This acid contains no nitrogen; it does not reduce oxide of copper in Trommer's test; it dissolves in concentrated sulphuric acid without forming any conjugate combination. When boiled with a mixture of hydrochloric acid and chlorate of potash it is decomposed, but without giving rise to chloranile; it gives no coloration when boiled with solution of hypochlorite of lime. Nitric acid, especially when aided by heat, attacks larixinic acid, leaving oxalic acid as the only fixed product. When heated with bromine it is destroyed, hydrobromic acid vapours are given off, and an uncrystallizable resin remains. Salts of copper give to solutions of larixinic acid an emerald-green colour, but cause no precipitate; chloride of manganese produces neither coloration nor precipitation. Characteristic effects are produced by salts of iron: perchloride and persulphate give a beautiful purple colour which stands dilution well; and larixinic acid becomes in this way an excellent reagent for detecting the presence of iron, even in minute quantity. It does not affect neutral proto-nitrate of mercury in the cold, and on the application of heat no mercury is reduced.

This acid appears to be peculiar to the larch tree; at least the author has not been able to find any trace of it in the spruce fir (*Abies excelsa*), or in the Scotch fir (*Pinus sylvestris*). It evidently belongs to that small group of substances, of which pyrogallic acid and pyrochatechin, the oxyphenic acid of Gerhardt, are the only other members yet known. It is much less easily oxidizable than oxyphenic acid, which again is less easily oxidated than pyrogallic acid. Larixinic acid volatilizes at a much lower temperature than either of these two substances, from which it also differs in being a ready-formed proximate principle, and not an educt.

III. "On the Great Magnetic Disturbance of August 28 to September 7, 1859, as recorded by Photography at the Kew Observatory." By Balfour Stewart, Esq., A.M. Communicated by General Sabine, R.A., Treas., V.P.R.S. Received June 28, 1861.

(Abstract.)

During the latter part of August, and the beginning of September, 1859, auroral displays of almost unprecedented magnificence were

observed very widely throughout our globe, accompanied (as is invariably the case) with excessive disturbances of the magnetic needle.

The interest attached to these appearances is, if possible, enhanced by the fact, that at the time of their occurrence a large spot might have been seen on the disc of our luminary, a celestial phenomenon which we have grounds for supposing to be intimately connected with auroral exhibitions and magnetic storms.

The auroral displays just mentioned were very attentively observed throughout Europe, America, and Australia. In many places these were of the most gorgeous character, and other places were visited by this meteor where its appearance was an event of very rare occurrence. Even from as low a latitude as Cuba we have a description of it by the Director of the Havannah Observatory, accompanied with the remark that only four previous displays had been recorded in the traditions of the island. In not a few instances telegraphic communication was interrupted owing to the current produced in the wires; and in some cases this proved so powerful that it was used instead of the ordinary current, the batteries being cut off and the wires connected with the earth. The descriptions of this meteor, given by various observers, have been collected together by Professor Loomis, and published in a series of papers communicated by him to the American Journal of Science and Arts. From all these accounts there appears to have been two great displays, each commencing at nearly the same absolute time throughout the globe; the first on the evening of the 28th of August, and the second on the early morning of the 2nd of September, Greenwich time.

Magnetic disturbances of unusual violence and very wide extent were observed simultaneously with these displays. These were recorded more or less frequently at the different Observatories; but at Kew there is the advantage of a set of self-recording magnetographs, which are in constant operation, and by means of which the state of the elements of the earth's magnetic force may be known at any moment.

The author then refers to curves, which accompany his paper, and shows that the first disturbance commenced about $10\frac{1}{2}$ on the evening of August 28th, affecting all the elements simultaneously. At about $7\frac{1}{2}$ P.M., 29th August, the violence of this disturbance had somewhat abated, and things remained nearly in this state until

September 2nd, 5 A.M., about which time another very abrupt disturbance simultaneously affected all the elements, and continued with great violence until about 4 P.M. of the same day, when it somewhat abated. The elements, nevertheless, remained in a state of considerable disturbance until September 5th, and only attained their normal positions on September 7th. It thus appears that we have two distinct well-marked disturbances, both commencing abruptly and ending gradually, the first of which began on the evening of August 28th, and the second on the early morning of September 2nd.

These two great disturbances correspond, therefore, in point of time, to the two great auroral displays already alluded to.

The average effect of both of these disturbances was to increase the declination, and to diminish the horizontal and vertical components of the earth's magnetic force.

The author then alludes to a disturbance which took place about 5 minutes past 11 o'clock on the forenoon of September 1st, similar in its mode of action to the two great disturbances already mentioned, but not equalling them in extent or in duration. This disturbance affected the magnetograph simultaneously with the breaking out, near a spot on the sun's disc, of a bright star, which was fortunately observed both by Mr. Carrington and Mr. Hodgson, independently.

The study of the curves furnished by the magnetograph during this great storm, in the author's opinion seems to throw light upon the connexion which subsists between magnetic disturbances, earth-currents, and auroral displays. These curves show that at the commencement of the disturbance, the horizontal and vertical components of the earth's force remained depressed below their normal values for at least seven hours. The curves for this portion of time have also a peculiar serrated appearance, as if on the great wave of disturbance whose period was seven hours, there were superimposed smaller waves whose period might be perhaps only a few minutes, or even less.

Now Mr. C. V. Walker, in a paper communicated to the Royal Society (January 31st, 1861), shows that the earth-currents which accompany auroras are of very short period (say a few minutes), and the auroras themselves also appear to be of a very fitful nature. We

cannot, therefore, well imagine how any combination of auroras and earth-currents could cause the period of seven hours, which the magnetic curves exhibit; while at the same time we cannot fail to associate the rapidly reversed earth-currents with those serrated appearances which the curves present.

The author suggests the following explanation of these phenomena. The earth itself may be likened to the soft iron core of a Ruhmkorff's machine, and the lower strata of the atmosphere to an insulating material interposed between the earth and the upper strata of the atmosphere, which, being very rare, become conducting, and form as it were the secondary coil of this arrangement.

Now suppose a primary current, probably in our luminary, to influence the earth, and suppose its general direction to remain the same for at least seven hours. This current would act on the magnetic matter of the earth in the same manner during these seven hours; and would, therefore, account for the magnetic wave of seven hours' duration.

But although this current has been supposed to remain in the same direction for seven hours, yet we may suppose that its intensity, especially if it have an atmospheric origin, is of a fluctuating character. Now any *sudden* increase or diminution in the intensity of this current, heightened by the iron core on which it acts, *i.e.* the earth, will produce secondary currents,

1st. Along the surface of the earth, which is sufficiently conducting for this purpose.

2ndly. Along the upper strata of the atmosphere, which are also sufficiently conducting.

These will be the earth-currents and auroras which, according to this hypothesis, are therefore due to the fluctuating nature of this primary current; while, on the other hand, the magnetic disturbances are due to its absolute intensity.