

The storms generated in the Bay of Bengal afford unusual facilities for studying the genesis of cyclones. We have observatories round three sides of the bay, and the sea is, at all times of the year, traversed in all directions by numerous steamers and sailing vessels, which have furnished abundant logs. Did parallel currents play any important part in the production of the vortices, they could not possibly escape our notice. But we find that the antecedent conditions of a cyclone are light, variable winds and calms, with a nearly uniform barometric pressure all round the coasts; and only to the south, in the neighbourhood of the equator, is there any considerable movement of the air, viz., from the west. Under these circumstances, the pressure falls over some part of the bay; most frequently in the middle, and especially to the west of the Andamans. This region of falling pressure is characterised by torrential rains, with, at first, but little wind; but after a day or two (sometimes several days) of this weather, a cyclonic circulation is set up, with a marked indraught in the neighbourhood of the cyclone cradle, and thus the storm is generated.

Having regard to these facts of observation, it appears to me that it is in the condensation of the heavy rain (constantly noted as "torrential" in ships' logs) over the cyclone cradle, that we have the real source of the energy of the incipient storm. The hypothesis of parallel currents fails to provide this energy; for it is obvious that the deviation of the winds under the influence of the earth's rotation can furnish no energy, and can produce only a moderate barometric depression, the amount of which depends on the velocity of the original winds, and can be calculated by Ferrel's law. When this is reached, the system of pressures and wind-movements will be in equilibrium. If (and this I am not prepared to deny) a cyclone is sometimes generated between parallel currents, it must be that the energy of the storm is supplied from some other source, and what this is, is, I think, clearly indicated by the case of the Bay of Bengal storms.

It was first noticed by Mr. Eliot as a general fact, that, during the formation of a cyclone in the Bay of Bengal, little or no rain falls on the coasts; while, as already remarked, it is exceedingly heavy over the place of the storm's origin. The vapour generated over the bay, which, under other circumstances would be carried away by the winds and condensed over the land, is then condensed over the bay itself. The quantity of latent heat thus set free is enormous; and as Reye has shown, is ample for the production of the most violent cyclone. It would be erroneous to say that the air is thereby warmed and expanded, because, of course, the very fact of its vapour being condensed proves that it must be cooling; but Welsh's and Glaisher's balloon observations show that in a cloud-laden atmosphere, the vertical decrement of temperature is slow, as compared with that in a clear atmosphere; and the same fact is further illustrated by the temperature of hill-stations in the wetter parts of the Himalaya as compared with that of the plains at their foot. At Darjiling, for instance, the temperature from June to August (the season of greatest cloudiness and heaviest rainfall) is only  $17^{\circ}$  or  $18^{\circ}$  below that of Goalpara. In February and March (the driest months) it is between  $23^{\circ}$  and  $24^{\circ}$ . The explanation of these facts is afforded by the different rates of cooling experienced by saturated and unsaturated air, respectively, in an ascending mass of air which is expanding under a constantly diminishing pressure. Saturated, *i.e.*, cloud-laden and rain-condensing air at  $80^{\circ}$  cools only  $20^{\circ}$  by the work done during its ascent from the plane of 30 inches pressure to that of 20 inches pressure, say through 10,000 feet; whereas unsaturated air cools about  $54^{\circ}$  in the same ascent, the exact amount varying slightly according to the quantity of vapour it contains. The latent heat set free in the condensation of cloud and rain is then entirely used up in the work of expanding the cloud-laden air under a constantly diminishing pressure, and economises more than half (indeed, in the case adduced, nearly two-thirds) of the sensible heat which furnishes the energy to unsaturated air. Hence, an ascensional current, however small, once set in action in a nearly saturated atmosphere, such as exists over the Bay of Bengal during the formation of a cyclone, carries warm air to a greater height than in the clearer and drier atmosphere around the coasts, relatively raising the mean temperature of the former air-column, and of course reducing its weight. This differential effect goes on increasing, and the ascending current becomes more rapid, until the indraught below attains the conditions of a cyclonic storm.

Now, in the case of parallel currents, there must be between them a region of calm; and, if this is over a sea of high tem-

perature, it is conceivable that, as in the Bay of Bengal, local condensation may proceed for a sufficient time unchecked to lead up to the formation of a cyclone; but, in that case, the cyclone will be generated, not immediately, as supposed by Mr. Barham, by the energy of the pre-existing winds, but by their affording conditions in which another and far more potent source of energy comes into play.

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Dinard, France, July 10

### The Tasimeter and Magnetisation

AFTER perusing an account, in a recent number of the *Scientific American*, of Edison's Tasimeter, it occurred to one of us to apply it to detect, and, if possible, to measure the elongation and shortening, which, as discovered by Joule, are produced in a bar of iron by magnetisation and demagnetisation. Accordingly to test whether the effect could be observed in this way, a rough specimen of the instrument was constructed, and with it some preliminary experiments made, an account of which may interest the readers of NATURE. A small cylinder, about half a centimetre in length and diameter, of the carbon used for Bunsen's cells, rested with its ends which were slightly rounded, in contact with two brass plates, one of which was fixed to a rigid upright attached to one end of the base of the instrument, while the other, resting with one end on the base, formed a spring, which in its normal position just touched the end of the carbon. A coil containing four layers of insulated wire, six turns to the layer, was wound round a tube ten centimetres long and eight millimetres in diameter, and fixed with its axis in line with that of the carbon cylinder. A piece of iron wire was then placed in the axis of the tube with one end resting against the spring, and the other in contact with the end of a screw working in a nut fixed to a rigid upright at the end of the base remote from the carbon. By means of this screw the pressure of the iron bar on the spring, and consequently of the spring on the carbon, could be varied at pleasure.

A terminal of copper wire, was attached to each of the brass plates bearing on the carbon, and joined up so that the carbon, plates, and terminals formed one of the resistances of a Wheatstone's bridge, in connection with which a battery of one Daniell's cell and a very delicate Thomson's reflecting galvanometer were used. When the iron wire forming the core of the electro-magnet had been so adjusted that there was only a very slight pressure on the carbon, the resistances of the bridge were arranged to make the deflection of the galvanometer produced by the current from the battery nearly zero. The galvanometer and battery keys were then put down and the current allowed to flow through the bridge during the remainder of the experiment. The electro-magnet was then excited by the current from three of Thomson's Tray Daniells. This produced a deflection of the image on the galvanometer scale of about fifty divisions in the direction indicating a diminution of the carbon resistance, which must have been caused by change of contact produced by increased pressure on the spring. The length of the iron core of the electro-magnet had therefore been increased by magnetisation. When the magnetising force was removed the image immediately returned to its former position. As a verification that the diminution of resistance indicated by the bridge arrangement was caused by elongation of the iron core, the adjusting screw was turned forward through a very small distance, when the deflection was found to be in the same direction as before. When the screw was brought back the image on the scale returned towards its zero. Experiments with various strengths of current gave perfectly accordant results.

We hope by replacing the comparatively rough adjusting screw by a micrometer screw to be able to make some measurements of the exact amounts of elongation or shortening produced in a piece of soft iron or steel by given changes of magnetic intensity. It may be remarked that this method of measurement could be advantageously applied in cases where the amount of change of dimensions to be discovered or measured is very small, but the force which it could be arranged to produce abundant.

University of Glasgow, July 12

ANDREW GRAY  
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### Physical Science for Artists

THE curious phenomenon described by Prof. Brücke and Mr. Norman Lockyer, under the name of "les rayons de crépuscule," though rare and uncommon in the island of Ceylon, is