kind, like that involved in the preparation of the photographic chart of the heavens, it was absolutely necessary, from the magnitude of the undertaking, that a collective effort should be made. In another case, that of the British Association Committee on Luminous Meteors, which existed between 1848 and 1881, a mass of valuable work was performed (as the annual reports will testify) by the collection and discussion of observations and investigation of theories. Other instances might be adduced, but they are rather exceptional in character and distinct to the ordinary sectional work of societies.

In certain respects, it cannot be denied that the latter serve a useful purpose. Many gentlemen find it an encouragement and a source of interest to engage with others in combined work. They are thus enabled to compare notes, and it is a satisfaction to feel that a bond of association exists between them, and that they are all actively employed in a similar direction. Observations are taken, drawings are made, and many hours are spent at the telescope, which would never be so employed but for the influence of the circumstances referred to. They have the pleasure of seeing their observations in print; possibly some of their drawings are also reproduced, and the consciousness of having done something to merit public notice cannot fail to stimulate them to further effort. But, in such cases, it must be admitted that the benefit to science is inconsiderable. Very little work of real value is accomplished in this way, and in many instances the observations are not properly reduced and utilised as they should be. It is not sufficient that results of this kind should be simply allowed, year after year, to accumulate. Many thousands of drawings and observations have been made by the members of planetary sections; but we can trace very few salient facts, or additions to our knowledge, as the outcome of them all. Observers, as a rule, do not probe into their subject with sufficient depth, and ferret out all the details possible of any particular object observed. Nor is attention always directed to those points which are the most significant and suggestive. It needs a man like Mr. Marth to be the really efficient director of a section, to single out the really essential work to be performed, and then to sift it with thoroughness and critical accuracy.

To beginners sectional work is often most beneficial, as it affords them a useful preliminary training. But observers who need and will submit to "direction," except at the outset of their careers, are not generally the men who accomplish work of an important and enduring kind. The aspirations of a really capable man are not likely to be satisfied by the facilities offered by combination with many others. It has been said, "Talent does what it can, Genius does what it must." When a young observer begins to feel confidence in himself, it is, perhaps, better that he should strike out in a path of his own. There are some who will naturally be allured by the prospects of doing original work, and effecting discoveries in an independent way. They do not want to triple the channels of Mars, to distinguish the hard straight lines on Mercury and Venus, or to trace the zebra-leopard-like aspect of the globe of Saturn. But they want to do really useful work, and to rely only upon the unmistakable evidence of their eyes; in this respect, dissociating themselves from some modern observers, who can but very vaguely discriminate between romance and reality.

To sum up the matter: it appears that the organised work of "sections," though it unquestionably affords a stimulus to many, and assists in maintaining the interest in a subject, is yet, except in certain special circumstances and cases, disappointing and unproductive of results which materially advance astronomy. Individual and independent effort has hitherto been, and will still continue to be, the fountain-head of the most valuable work.

In concluding, it may be mentioned that the issues of recent planetary observation appear to be totally dissimilar to anything previously experienced in astronomical history. No two observers see alike when they examine the images of Mercury, Venus, Mars, or Saturn, and the actual character of the visible surface markings of these orbs is more an enigma than it was in the days of Herschel and Schroeter. There is also a pronounced conflict of opinion as to the utility of large and small telescopes in displaying delicate features on the planets. This want of unanimity amongst observers has become a serious question to consider; in its presence organised attempts to study the planets are of little avail, since many individuals seem to display their own particular idiosyncrasies and peccadilloes, greatly to the chagrin of every director of a section, who finds his post no sinecure.

W. F. DENNING.

Shelly Glacial Deposits.

I FEAR that the hope expressed by Prof. Bonney, somewhat incongruously in its connection, in his recent review of Russell's "Glaciers of North America," that "perhaps in future we shall hear less of rampant ice-sheets at Gloppa and Moel Tryfan!" is not destined to be fulfilled. There will be something more to hear shortly, if he care to listen, respecting that part of this ice-sheet which covered the Isle of Man. This portion was distinctly of the "rampant" type, as Mr. P. F. Kendall has already shown, carrying up shells in one place, and boulders of Foxdale granite in another, and erratics from the south of Scotland in another, as a matter of every-day work—just as recent investigations have shown to be the case in regions where to-day there are glaciers of other than the Alpine type.

I am quite in agreement with Prof. Bonney when, elsewhere in his review, he asks: "May not the difficulties of the subject be augmented by defective knowledge?" For this reason I may be pardoned for once more dragging forward the facts which I put on record some years ago respecting the shelly Basement Clay of the Yorkshire Coast. In this deposit the shells occur not only scattered throughout the clay, but also in limited patches or boulders of marine sand and mud, which are associated with similar masses of peat and mud of fresh-water origin, and with patches of shale and clay derived from the Lower Cretaceous and Jurassic strata of the country farther northward with the bedding still preserved and the characteristic fossils in place.

