are chromolithographed from the author's own drawings, which appear to be exceedingly well done. We defer a more extended notice until more parts shall have appeared, especially because the subjects illustrated in the first part are almost the least difficult for the chromolithographic process. The text is clearly printed, but a little more care in writing the short descriptions should be exercised. Thus at the very commencement we read as one of the characters of the family *Papilionidæ*, "Larva cylindrical, not spiny, furnished with two retractile tentacles on the second segment." We doubt if this is correct for *all* the European species of *Papilio;* it certainly is not so if exotic species of the same genus are considered; and almost immediately afterwards the author, in defining the genus *Thais* (one of the *Papilionidæ*), says, "Larvæ armed with spines." Nowhere do we find any reference to the veining of the wings, which certainly should have formed part of the sketch of the principal groups given in the Introduction. The author will do well to consider the importance of this suggestion. We presume the chief object of the work is to enable collectors of European butterflies to name their captures, and especially by means of the figures. For this purpose it promises to be exceedingly well adapted.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Chemical Equivalents

MR. J. P. O'REILLY'S paper in your last number (p. 274) appears to involve a complete misconception of the theory of chemical equivalents. The equivalents are mere ratios, and are not altered by multiplying their representative numbers throughout by any factor, whether π or any other.

In fact we may write the equivalents of hydrogen, carbon, and oxygen as x, $12x$, and $16x$, without troubling ourselves about the value of x. This is not only the theoretical view, but the one actually used in practice. So far, there is nothing new or special about writing, as Mr. O'Reilly does, $x = \frac{1}{3}\pi$.

But then Mr. O'Reilly goes wrong, and gets results which contradict his hypothesis. When he writes $H = \frac{1}{3}\pi$, and $O = 5\pi$, the real inference is that the equivalents of H and O are as 1 : 15, instead of as 1 : 16 which he started from.

If his π-values are to be taken as corresponding with the equivalents, this simply means that the latter are not to be depended upon within a limit of error of 5 per cent. I think the mistake is not in this respect, but in overlooking the circumstance that the chemical equivalents are not absolute values, but ratios.

July 24 C. W. M.

Slow Lightning

HAVING just seen the statement of Prof. Tait (NATURE, vol. xxii. p. 341) quoted, as a final authority, against the possibility of distinguishing the source from the termination of a lightning flash, I wish to record a storm that I saw. On May 19 there had been a brisk, hot south-west wind blowing at Gizeh, off the Libyan Desert, at about or over 100° F.; at near sunset a north wind began to come up against it, and there was heavy thunder and lightning all along the line of the mingling of the winds, extending as far as I could see to east and west, and passing a few miles to the north of the Pyramids: the lightning was solely between the clouds, at a height of about one and a half miles; the air around me was 94°, though almost dark. I sat on a rock in front of the door of my tomb (from which I could see eighteen miles over the Delta) and quietly watched the lightning. To my sight there were distinctly differences in the duration of the flashes: some appearing instantaneous and others in which I could see a spot of light occupying an appreciable interval to travel from one cloud to another; and I should be puzzled to draw a hard and fast line between the classes. Does this moving spot-lightning merge insensibly into the variation, of which I saw a fine case years ago near Guildford, where a spark would slowly sail down in the air and then move over the ground before it disappeared?

In any case can these slow flashes (lasting perhaps half a second), seen as well as instantaneous flashes, be disposed of by that blessed word *subjectivity*, which is so comforting to theorists on many objects? Or may not the confession of our ignorance of the cause of ball-lightning be extended to slow flashes in general, instead of treating them just as meteorites were put out of court a century ago? W. M. FLINDERS PETRIE

Bromley, Kent

[Several instances are recorded by Faraday, Joule, and others of flashes which seemed to last for a sensible time. But they are easily explained by one or other of two *veræ causæ*, viz. (1) oscillatory discharges along the same path, succeeding one another at smaller intervals than one-seventh of a second; or (2) phosphorescent matter in the track of the flash. More definite particulars would be necessary before one could decide which was active in the present case.—ED.]

Thought-Reading

As having a bearing upon the hypothesis that in "thought-reading" the information is transmitted by unconscious muscular exertion, allow me to state a modified form of the experiment I tried in the presence of two or three others with Mr. J. R. Brown, who, a few years ago, attracted considerable attention in various parts of the United States by doing precisely what is related of Mr. Bishop in your issue of June 23 (p. 171). After witnessing experiments of the same kind as those stated by Mr. Romanes and performed under the same conditions, I thought to vary them by using a flexible copper wire as a connecting medium. Selecting one, two or three yards long, I held one end in my hand, while Mr. Brown, winding the other end once or twice around his fingers, held it against his forehead, the wire being all the time kept slack between us. Here evidently there could have been no indications received through muscular movements. Yet in this way Mr. Brown would find things concealed or go to certain points determined upon, though apparently with not quite the same readiness and confidence as when the subject's hand was placed against his forehead. Once he partially failed, selecting, instead of a particular spot on the wall I had fixed my mind upon, a small object near it. The experiment in this form was tried with another as his subject, and with equal, if not better, success. GEO. B. MERRIMAN

Rutger's College, New Jersey, July 11

Optical Phenomena

THE photographic halo phenomena described in NATURE, vol. xxiv. p. 260, seem analogous to some observed by me, and upon which, in the spring, I read a paper (since published in the *Notices*, vol. xli. No. 6) before the Royal Astronomical Society. In this I described that not only the sun's disk and the moon's full and partial phases, but also apertures (of similar shape to these) in the shutter of a dark room, when photographed, were, one and all, surrounded by a strong ring halo not visible to the eye. A correspondent essayed some time since to prove in your journal that this halo only surrounded the moon when at full, but on trial the question proved one of time of exposure; and it now seems pretty clear that whatever may be its form and nature, a very bright object when photographed (especially in relief against a dark ground) is found, if sufficient exposure be given, surrounded on the plate by a halo separated from the object by a dark space. Mr. Cowper Ranyard and others attribute these halos to reflection from the back of the plate, a point on which I have not experimented. The dark spot mentioned in connection with the aperture in the rock is probably a reversal of the brightest light owing to the length of exposure.

In two seconds, with Wratten and Wainwright's instantaneous plates, I have found the sun's image so reversed in a camera landscape, showing as a white spot on the negative and a black dot when printed. J. RAND CAPRON

Guildown, July 23

Symbolic Logic

MR. MCCOLL still expresses surprise at my declining to answer a Yes or No question which he was pleased to put to me in

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