

given if only for the benefit of those who like to make gorgeous preparations.

A small book on "Microscopical Manipulation," well up to the time, would be useful to students. We are sure Mr. Suffolk does not wish to claim this position for his digest of the older handbooks. His excuse for its publication must be that in this country there are many people who indulge in the expensive peepshows sold by our English opticians, to whom it will really be acceptable.

It must not be imagined that we for one moment object to such amusements; on the contrary, they are altogether to be commended where more serious work cannot be undertaken—and only then.

E. R. L.

*Notes of a Season at St. Moritz in the Upper Engadine, and of a Visit to the Baths of Tarasp.* By J. Burney Yeo, M.B. (London: Longmans, 1870.)

WE commend this sensibly-written and interesting little book to the notice of our readers, many of whom, notwithstanding the outbreak of hostilities between our friends across the Channel, may yet seek health and enjoyment in these remote valleys, where it is in the highest degree improbable the tide of war will ever roll. Dr. Yeo's little brochure contains all that it is necessary the intending tourist need know, and much that the invalid ought to know before starting for the Upper Engadine. To the latter class of travellers in particular it is of no slight importance to know the nature of the lodging and food they can obtain, and the advantages to be gained from a residence in a new and untried region; and upon these points Dr. Yeo's experience enables him to speak with much confidence. St. Moritz, it must be remembered, is 6,000 or 7,000 feet above the level of the sea, and the air, though bright and clear, is by no means warm. The waters contain a small proportion of iron, and are strongly charged with carbonic acid, which may perhaps act as a stimulant both to the skin and the stomach in tolerably healthy patients; but Dr. Yeo makes some judicious remarks on their effects on those who are debilitated and exhausted, and the advantages resulting from leaving off the prescribed cold bath, and glass or glasses of cold water. The last chapter contains a capital account of the Fauna and Flora of St. Moritz and Tarasp, the latter embracing between 300 and 400 plants, arranged according to their natural orders.

*Reactions-Schema für die qualitative Analyse, zum Gebrauche im chemischen Laboratorium zu Berlin.* (Berlin, 1870. Verlag von August Hirschwald. London: Williams and Norgate.)

THIS is a kind of pictorial analytical table in which the characters of the precipitates obtained are indicated by coloured oblong spaces, which will, doubtless, be found very useful for impressing the appearances of the different precipitates on the mind of the student. The borax bead obtained with a compound of cobalt is represented by a blue oval, and the effect of ammonia on red litmus paper is shown by an oblong half red and half blue. The changes of colour produced by the action of sulphuretted hydrogen on a salt of mercury are indicated by an oblong of four different colours, white, yellow, orange, and black.

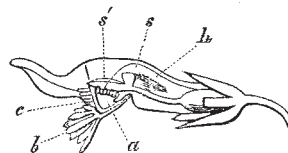
It is unfortunate that this table is not more complete; thus no means of obtaining the solution to be treated is mentioned; the destruction of organic matter before precipitation by ammonia and ammonia sulphide is omitted; the possibility of the precipitate in the third group containing phosphates, and the mode of examining it under such circumstances, is passed over entirely. The spectra of potassium, sodium, and lithium, are indicated by black lines with fine transverse white ones, representing the coloured bands, but unfortunately no means are given to show which is the more refrangible end of the spectrum. Besides these omissions there are some misprints which will no doubt be corrected in a subsequent edition.

## LETTERS TO THE EDITOR

*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.]*

### Fertilisation of *Polygala*

HAS the method of fertilisation of the milkwort, *Polygala vulgaris*, yet been described? It presents one of the most beautiful contrivances with which I have hitherto met for securing a cross through the agency of insects. The corolla consists of five petals united into one piece and folded into the form of a two-lipped tube, the upper lip of which is formed by the overlapping edges of the corolla; while the lower lip is a somewhat cup-shaped appendage (*c*), furnished with a "beard" of gland-like bodies (*b*), and opening in front by a narrow, vertical slit. The filaments of the stamens are united throughout the greater part of their length with the corolla, but expand within the cup of the lower lip into a two-lobed membrane, crowned by the anthers (*a*). The pistil has two stigmas, one of which (*s*) is