These facts have never been impugned, but they are rarely referred to by the opponents of the "rampant ice-sheets." They have surely a more immediate and direct bearing upon the subject than the isolated observation respecting the deposit in the neighbourhood of the Malaspina Glacier on which Prof. Bonney leans so wide a hope.

If the sands and gravels accompanying this Yorkshire drift-series be, as is usually held, the result of the washing-out of the same material, the shelly fragments contained therein are no better proof that the gravels are of marine origin than their derivative Jurassic fossils are that they are of Jurassic age.

I do not think that any one has attempted to deny that marine deposits of Glacial age may and do exist within the limits of the British Islands. But what the "extreme glacialists" wish to insist upon is that better evidence is required than the mere presence of sporadic marine organisms to prove such origin against the very strong evidence which can be adduced against it in such instances as those referred to by Prof. Bonney.

Dalby, Isle of Man, April 22. G. W. LAMPLUGH.

Sieve for Primes.

MAY I draw the attention of your readers to a series from which the primes may be recovered?

The series is given below, together with the accompanying primes.

1,	4,	11,	29,	76,	199,	521,	1364,	3571,	9349,	&c.
1.	3.	5.	7.		11.	13.		17.	19,	&c.
		2.								

The law of formation is $a_{n+1} \equiv 3a_n - a_{n-1}$.

It can be proved in various ways that the nth term of

$$(w_2 + w_3)^{2n-1} + (w_4 + w_5)^{2n-1} - 1 \equiv p.q$$

where the roots are the unreal of $x^5 + 1 \equiv 0$ and $p = 2n - 1$ is any odd prime.

Is 13 a prime? Yes; because the 7th term $(2 \times 7 - 1 = 13)$ minus unity $= 13\,q$.

Is 15 a prime? No; because the 8th term less unity is not $= 15\,q$.

These are but easy numbers to test; but the law is general. We have here an alternative test for primes.

The series given above is intimately connected with the well-known "continuant" series 1, 1, 2, 3, 5, 8, 13, &c., whose law of formation is obvious.

The connection between the two series is as follows:—

Let a, b, be any two consecutive terms of the "continuant" series.

Then $5\,ab \pm 1$ will give the corresponding term in the former series.

There are other series which produce the primes, but the above can be produced *mechanically*.

I append a short proof, out of several which may be given. We have to show that

$$(w_2 + w_3)^{2n-1} + (w_4 + w_5)^{2n-1} \equiv 1 \bmod 2n - 1$$

when, and when only $2n - 1$ is prime.

Let w_2, w_3, w_4, w_5 be the unreal roots of $x^5 + 1 \equiv 0$ and $2n - 1 =$ any odd prime, then we may say

$$\left(\frac{1 + \sqrt{5}}{2}\right)^p + \left(\frac{1 - \sqrt{5}}{2}\right)^p = 1 \bmod p$$

$$= \left\{\frac{1 + pk + (\sqrt{5})^p}{2^p}\right\} + \left\{\frac{1 - pl - (\sqrt{5})^p}{2^p}\right\} = 1 \bmod p \text{ where } p$$

is any *odd* prime.

$$= \frac{2 + 2\,p.m}{2^p} = 1 \bmod p \text{ or } \frac{1 + p.m}{2^{p-1}} = 1 \bmod p.$$

Now, by Fermat's theorem $2^{p-1} - 1 = p.n$ when, and when only p is prime. Thus

$$p.m - p.n = 0 \bmod p$$

which proves the theorem for any *odd* prime.

It is also true for $p = 2$, since by ordinary work

$$\frac{1 + 2\sqrt{5} + 5}{4} + \frac{1 - 2\sqrt{5} + 5}{4} = 3 = 1 \bmod 2.$$

Thus the theorem is universally true for all primes.

It is remarkable that the second factor of the prime series given above is also a function of the prime p, viz. :

$$1 + \frac{p-3}{2!} + \frac{p-4 \cdot p-5}{3!} + \frac{p-5 \cdot p-6 \cdot p-7}{4!} +, \&c.$$

ex. gr. the 4th term of the prime series is 29, thus

$$29 - 1 = 7\left\{1 + \frac{7-3}{2!} + \frac{7-4 \cdot 7-5}{3!}\right\} = 7\{1 + 2 + 1\} = 28.$$

As this communication is somewhat long, I reserve the proof of this.

ROBT. W. D. CHRISTIE.

April 28.

The Effect of Sunlight on the Tints of Birds' Eggs.

