

and the whole of the electrical conducting materials are suitable to its demonstrations.

The one represents a patentable improvement, the other a discovery too great and of too wide bearing for any one to be justified in holding it by patent, and claiming as his own, that which belongs to the world's domain.

D. E. HUGHES

London, July 2

### Insects Corroborative of the Nativity of Certain Plants

WHETHER certain plants are, or are not, natives of Britain is a question that often exercises botanists, and any new evidence on the subject is always acceptable. It has recently occurred to me that a certain kind of evidence may be obtained by studying the insects attached to such plants. The question is one of interest not only to phyto- but also to zoo-geographers; for if the species of plant to which an insect is restricted is proved not to be indigenous then the insect cannot be indigenous either. If, on the other hand, the plant is only doubtfully an alien, and the insect is not one that might be easily introduced, then the probability is that the plant is a true native.

The plant that has suggested this idea to me is the wild or yellow balsam, *Impatiens noli-me-tangere*. This plant is reported from twenty-seven counties or vice-counties, but in most of these it seems to be admittedly an "introduction." Mr. H. C. Watson, the indefatigable author of the "Cybele Britannica," &c., seems to think that its claim to being indigenous is very slight, for he writes ("Topographical Botany," part 2, p. 607):—"If the *Noli-me-tangere* be really native here it must be so very locally: say, in North Wales and Westmoreland." Sir J. D. Hooker ("Student's Flora," first edition, p. 80) says, "Probably wild in North Wales, Lancashire, and Westmoreland;" Prof. Babington ("Manual," seventh edition, p. 72) does not mark it as an introduction, but Hooker and Arnott ("British Flora") regarded it with doubt; finally Hudson ("Flora Anglica," 1762, p. 332) thought it in his day truly wild in Westmoreland. It is evident, therefore, that the *Impatiens noli-me-tangere* is looked upon with suspicion by many of the present race of botanists, and probably rightly so in many of the "stations."

There are two species of Lepidoptera attached to this plant, and, I believe, restricted to it. One of these—*Lygris reticulata*—has been for a number of years known as a native of Westmoreland, where, on the banks of Windermere, it occurs very rarely. Its connection with the *Impatiens* in this country was not, however, known till very recently, when Mr. J. B. Hodgkinson, a well-known Yorkshire naturalist, traced it to its headquarters amongst the plant, where he also, still more recently, found the other Lepidopteron—*Penthina postrema*—which is attached to the balsam. Both of these insects are far from common (though *Lygris reticulata* is, like its food-plant, widely distributed—even as far as Siberia), and their occurrence in Westmoreland seems to me conclusive that the *Impatiens* is really indigenous there.

As apparently opposed to my theory, it must not be forgotten that there are several plants, certainly introduced into Britain, which have insects attached and restricted to them. Amongst others are the spruce-fir and the larch. On the spruce the following insects occur: *Eupithecia togata*, *Semasia nanana*, *Asthenia strobilella*, *Coccyx hercyniana*, &c., and on the larch *Eupithecia lariciata*, *Boarmia crepuscularia*, *Spilonota lariciana*, *Coleophora laricella*, &c. But it must be remembered that the spruce and larch are perennial trees (while the *Impatiens* is an annual plant), and that they are frequently imported in the form of young trees, or as undressed timber, and sent hither and thither all over the country. Hence the insects attached to them have many chances of being introduced, and of establishing themselves where the conditions are favourable.

It is possible that some of the insects I have last mentioned may have transferred themselves from the native coniferæ to the introduced ones, but I do not think this is likely. A few species live on the introduced as well as the native trees, as, for example, *Myelois abietella*, upon scots-fir and spruce, and the rare beetle *Dendrophagus crenatus*, upon scots-fir and larch, as I noticed when investigating the natural history of Aberdeenshire some years ago.

It is desirable that all the "stations" in which there is any doubt about the introduction of the *Impatiens* should be searched for the insects mentioned above, for it is not likely that they

are confined to Westmoreland; and should they be found in any other locality, the probability is, it seems to me, that there the plant is really indigenous.

F. BUCHANAN WHITE

Perth, July 5

### Physical Science for Artists

SOME years ago, in Madeira, we had been watching a glorious sunset from the hills above Funchal; and, on turning to go eastward, we saw the sky before us suffused with a bright rosy tint, which ended abruptly beyond the Desertas, at some little distance above the horizon-line of the Atlantic.

At first it did not occur to us what was the cold blue-grey form that rose into the pink flush above, slowly losing its definition of outline as it gradually grew higher.

But this strange silhouette had so distinctly mountain outlines that, almost at once, we recognised the fact that we were looking at the shadow of Madeira cast by the setting sun on the mist.