placed at right angles to the upper side of the style and is perfect, while the other (*s'*) is transformed into a spoon-shaped, petaloid prolongation of the pistil, reaching to the opening of the lower lip of the corolla, and dividing the interior of the flower into two chambers, in the lower of which are the stamens, thus completely separated from the true stigma. The entrance to the flower, below the style and in front of the stamens, is closed by hairs pointing outwards from the flower and meeting in front, on the mouse-trap principle; but a narrow passage is left open above the petaloid stigma, and is perhaps capable of a slight distension from the flexibility of the overlapping petals. On each side of the interior of the tube of the corolla, above the style and just behind the true stigma, is a group of strong, white hairs (*h*), pointing down the tube of the corolla, and meeting above the style. If we now suppose a small insect to light upon the "beard" of the flower, it is prevented from immediate entrance by the projecting hairs, but soon finds the narrow passage leading over the stigma into the upper chamber. It is prevented by the hairs in the tube of the corolla from returning by the same path, and is obliged to crawl out through the lower chamber and over the stamens; pollen from which it will, by a repetition of the same process, convey to the stigma of the flower next visited.

In the bud the anthers are in contact with the stigma, and some caution is necessary in dissecting that they may not be crushed, giving the appearance of the pollen having been deposited *en masse* on the spoon-shaped stigma. Naturally, I believe, the pollen is never shed till after the complete expansion of the flower.

I have never actually observed any insect either in the flower or sucking nectar from it, but I have almost invariably found a few small black flies upon the bunches that I have brought in for examination.

The broad and conspicuous "wings" of the calyx having fulfilled their office of "tempting insects to their food," gradually assume the green colour of the ordinary leaves, and closing over the ripening capsule, serve probably to conceal and protect it from the attacks of some enemy.

Kilderry, Co. Donegal

W. E. HART

P.S.—I have to record a similar phenomenon with respect to the holly berries of this neighbourhood to that mentioned by Mr. Henry Reeks (NATURE, June 9). I did not remark that any varieties in particular had been rejected; but few that bore fruit (of which there was a much greater quantity than usual) appeared to have lost any of it, so late as the end of May. And yet we had not fewer of the migratory thrushes than in former years, when the holly bushes were generally stripped of their berries before the end of January; and, on the other hand, we had several days of frost, extraordinarily hard for this neighbourhood. On what arguments does Mr. Reeks ground his presumption, so different from Mr. Darwin's own con-

clusions on the subject, that "berries obnoxious to birds will stand a better chance of propagating and increasing that variety?" If C. W. W. (NATURE, July 7) will turn to Letter 55 of White's "Selborne" he will find the following observation on the House Martin:—"The young of this species do not quit their abodes all together, but the more forward birds get abroad some days before the rest. These approaching the eaves of buildings and playing out before them make people think that several old ones attend one nest."

### Our Middle-Class Schools

I WISH to bring before your readers the necessity of immediate action with regard to a branch of education at present not liable to legislative interference. Government is becoming more and more alive to the fact that Education and Science at the present are England's greatest needs; hence the steps taken to extend and enforce primary education. But whilst increased facilities are being afforded to raise the standard of primary education, secondary education is at a stand-still, and upon the whole falls far short of the point it should reach. Thousands of our middle-class schools when compared with what is required, may be placed in the same category as the old dame's school when compared with the modern national school. It requires but the slightest knowledge of the subject to know that our middle-class educational system is as a whole a mere farce, and yet so averse are we to change, that matters are allowed to go on year after year in the same old matter-of-course style without the slightest indication of reform. In order to encroach upon your space as little as possible, I will in a succinct and concise form lay before your readers a scheme which has been lately mooted, which has received the sanction of the highest authorities in these matters, and which is destined ultimately to bring about quite a new system." In speaking thus indiscriminately of our middle-class schools, I do not include many excellent institutions, in which a thorough course of training forms the routine, and which are conducted by gentlemen capable and willing to do the work required. Alas that there should be so few!

Then 1st. It is well known that individual influence is of little service. This fact supports the theory that an association must be formed, consisting of the principals and assistants of middle-class schools, and others interested in the question.

2nd. This society should have certain objects, and its members combined should use their utmost endeavours to assist in carrying out these objects. A few of the aims would be as follows:—

a. The institution of normal colleges for the training of gentlemen who wish to enter the scholastic profession.

b. To recognise some examination, diploma, &c., as sufficient guarantee of the capabilities of gentlemen entering the profession, and insist that such gentlemen shall have this diploma. The evils arising from the incapability of so many of our masters cannot be over-estimated.

γ. The necessity of Government or other central supervision and examination of every school. At the present moment the standard of a school is calculated by nothing. An advertisement perhaps appears, stating that *all* boys sent to special examinations have passed; and instances are known where *one* boy has been sent up to such examination. It is impossible to decide upon the general tone of a school by the examination of a *few* of the best boys.

