there was no rising and setting observations, for Eridu the most southern of the old Babylonian cities had about the same latitude as Bubastis, in Egypt. The pole of the ecliptic (Anu) would revolve round the pole of the equator (Bīl) always above the horizon.

So that since Sutech = Anu
and Baal = Bīl,

the temple at Memphis to those divinities reported by Maspero (see *ante*) must have been oriented in the same way as the one at Babylon; and if the above evidence be considered strong enough to enable us to associate the Babylonian Bīl with the Egyptian Taurt, we have not only Ursa Minor but Draco represented in the mythology both of Egypt and early Babylonia.

I gather from Prof. Sayce's "Hibbert Lectures"[7] that there is a distinct evidence of a change of thought with regard to Anu. Observations of stars near the pole of the ecliptic appear to have been utilised before they were taken as representing either the superior or inferior powers—before in fact the Anubis or Set stage *quâ* Egypt was reached. After this had been accomplished there was still another advance in which Anu assigns places to sun, moon, and evening star, and symbolises the forces of nature.

It seems probable that the same rectangular arrangement of temples which held in Egypt, held also in Babylonia,[8] and this perhaps may be the reason why Bīl seems so often to refer to the sun, whereas it was the name given to the combined worship. Sometimes, on the other hand, the worship of the stars is distinctly

[1] Besides the book on omens we have "The Observations of Bel," or "Illumination of Bel" (Mul-lil), seventy-two books dealing with conjunctions of Sun and Moon, phases of Venus, and appearance of comets. "Hibbert Lectures," (Sayce, 1887, 29).
[2] Maspero, "Histoire Ancienne," p. 165.
[3] Pierret, "Le Panthéon Egyptien," p. 4.
[4] *Idem*, p. 48.
[5] Maspero, p. 357.

[1] Kosmologie der Babylonier, p. 147 on the word Anu.
[2] P. 147. [3] Sayce, p. 193. [4] Sayce, p. 193.
[5] Jensen, p. 149. [6] Sayce, p. 439. [7] P. 190.
[8] In the ceremonials in the temples also the statues of the gods in boats or arks were carried in procession. Sayce, p 280.

referred to as taking place in a solar temple. Thus at Marduk's temple, E-Sagila we are told "two hours after nightfall the priest must come and take of the waters of the river, must enter into the presence of Bīl, and putting on a stole in the presence of Bil must say this prayer," &c.[1] The temple then will have been probably oriented to the north.

Nor was this all; movements in relation to the ecliptic had been differentiated from movements in relation to the equator. We have inscriptions running:—

"*The way in reference to Anu,*" that is the ecliptic with its pole at Anu.

"*The way in reference to Bīl,*" the equator with its pole at Bīl.

In other words, the daily and yearly apparent movements of the heavenly bodies were clearly distinguished, while we note also

Kabal šami, "the middle of the Heavens" defining the meridian.

So far as I have been able to gather any myth like that of Horus involving combats between the sun and circumpolar star gods is entirely lacking, but a similar myth in relation to some of the ecliptic constellations is among the best known.

The Ecliptic Constellations.

I have already in previous articles pointed out that at On we seemed limited to Set as a stellar divinity; so soon as pyramid times are reached, however, this is changed.

I have given before the list of the gods of Heliopolis, and have shown that with the exception of Sit none are stellar. But we find in pyramid times the list is increased; only the sun gods Ra, Horus, Osiris, are common to the two. As new divinities we have[2]:—

Isis.
Hathor.
Nephthys.
Ptah.
Selkit.
Sokhit.

Of these the first two and the last two undoubtedly symbolised stars, and there can be no question that the temples of Isis built at the pyramids, Bubastis, Tanis, and elsewhere, were built to watch the rising of some of them.

The temple of Saïs, as I have said, had east and west walls, and so had Memphis, according to Lepsius. The form of Isis at Saïs was the goddess Neith, which, according to some authorities, was the precursor of Athene. The temple of Athene at Athens was oriented to the Pleiades.