This phenomenon may not be unusual, but I do not recollect having seen it described; and it is perhaps sufficiently different from the phenomena described by Prof. Brücke and Mr. F. Pollock to be worth recording.

G. HUBBARD

### Remarkable Form of Lightning

I AM able to confirm the fact that lightning occasionally takes the "punctuated" form described by Mr. Joule in NATURE, vol. xviii. p. 260. Some forty years ago, in a thunderstorm which I had the good fortune to witness at Ampton, in Suffolk, the lightning (with heavy rain) was almost incessant for half an hour or more, and about a quarter of the flashes (speaking from memory only) presented this unusual appearance. I have often looked out for it since, but only once with success, and then it only showed itself in a single flash out of many. On both occasions the "punctuated" flashes presented in general a curved or sinuous line without sharp angles; and two or three of them in the first-mentioned storm appeared to my eye as closed curves, one an almost perfect figure of 8; but their dazzling brightness made it impossible to speak to this with certainty.

London, July 8

E. J. LAWRENCE

### Microscopy. The Immersion Paraboloid

THE immersion paraboloid illuminator exhibited at the recent *soirée* of the Royal Society as designed by me, proves to have been anticipated in principle and construction by Dr. John Barker, of Dublin, from whom a paper on the subject will be found in the *Proceedings* of the Royal Irish Academy for 1870.

An immersion paraboloid illuminator was also described by Mr. Wenham in the *Transactions* of the Royal Microscopical Society for 1856. My paper on the subject appeared in the *Monthly Microscopical Journal* for August, 1877, but that journal being defunct, I ask you to allow me to credit these gentlemen with a priority which, on perusing their papers, I find to be due to them. I ought to add that, until the construction by Messrs. Powell and Lealand of my illuminator, the device had never come into practical use, and that, so far as I can learn, no reference to it exists in any optician's catalogue or textbook on the microscope.

JAMES EDMUNDS

8, Grafton Street, Piccadilly

### Review of Henfrey's Botany

ALLOW me to correct an error which Mr. Bennett has made in his review of "Henfrey's Elementary Course of Botany" (NATURE, vol. xviii. p. 217). He adds a note as follows:—

"Evidently by an error of the press, the continued fraction of which the most common angles of divergence are successive convergents, is given as  $\frac{1}{2} + \frac{1}{1} + \frac{1}{1}$ , instead of  $\frac{1}{2} + \frac{1}{1 + \frac{1}{1}}$ , &c.,

a correction needful to render the sentence intelligible to the student."

My note (p. 44) is as follows:—

"The mathematician will observe that these fractions are the successive convergents of the continued fraction  $\frac{1}{2} + \frac{1}{1} + \frac{1}{1}$ , &c."

I subjoined it for the sake of mathematical students only, who would know what Mr. Bennett does not seem to be aware of, that the method of writing the continued fraction I have adopted,

is simply a convenient way of expressing it in one line; and it is *not* printed as he has misquoted it above.

GEORGE HENSLOW

6, Tichfield Terrace, Regent's Park, N.W.

[I am obliged to my friend Mr. Henslow for correcting my oversight in not accurately noting the form of his formula. The fact, however, that the sentence is, as, Mr. Henslow admits, put in a form which is adapted for "mathematical students only," in a work intended for beginners, seems to furnish a strong justification of the main point of my criticism.—A. W. B.]

#### Alumina

It may interest your readers to know that pure alumina dissolved nearly to saturation before the blowpipe in an *acid* flux, such as a bead of phosphoric acid, invariably causes that to assume a pale but beautiful sky blue on cooling.

In an *alkaline* flux such as a bead of boric acid containing sufficient soda to dissolve it to saturation, alumina causes the bead to assume a pale red colour on cooling.

The greatest care has been taken to ascertain that the materials are absolutely free from any metallic or other oxide which might produce such colours, and the resulting beads have been shown to several gentlemen, as Messrs. Hunt and Roskell, Mr. Hutchings of Freiberg, and others.

Might not these facts then afford us some clue (so much wanted) to the cause of coloration in the sapphire and ruby?

London, July 1

W. A. ROSS

#### A Subject-Index to Scientific Periodical Literature

I HAVE been occupied for years in drawing up a classified index, not only to the titles of papers, but to what is still more wanted, to the facts contained in those papers. As yet I have met with scant encouragement.

