

Having made this assumption, the rule that the sum of the squares of the remaining errors is a minimum follows very simply: *vide* the late Memoir of Hansen, art. 3.

With regard to the practical application of the Method of Least Squares, I think the whole honour of its introduction belongs to Gauss. The rules which he and his scholar Encke have given for the application of the method, and for executing the numerical operations, are so complete and perfect that but little more can be desired.

Washington, July 4

ASAPH HALL

Solar Rainbow

ON the 10th instant at about half-past seven in the evening I saw part of a well-defined rainbow about 5° west of the zenith, the convexity of the bow towards the setting sun, which at the time was about 3° above the horizon. Light clouds were passing beneath the bow. There was no rain.

Brighton, July 15

GEORGE DINNOW

Hive Bees *v.* Mechanism

I HAVE never followed Huber through his wonderful researches into the astounding working proceedings of hive bees—that elder Huber, who, by the way, aided by so admirable a spouse, brought his researches to so successful an issue, notwithstanding his blindness. Hence my excuse, if what I attempt to describe as being original to my own sense of observation, prove not so to others. I think it is conceded universally that amongst other leguminous plants peas have ever been secure from cross fertilisation, one variety with the other, in so far as natural influences, insect agency, &c., are concerned. Our stocks of garden peas, though known to run weedy and grow inferior when cultivated too long upon one kind of soil, very rarely, if ever, sport or vary as other plants placed in juxtaposition of species, especially varieties, are known to do. So decidedly has this fact been confirmed, that invariably sweet peas, even when it is desirable to grow them true to name, are sown in rows, side by side, whites, scarlets, blues, &c., with the utmost impunity. And this is wholly owing to the fact that the floral envelopes are so securely wrapped around the pistil and the stamens, that these parts cannot be reached without the exertion of more power than the strength bees and similar winged insects are supposed ordinarily to possess; unless, indeed, mechanism be called to their aid—a science in itself, but which, nevertheless, has been resorted to in the instance to which I would direct attention. Here then the hive-bees methodically bare the stamens by sheer mechanical force, and rob each of its load of pollen by sense of touch alone. And this they do in this wise. Alighting on the *ala* or “wings” of each bloom, they first of all press their heads up under the base of that part of the papilionaceous corolla called the “standard,” or *vexillum*, and extract what nectar they find. Then, with their little heads firmly pressed therein, and holding fast by the four fore legs, they exert their power, thus artificially contrived, by treading down both the aforesaid wings and the “keel,” or *carina*, which so securely envelopes the sexual organs, that they protrude, so that the anthers are laid bare, when they generally rub the pollen off the stamens on to their hairy bellies, only occasionally using one hinder leg to aid them. It will be seen that they do this with their hinder legs and body, at a time when their heads are entirely hidden from view. I have tested these parts in regard to the pressure needed to disclose the pollen thus, and find that a pressure of half to three quarter ounce is necessary; and computing the weight of an individual bee to be about the sixteenth of an ounce, we see what an amount of power must be exerted in this hind-before, or blindfold manner, by these interesting little creatures.

I should add, however, though I have been a selector of sweet peas for more than a dozen years in other parts of the country, as the selection sold by some seedsmen with my signature attached confirms, I nevertheless have not previously believed in any power possessed by insect agency to thus destroy selections. Here, at Valentines, however, being only seven miles from London, it would appear that the bees, like town sparrows, are unusually “wise in their generation,” and that, owing to scarcity of honey-yielding materials, they are driven to such wonderful feats as I have explained.

WILLIAM EARLEY

The Gardens, Valentines

The Red Rocks

IF the peroxide of iron was deposited (as in the Swedish lakes) as brown hydrous peroxide, and if long boiling in the laboratory may be considered analogous to evaporation in an inland sea, then it would appear from the following extract from Watt's “Dictionary of Chemistry” that there is no difficulty in accounting for the colour of the red rocks:—

“A remarkable insoluble modification of ferric hydrate is produced by boiling the ordinary yellow hydrate to $2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ (precipitated from the chloride by ammonia) in water for seven or eight hours. The colour then changes from ochre-yellow to brick-red, and the hydrate thus altered is scarcely acted upon by strong boiling nitric acid, and but very slowly by hydrochloric acid. In acetic acid, or dilute nitric or hydrochloric acid it dissolves, forming a red liquid, which is clear by transmitted, but turbid by reflected light; is precipitated by the smallest quantity of an alkali salt or a sulphate; and on addition of strong nitric or hydrochloric acid, yields a red granular precipitate, which redissolves on diluting the liquid with water.”

The change of colour from brown to red is readily obtained by boiling the hydrate in a flask for several hours, as described above. The change is gradual, and before becoming finally red the precipitate is of a chocolate colour, corresponding with that sometimes observed in the red sandstones.

Small pieces of white sandstone, introduced into the flask during the boiling, are of course coloured red, and resemble red sandstone when taken out and dried.

R. D. P.

Instantaneousness of Lightning

DURING a recent night thunderstorm I got out my colour-top, with the usual disc of so-called primary colours arranged to blend into grey or white on rotation, in order to show to my children the instantaneousness of the lightning, and that by its light the disc would, as I had no doubt, appear stationary in one or several successive positions according to the character of the flash, as it does by the light of an ordinary electric spark from a Leyden jar or induction coil. On trying the experiment, however, by turning the disc (about forty times in a second) at a window in a dark room opposite to the cloud in and from which the discharges were taking place, I found that this was only very partially the case. When the direct stroke was actually visible, or only slightly veiled by cloud, the effect I looked for was produced, the bands of colour standing out clear and apparently motionless; but at other times during the apparently (to the eye) prolonged flash, the colours blended so as to indicate a continuous fainter light in addition to the occasional instantaneous appearance of definite colour and form due to the intermittent light of the discharge. Of course I satisfied myself that there was no other light to account for this, the night and the room being very dark in the intervals of the flashes, and I repeated the experiment in another night storm (on the 11th) with just the same result. The effect appears to be due to the retention of light in the cloud by phosphorescence, and, so far as I can find on inquiry, does not seem to have been noticed before.

If my view is correct, it would explain the fact that distant lightning at night, when no cloud is in sight, is apparently so much sharper than when nearer.

A propos to the subject, a letter to the *Times* describing the storm of the 11th inst., speaks of the lightning “flickering with a perceptible rustle”—a curious instance of transference of impression from one sense to another, the visual sensation of flickering being exactly analogous to the auditory sensation of rustling.

B. W. SMITH

Hampstead, July 20

Severe Thunderstorm

A HEAVY thunderstorm passed over this neighbourhood this afternoon. One of the flashes was followed by a smart “snap” like that of the discharge of a large Leyden jar, or the explosion of a heavy percussion cap. The interval between this noise and the crash of the thunder was about half or three-quarters of a second. I have not infrequently noticed a hissing noise immediately preceding a violent clap of thunder, but never anything so distinctly resembling the sound of the ordinary electric spark.

ALEX. BEAZLEY

Willesden Lane, Kilburn, July 23