THE beautiful and delicate colours observed on the eggs of birds are not very fast to light, more especially when they belong to the lighter class of colours. Egg-collections should be carefully protected from the light by some covering over the case, when they are not being inspected; otherwise much of their beauty of tint becomes lost in course of time. It is gratifying to notice that in museums and natural history collections this precaution of protecting egg-cases with covers is now almost universally observed. In many instances some of the finest and most characteristic tints of several eggs disappear on exposure to much sunlight. A common example may be found in the beautiful pale blue of the starling's egg (*Sturnus vulgaris*). This, on exposure to sunlight for a few days, loses its clear blueness of tone, and becomes purplier, approaching more to the slate tint. Such is also the case with most of the greenish-blue eggs, like those of many sea-birds, the common guillemot's (*Uria troile*), for instance, the beauty of which largely depends on the clear freshness of its blue tints. The writer, some time ago, made some experiments on the fastness to sunlight of those egg-tints. The method employed was a very simple one, and may be briefly described as follows. Various birds' eggs were selected for experiment, those having decided and well-marked colours being preferred. These shells were halved lengthwise, care being taken before the operation to divide it so that each half should, as nearly as possible, present the same amount of colouring. One half was kept from the light for future comparison, while the other half was exposed in a glass case to direct sunshine. After various exposures, amounting to one hundred hours' sunshine, each exposed half was then compared with its unexposed counterpart, and the changes in hue carefully noted. Little change was visible in the darker coloured eggs of the olive-brown or chocolate depth, but in the lighter tints, especially among the blues and green-blues, the changes became more marked. Among the darker shades of eggs was the common curlew's or whaup (*Numenius arquata*), with its dull olive-green spotted with deep shades of brown; and also the lapwing (*Vanellus cistatus*), which closely resembles in general appearance that of the curlew. Such deeply-coloured eggs are little altered on exposure to light, unless after very long exposure, when they lose some of their rich warmth of tone, and become a trifle clearer in their ground tints, making them look somewhat bleached. Many sea-birds' eggs have a bluish-green colour—sea-green it might be called—which, when new and unexposed, is rich and beautiful. This clear tint, however, is lost on exposure, and it assumes a more dingy slate hue. Some of their eggs have a network of white chalk-like incrustation streaked over the bluish ground tint. This may be seen on the egg of the common cormorant (*Phalacrocorax carbo*). If such shells be exposed for several days to sunlight, and afterwards the white incrustation removed with a knife, the difference produced on the ground tint by exposure becomes at once apparent. The exposed parts will be found of a slaty, duller hue, more approaching a stone-grey tint; while the unexposed parts, protected by the incrustation, will reveal the original sea-green tint in all its freshness. Another example is the fair blue egg of the common thrush or mavis (*Turdus musicus*). This egg when newly laid is of soft light blue of a fine shade, but on exposure it loses much of this clearness of tint, and becomes dull and purply, tending more to a leaden hue. Many similar examples might be given of beautiful shades of blue and blue-green tinted eggs which all tend to become redder and duller on exposure. The red blotched egg of the fieldfare (*Turdus pilaris*) fades in this manner, and the red markings assume a lighter rusty-brown hue. The ring ouzel (*Turdus torquatus*) so well known for its predatory visits to the strawberry-beds, has an egg closely resembling the fieldfare's, both in ground tint and markings, which undergoes the same changes in every respect. One of the commonest eggs is that of the blackbird; it also loses its greenish hue and becomes more of a stone-grey, while its varied markings lose considerably in depth. In the beautiful eggs of the yellow hammer (*Emberiza citrinella*), so curiously veined and mottled with dark red-brown over a pale ground, little or no fading was visible after exposure. Its markings may thus be considered fast to light. There are but few coloured eggs which show no appreciable change after so severe an exposure test as 100 hours' direct sunlight. A good example of a fairly fast-coloured egg is that of the favourite songster the skylark (*Alauda arvensis*). Its eggs vary considerably in colour, but they are always of an indescribable hue, sometimes an ashy brown, or a dark purplish grey, other times more of a greenish tinge. These stand the light very well. The specimens tested looked only a trifle bleached, but those having the greener tinge fade more. One of the prettiest of blue eggs is that of the the common hedge-sparrow. The loss of its clear blue tint to a purplish blue drab was most marked. To illustrate the unstable nature of egg-colouring in comparison with colours of different origin, various other colours resembling in tint those of the eggs were exposed in a similar manner. These were "distemper" colours, and water colours, painted on paper, and coal-tar colours dyed on wool. The distemper colours were perfectly fast to light; their colour constituents all being of mineral origin. The water colours examined were both of mineral and vegetable origin; those belonging to the latter faded very considerably. The coal-tar colours selected were mostly of the bluish cast, corresponding to many of the egg tints. The summary of the results obtained might be tabulated as follows:—

Colours examined.	Result after 100 hours' exposure.
Distemper colours...	100 per cent. fast.
Water colours	60 ,, ,,
Coal-tar colours	30 ,, ,,
Egg-shell colours	20 ,, ,,

The above results, along with the few common examples which have just been given, readily show that eggs lose much of their delicate and characteristic beauty of tint on being too freely exposed to sunlight.

DAVID PATERSON.

Rosslyn, Midlothian.

Physiological Specific Characters.

PROF. R. MELDOLA, in his very suggestive presidential address to the Entomological Society, remarks (*Trans.* Ent. Soc. for 1896, Pt. v. p. lxxviii.):—"At any rate, it appears to me inconceivable that any change of environment requiring a modification of structure of sufficient magnitude to rank as diagnostic in the systematic sense, should not also be accompanied by a