There is also no question that the goddess Selk symbolised Antares.

We find ourselves then in the presence of the worship of the sun and stars in the constellations of the ecliptic in Egypt, in pyramid times, and in constellations connected with the Equinoxes; for if we are right above the Pleiades and Antares these are the stars which would herald the sunrise at the Vernal and Autumnal Equinox respectively, when the sun was in Taurus and Scorpion.

Now associated with the introduction of these new worships in pyramid times was the worship of the bull Apis.

The worship of Apis preceded the building of pyramids. Mini is credited by some authors with its introduction,[3] but at any rate Kakau of the second dynasty issued proclamations regarding it,[4] and a statue of Hapi was in the temple of Cheops.[5]

The first question which now arises is When were these constellations established in Babylonia? Is there any information?

With regard to the constellations of the Bull and Scorpion, there does seem to be some information, and on this point in a subsequent article I shall have to refer at some length to Jensen's recent important book.[1]

J. NORMAN LOCKYER.

(*To be continued.*)

1 Sayce, p. 101.
2 Maspero, *op. cit.* p. 64.
3 Maspero, *op. cit.* p. 44. note.
4 Maspero, *op. cit.* p. 64.
5 Maspero, *op. cit.* p. 46.

PUBLICATIONS OF THE ZOOLOGICAL STATION AT NAPLES.[2]

DURING the winter of 1876, when the Zoological Station was already a fact in brick and mortar, and my late friend, Mr. Frank Balfour, had already shown by his famous work on the Elasmobranch Development how profitable its arrangements might turn out for the progress of research in morphology, I began to busy myself with the literary phase of my enterprise. From the very beginning it had been my intention to erect not merely a simple laboratory, in which a more or less long series of "Contributions to the knowledge" of all sorts of groups or problems ought to be worked out, but to create an organisation which by its own power and weight might influence the further progress and development of morphological science in the direction of greater concentration and by production of such scientific work as could hardly be taken up and still less carried through by individual effort alone. Of course the Zoological Station ought to have its own Journal, similar to the many Journals or Zeitschriften or Archives of other and perhaps less powerful institutions or societies, but I hoped to do more than that. If my ideas of, and confidence in, the future development of the Zoological Station were right, more important productions might be expected from it, and thus it became only a question of organisation and combination of means and ends to secure such a result. I had learned by almost daily experience how difficult, almost hopeless, it was to succeed with the specific determination of all the numberless organisms, worms, crustaceans, hydroids, tunicates, &c., &c., which our fishermen brought to light day by day. Even if the library of the Zoological Station at that time had been complete enough, it would have been almost impossible to ascertain the names of all these creatures, the descriptions and figures in former works being far too incomplete and too superficial to enable even specialists of all these groups to decide which name belonged to which animal. All attempts to form a well-determined collection of any group—not excluding even the larger crustaceans, echinoderms, and medusæ—failed, and sometimes to such a degree that my assistants and myself simply felt ourselves in the midst of chaos. This may sound strange to conchologists, ornithologists, and entomologists, who can rely on splendid monographs and innumerable synopsis and similar works for classification, but it is nevertheless a deplorable fact for the marine fauna of almost all the seas. And the want is greatly felt, for the marine organisms in by far the greater number of cases require not only an outside investigation by a simple magnifying glass, but microscopical examination of anatomy and development, both embryological and larval, to state definitely to which species they belong, the sexual difference being often so great as to have given occasion to create different genera and even groups for male and female of the same species, and the larval forms in many cases being so utterly unlike the adults that they have been classified in different orders! Tornaria is now known as the larva of Balanoglossus, whereas not long ago it was

1 "Kosmologie der Babylonier," p. 315, *et seq.*
2 "Systematik und Faunistik der Pelagischen Copepoda des Golfes von Neapel," von Wilh. Giesbrecht. XIX. "Monograph of the Fauna and Flora of the Gulf of Naples," published by the Naples Zoological Station, 1892, pp. 1–831, pl. 1–54.