November 15, 1866.

Lieut.-General SABINE, President, in the Chair.

In accordance with the Statutes, notice of the ensuing Anniversary Meeting for the Election of Council and Officers was given from the Chair.

Dr. Gladstone, Mr. Huggins, Mr. Lassell, Sir John Lubbock, and Colonel Smythe, having been nominated by the President, were elected by ballot Auditors of the Treasurer's accounts on the part of the Society.

Dr. John Charles Bucknill, Dr. William Augustus Guy, and Mr. John William Kaye, were admitted into the Society.

The following communications were read :—

I. "On the Congelation of Animals." By JOHN DAVY, M.D., F.R.S., &c. Received July 19, 1866. (See page 250.)

II. "Letter to the President from Lieut.-Colonel WALKER, R.E., F.R.S., Superintendent of the Trigonometrical Survey of India." (See page 254.)

III. "Spectroscopic Observations of the Sun." By J. NORMAN LOCKYER, F.R.A.S. Communicated by Dr. SHARPEY, Sec. R.S. Received October 11, 1866.

(Abstract.)

The two most recent theories dealing with the physical constitution of the sun are due to M. Faye and to Messrs. De la Rue, Balfour Stewart, and Loewy. The chief point of difference in these two theories is the explanation given by each of the phenomena of sun-spots.

Thus, according to M. Faye *, the interior of the sun is a nebulous gaseous mass of feeble radiating-power, at a temperature of dissociation ; the photosphere is, on the other hand, of a high radiating-power, and at a temperature sufficiently low to permit of chemical action. In a sun-spot we see the interior nebulous mass through an opening in the photosphere, caused by an upward current, and the sun-spot is black, by reason of the feeble radiating-power of the nebulous mass.

In the theory held by Messrs. De la Rue, Stewart, and Loewy †, the appearances connected with sun-spots are referred to the effects, cooling and absorptive, of an inrush, or descending current, of the sun's atmosphere, which is known to be colder than the photosphere.

In June 1865 I communicated to the Royal Astronomical Society ‡

* Comptes Rendus, vol. lx. pp. 89–138, abstracted in 'The Reader,' 4th February, 1865.

† Researches on Solar Physics. Printed for private circulation. Taylor and Francis, 1865.

‡ Monthly Notices Roy. Ast. Soc. vol. xxv. p. 237.

some observations (referred to by the authors last named) which had led me independently to the same conclusion as the one announced by them. The observations indicated that, instead of a spot being caused by an *upward* current, it is caused by a *downward* one, and that the results, or, at all events, the concomitants of the downward current are a dimming and possible vaporization of the cloud-masses carried down. I was led to hold that the current had a downward direction by the fact that one of the cloud-masses observed passed in succession, in the space of about two hours, through the various orders of brightness exhibited by *faculæ*, general surface, and *penumbræ*.

On March 4th of the present year I commenced a spectroscopic observation of sun-spots, with a view of endeavouring to test the two rival theories, and especially of following up the observations before alluded to.

The method I adopted was to apply a direct-vision spectroscope to my $6\frac{1}{4}$-inch equatoreal (by Messrs. Cooke and Sons) at some distance outside the eyepiece, with its axis coincident with the axis of the telescope prolonged. In front of the slit of the spectroscope was placed a screen on which the image of the sun was received; in this screen there was also a fine slit corresponding to that of the spectroscope.

By this method it is possible to observe at one time the spectra of the umbra of a spot and of the adjoining photosphere or penumbra; unfortunately, however, favourable conditions of spot (*i. e.* as to size, position on the disk, and absence "of cloudy stratum"), atmosphere, and instrument are rarely coincident. The conditions were by no means all I could have desired when my first observations were made; and, owing to the recent absence of spots, I have had no opportunities of repeating my observations. Hence I should have hesitated still longer to lay them before the Royal Society had not M. Faye again recently called attention to the subject.

On turning the telescope and spectrum-apparatus, driven by clock-work, on to the sun at the date mentioned, in such a manner that the centre of the umbra of the small spot then visible fell on the middle of the slit in the screen, which, like the corresponding one in the spectroscope, was longer than the diameter of the umbra, the solar spectrum was observed in the field of view of the spectroscope with its central portion (corresponding to the diameter of the umbra falling on the slit) greatly enfeebled in brilliancy.

All the absorption-bands, however, visible in the spectrum of the photosphere, above and below, were visible in the spectrum of the spot; they, moreover, appeared thicker where they crossed the spot-spectrum.

I was unable to detect the slightest indication of any bright bands, although the spectrum was sufficiently feeble, I think, to have rendered them unmistakeably visible had there been any.

Should these observations be confirmed by observations of a larger spot free from "cloudy stratum," it will follow, not only that the phenomena

presented by a sun-spot are not due to radiation from such a source as that indicated by M. Faye, but that we have in this absorption-hypothesis a complete or partial solution of the problem which has withstood so many attacks.

The dispersive power of the spectroscope employed was not sufficient to enable me to determine whether the decreased brilliancy of the spot-spectrum was due in any measure to a greater number of bands of absorption, nor could I prove whether the thickness of the bands in the spot-spectrum, as compared with their thickness in the photosphere-spectrum, was real or apparent only*.

On these points, among others, I shall hope, if permitted, to lay the results of future observations before the Royal Society. Seeing that spectrum-analysis has already been applied to the stars with such success, it is not too much to think that an attentive and *detailed* spectroscopic examination of the sun's surface may bring us much knowledge bearing on the physical constitution of that luminary. For instance, if the theory of absorption be true, we may suppose that in a deep spot rays might be absorbed which would escape absorption in the higher strata of the atmosphere; hence also the darkness of a line may depend somewhat on the depth of the absorbing atmosphere. May not also some of the variable lines visible in the solar spectrum be due to absorption in the region of spots? and may not the spectroscope afford us evidence of the existence of the "red flames" which total eclipses have revealed to us in the sun's atmosphere; although they escape all other methods of observation at other times? and if so, may we not learn something from this of the recent outburst of the star in Corona?

IV. "On a Crystalline Fatty Acid from Human Urine."

By E. Schunck, F.R.S. Received September 21, 1866.

(Abstract.)

After referring to the various forms in which fatty matter occurs in human urine, and to our extremely defective knowledge regarding its physical and chemical properties, the author proceeds to describe a process whereby he obtained from healthy urine a small quantity of a substance having the properties characteristic of the fatty acids which are solid at the ordinary temperature. The process consists in passing urine, after having been filtered in order to separate all insoluble matter which may have been deposited, through animal charcoal in an ordinary percolating apparatus. The urine is thereby completely decolorized and deodorized, a small quantity of charcoal producing this effect on a large quantity of urine. The charcoal, after being thoroughly washed with water, is treated with boiling alcohol, to which it communicates a bright yellow colour like

* Irradiation would cause bands of the same thickness to appear thinnest in the more brilliant spectrum.