A. RAMSAY

Kilmorey Lodge, 6, Kent Gardens, Ealing, W., July 8

#### CLUB-ROOT

ALL our readers who are agriculturists or practical gardeners will be familiar with the disease called in England "Club-root," or "Finger and Toes," or "Clubbing." It seems almost to confine its ravages to cruciferous plants, and often causes great destruction to large crops of turnips, cabbages, cauliflowers, not to mention what disappointments it may occasion to the growers of wallflowers, Brompton stocks, candytufts, and many other favourite flowers belonging to this large natural family. Not only is it well known, but it has often been written about, as the pages of our contemporary, the *Gardeners' Chronicle*, and most works on the cultivation of gardens, will abundantly prove.

The question of what did it consist of was often asked, and the answer was that it was caused by some insect or another, and some poor beetles and flies were signalled out as those which laid their eggs in the tissues of the young roots of the plants attacked, and, if we are not mistaken, this is the general belief to this present moment. The explanation never was, however, satisfactory. True, in the advanced stage of this disease insect larvæ were to be found in the club-like swellings of the roots; but in the very early stages no trace of larva or egg of any insect was to be seen, and yet the club-root disease was clearly there.

In the *Botanische Zeitung* for May 14, 1875, there appeared a short abstract of a paper read by M. Woronin, before the Botanical Section of the Natural History Society of St. Petersburg, on the 5th of March of the previous year, on the cause of this disease, and within the last few weeks we have received the full memoir, illustrated with upwards of fifty figures. This memoir is in Russian, but, thanks to a colleague (Prof. R. Atkinson), the writer has been able to glean a notion of its most interesting contents, in which he has been much assisted by the beautiful figures. The disease is

known in Russia as "Kapustnaja Kila" (Kapusta = Cabbage, Kila = Hernia). About three years since it was so extremely prevalent that the vegetable crops about St. Petersburg failed, and the government ordered an investigation, from which much information was obtained as to the means adopted in different countries for its cure: such as sowing the ground, before planting the crop, with common salt, wood ashes, or, before all, soot. Every one knows, too, that in transplanting the young crucifers into their permanent beds that it is customary to pinch off the swollen portions, and then, if favourable weather followed, the newly-formed roots could well keep ahead of any fresh appearance of the disease. But M. Woronin went scientifically to work, and he was not long in discovering that the cause of the disease was a parasitic vegetable which seemed to have some affinities with the Myxomycetes on the one hand, and the Chytridiaceæ on the other, and the result of constant researches carried on through 1875, 1876, and last year, have resulted in nearly the whole life-history of this new plant being discovered. It is called *Plasmidiophora brassicæ*, and is decidedly very nearly allied to the Chytridia, but the new forms of this group daily coming to light, appear so different in their development, that much more must be known about them ere any satisfactory classification can be attempted. One most striking feature in the new plant is indicated by its generic name; this will be best understood by a short history of the plant's life. Take an old well-developed knob off a club-root, and examine the tissue; most of the parenchymatous cells will be found enlarged, their starchy contents gone, and they themselves gorged with a mass of spore-like bodies; by the ordinary disintegration of the cellular tissue these spores will get released, and after a lapse of six days, out of each spore will proceed the whole of the contents, which, colourless, but nucleated, will move about like so many minute amœba; these plasmodia will then attach themselves to the delicate root-hairs of the nearest young cruciferous seedling. One end of the plasmodium is attenuated like a cilium. The spores soon penetrate into the cells, where they will look just like Myxamœbæ. Filling the cells up with delicate plasmodic projections, they will next soon develop lots of spores, which will further contaminate the cellular tissue of the root, and in process of time the formation of the clubbing will be seen.

Sometimes the ripe spores are spherical, sometimes they are twin-like, or lenticular. If cabbage or turnip seeds be sown in a watch-glass and supplied with distilled water, and shortly after the first appearance of germination, a number of spores of *Plasmidiophora brassicæ* be added to the water, these will be found to at first float freely in the water, but sooner or later will sink and attach themselves to the delicate root-hairs of the little seedlings, and in this way their whole history, so far as now known, may with facility be traced. It seems noteworthy that the whole mass breaks into spores all at once, as in Chytridium proper. There would seem to be as yet no conjugation detected, and the plasmodia would appear as if they absolutely engulfed the starch granules on which they feed.

It must be a matter of regret that this memoir is written in a language known unfortunately to so few scientific botanists. If the learned author knew only Russian it would be absurd and unreasonable to record this regret, but to one knowing French and German, as M. Woronin does, it would have been no trouble to have increased a hundredfold the grateful readers of this important memoir.

E. PERCEVAL WRIGHT

#### SCIENCE IN SCHOOLS

THE following article on Sir John Lubbock's Bill on the introduction of science in elementary schools appears in Monday's *Times*:—