δ. The institution of a club-house in London where appointments could be made, business transacted, &c., and attached to it some means by which the incubus of agents could be avoided.

e. Periodical meetings, &c., &c.

I am afraid this letter is running to an inordinate length, but I just wish to add that invitations have been issued by the editor of the *Quarterly Journal of Education* to a few representative gentlemen for a private preliminary meeting to be held in September next, when the above scheme is to be discussed. Any gentleman wishing to take part in that meeting should address the editor upon the subject. I might have referred to the failure of the College of Preceptors to do the least good. What we must have is an obligatory examination of the whole school, and every school; not leaving it to the whim of the principals. Neither are assistant masters treated as they should be by the College of Preceptors.

X

### The Source of Solar Energy

MR. GREG ascribes to me views I do not hold, and then employs my own reasoning to overthrow them. He must have formed his conceptions of my theories from Prof. Pritchard's critique of my "Other Worlds"—a most unreliable source.

To begin with,—I do not believe that the solar heat supply is solely derived from the downfall of meteors. I have impressed this very clearly at p. 54 of my "Other Worlds."

I do not believe that *any part whatever* of the solar heat supply is derived from meteoric percussion, nor that any meteor ever comes within tens of thousands of miles of the sun's surface in the solid state.

Mr. Greg is very careful to show me that the meteor-systems encountered by the earth cannot fall into the sun. I dwell on this very fact at p. 203 of "Other Worlds"—I say, *totidem verbis*, that no known meteoric system can form a hail of meteors upon the sun. "It is forgotten," says Mr. Greg, "that the meteors themselves revolve round the sun," &c. If he has at any time forgotten this, I certainly have not.

"Has it ever been proved," he asks me, "that the entire mass of meteors constituting the zodiacal light, is either composed of matter in a solid state, or, if it were, that its mass would be equal to that of our own earth?" I answer, as Mr. Greg would—"No, it has not been proved, nor is it by any means probable."

There is nothing new to me in Mr. Greg's letter, and little which I have not described myself long ago in the *Intellectual Observer and Student* of 1867, 1868, and 1869. To suppose that I should venture to treat at all of meteoric astronomy, in ignorance of such elementary facts—the very A B C of the science—is not complimentary. Mr. Greg might, at least, have examined what I have written before assigning to me the absurdities he attacks so successfully.

The fact is, this matter of the solar energy only comes in *par parenthèse* in my "Other Worlds." I express no confident opinion whatever about it. I point to some deductions from known facts, and respecting them express a certain feeling of confidence. It is not my fault (nor, indeed, can I blame Mr. Greg) if Prof. Pritchard has tacked my words "I am certain" (used with reference to reliable inferences) to a theory respecting which I have distinctly written, that "I should not care positively to assert" its truth. Even that theory is not the absurd one attacked (very properly) by Mr. Greg.

For the rest, most of Mr. Greg's letter is sufficiently accurate, but there are two mistakes in it.

1. We have abundant evidence that the density of the aggregation of cometic perihelia increases rapidly near the sun. For example, whereas between limits of distance 40,000,000 and 60,000,000 miles from the sun this density is represented by the number 1.06, it is represented by the number 1.67 for limits 20,000,000 and 40,000,000 miles, and by the number 8.65 within the distance 20,000,000 miles. The evidence derived from this observed increase of aggregation is not affected by what we know of those cometic or meteoric systems whose orbits nearly intersect the earth's (for they must form but the minutest fraction of the total number) nor by the observed minimum perihelion distance of cometic orbits (for observed comets are but the minutest fraction of the total number).

2. It makes no difference whatever as regards the force-supply of the solar system, whether the substance of a meteor reaches the sun in the solid, fluid, or vaporous state. Given that the substance of a meteor, moving at one time with a certain velocity at a certain distance from the sun, is at another time (after whatever processes) brought to rest upon or within the sun's substance, then either the "force-equivalent" of its motion has been already distributed or the substance of the meteor is in a condition to distribute that "force-equivalent" mediately or directly. In other words, either heat and light have been already distributed, or the central energy has been recruited to the full extent corresponding to the mass, motion, and original distance of the meteor.

I may express here my agreement with the opinion of the Editor of NATURE that the observations made on the zodiacal light by Lieut. Jones and M. Liats ought to be taken into account in any theory of that mysterious object. Taken in conjunction with the other known phenomena of the zodiacal light, they admit of but one interpretation as to the position, dimensions, and general characteristics of the object. Taken alone, we might infer from them that the zodiacal light is a ring of bodies or vapours travelling around the earth (at a considerable distance);