current between the equator and the doldrums is always from some point near east."¹

Here, then, was another actual confirmation of Siemens's theory. Two facts—the diffusion of the Krakatã dust, and Abercromby's observations—supported Siemens's theory of air circulation, yet doubts were not quite removed. Voices were loud against the Krakatã hypothesis and against Abercromby's observations, which allowed another explanation to appear possible. Meteorologists delayed mostly to accept Siemens's theory, because a theoretical, mathematical establishment of it was still lacking. But this was given, as before observed, by Oberbeck, a year or so ago. He arrived at formulæ by which Siemens's theory could be reproduced.

Now, in fact, nothing more was wanting. Siemens's system was confirmed on all sides, by facts and by mathematical treatment. The chief merit for this is certainly due to Oberbeck. Before I bring to your notice the system of the general circulation of the atmosphere, such as it is given by the present state of research, I must allude to one other point in Siemens's exposition—namely, the influence which the general circulation of the atmosphere should have on the origin of cyclones and anticyclones in our latitudes.

The origin of the maxima ought to be due to the fact that the air flowing from lower to higher latitudes is checked in consequence of the convergence of meridians, and so produces an increase of pressure. Thus we get the maxima, or anticyclones. If, then, in consequence of this increase of pressure below, air flows out laterally, and, in consequence of the interference, the confined current turns more to the eastward, it must carry the lower strata with it, and give rise to a rarefaction, causing a minimum or cyclone. But this is carried away as a whole by the general current, and thus the progression of cyclones is also explained.

Siemens holds very strongly to this explanation, principally because it contains a force which explains the energy which is accumulated in anticyclones and cyclones, and which refers finally to the heat of the sun, that maintains the general circulation. But I fear he has overshot the mark here. The meridians converge in the southern hemisphere the same as in the northern. Why, then, do almost constant west winds prevail there below, without interference of currents, while with us an almost uninterrupted system of driving cyclones and anticyclones exists? Does not this prove that in the formation of cyclones and anticyclones another factor is at work, and might not this perhaps depend on the peculiar distribution of land and water in the northern hemisphere? Upon this point Siemens will have to modify his views.

From my analysis we can easily sketch the outline of the general circulation of the atmosphere which corresponds to the present state of the science.

In consequence of the unequal heating of the sun and of the rotation of the earth, air currents occur at all parts of the globe. These currents are easterly between 35° N. and 35° S. latitude, and westerly outside this zone.

In the former zone the easterly currents on the earth's surface (in the northern hemisphere) are more north-easterly and northerly the nearer we approach latitude 35°, while in the higher strata they constantly become more southerly as we approach latitude 35°. This explains the circulation between the equator and latitude 35°. *An upper south-west trade-wind entirely fails in this region.*² At or near the equator a calm zone must be formed at the earth's surface, where the meridional components of the north-east and south-east trades ascend, but the height of the calm-zone cannot be considerable. Exactly over the calm-zone a pure east wind and the strongest of the whole zone will blow, and the higher the strata under consideration the stronger it will be.

In latitude 35° N. and S., calms exist at the earth's surface. The air, which has an ascending motion in the equatorial calm, has here a descending movement. But above, the current directed polewards continues to exist. Outside this great region, to the north and south, west winds will prevail; while above, the south-west (or the north-west) trade-wind blows, which in higher latitudes will become more and more westerly. At the earth's surface, air in south-westerly or north-westerly

motion flows from the zone of high pressure at latitude 35°, which becomes more westerly with increasing latitude. At a mean altitude, however, air flows again from the poles towards latitude 35° as a north-west wind.

This is the picture of the general circulation of the atmosphere according to the latest researches. There is undoubtedly much to be completed, and it presents many dark points which remain to be cleared up, but on the whole it possesses every guarantee of truth and reality, and will doubtless soon be generally accepted. The question of the effect upon cyclones and anticyclones of this general circulation of the atmosphere will certainly come to the front, but we shall have to wait for a considerable time for a satisfactory solution of the problem.

RELATION OF VOLTAIC ELECTROMOTIVE FORCE TO MOLECULAR VELOCITY.

IN a recent research published in vol. viii., p. 63, of the Proceedings of the Birmingham Philosophical Society, 1892, it is shown, by means of an extensive series of sixty-four tables of measurements of mean voltaic electromotive force, that the *dilution* of the liquid of a voltaic cell by means of water or alcohol, the *liquefaction* of either the positive or negative metal of the cell by means of mercury, the *dilution* of either of these amalgams by means of mercury, or the *dilution* of one solid metal by means of another in an alloy, is universally attended by an increase of mean electromotive force of the diluted and diluting substances, and consequently also of the actual electromotive force of the diluted one, provided that in all cases no chemical union or other chemical change occurs in the mixture. The manifest explanation of this extensive general result is that, by the act of solution or dilution, the molecules of the active substance are separated farther apart, and consequently acquire increased velocity of motion. In proportion, however, as chemical union occurs, the gain of electromotive force diminishes and is converted into a loss, and the loss is larger in proportion as the chemical union is stronger. The method enables chemical compounds in alloys, amalgams, and electrolytes to be distinguished from mere mechanical mixtures.

G. GORE.

SCIENTIFIC SERIALS.

In the *Botanical Gazette* for February and March, Miss Alice Carter has an interesting paper on evolution in methods of pollination. She points out that the larger proportion of Monocotyledons are either anemophilous or hydrophilous, and this is undoubtedly an earlier method of pollination than the entomophilous. Of the twenty-three natural orders which comprise more than 1000 species, only five are characterized by inconspicuous flowers. Of these, four, viz. the Cyperaceæ, Gramineæ, Urticaceæ, and Piperaceæ, are probably ancestral types, the fifth, Euphorbiaceæ, degenerate. It is probable that the period of the appearance of Dicotyledons was also that of the development of our great groups of insects. The first step towards the attraction of insects was probably the colouring of the stamens, as in *Thalictrum* and *Plantago*; then the development and colouring of the corolla, and the production of saccharine secretions. The most highly developed orders appear to be those in which the number of parts in a floral whorl is small, as the Violaceæ, Compositæ, Labiata, and Scrophulariaceæ.—Mr. P. H. Rolfs has an article on the Seed-coats of Malvaceæ; and Mr. Chas. Robertson continues his researches on Flowers and insects.

In the *Journal of Botany* for March and April, Mr. E. A. L. Batters describes and figures a new marine alga, *Goniophyllum Buffhami*, the type of a new genus. It belongs to the Delesseriaceæ, an order of Florideæ, and is epiphytic on *Nitophyllum lacertum*, being in fact nearly allied genetically to its host-plant. It was obtained from the coast near Deal.—Mr. R. J. Harvey Gibson describes the hitherto unknown antherids of *Polysiphonia elongella*, the mode of escape and conjugation of the zoogametes of *Enteromorpha compressa*, and the mode of development of the spores of British marine species of *Chantransia*.—Mr. E. G. Baker continues his Synopsis of the genera and species of Malvæ; and Mr. W. H. Clarke his First records of British

¹ Mr. Abercromby afterwards modified this opinion (NATURE, vol. xxxix. p. 437).—Translator.

² This statement as to the failure of the upper south-west trade-wind between the equator and lat. 35° was afterwards modified (see *Das Wetter*, 1890, p. 158).—Translator.