submitted to examination are added, with a Table specifying the sex, age, &c. of patients, weight and composition of the specimens, &c.

A second Table shows an arrangement of the ascertained ingredients in a form which, if not complete, may yet be useful; in it the rarer substances belonging to urinary calculi are not included.

Next follows a description of each well-known ingredient as it was observed to occur:—*Uric acid* is here crystalline, but not in the shapes prevalent in urinary deposits; free crystals (1) are comparatively rare, and open columns (2), or else compact laminæ (3), are most frequent; amidst these the very general occurrence of simple oxalate-of-lime forms is mentioned. The *Urates* are present in calculi, as (1) granules, (2) acicular crystals, (3) globules, (4) laminæ: the relation of the two latter forms is described, and the apparent character of their animal basis. *Oxalate of lime* would seem to be the most prevalent of all ingredients, and it exists as (1) granules, if the particles were really shapeless, as they appeared to be; (2) crystals—octahedral (often of enormous size), ovoid, and dumb-bell shaped; (3) spheroids, or large composite globular particles of very characteristic appearance, and originating from the last-named form; (4) laminæ, also characteristic. Some remarks are added on crystals of the oxalate artificially produced. Certain *crystals*, styled *peculiar*, are described; they are frequently admixed with the urates, and, upon grounds specified in detail, are judged to be a form of the calcic oxalate. *Phosphate of lime*: free crystals of this salt have not been seen in calculi; and compact layers, authoritatively recognized, have varied in appearance either as the result of disintegration, or possibly in consequence of some difference in chemical composition—a point amongst others needing further investigation. Respecting the *triple phosphate* and the *fusible calculus*, details of their microscopic appearance are submitted in the communication under notice.

In conclusion, figures arranged in four Plates, with descriptions, are appended.

III. "Researches in Spectrum-Analysis in connexion with the Spectrum of the Sun."—No. I. By J. Norman Lockyer, F.R.S. Received November 6, 1872.

(Abstract.)

The author, after referring to the researches in which he has been engaged since January 1869 in conjunction with Dr. Frankland, refers to the evidence obtained by them as to the thickening and thinning of spectral lines by variations of pressure, and to the disappearance of certain lines when the method employed by them since 1869 is used. This method consists of throwing an image of the light-source to be examined on to the slit of the spectroscope.

It is pointed out that the phenomena observed are of the same nature as those already described by Stokes, W. A. Miller, Robinson, and Thalen, but that the application of this method enables them to be better studied, the metallic spectra being clearly separated from that of the gaseous medium through which the spark passes. Photographs of the spark, taken in air between zinc and cadmium and zinc and tin, accompany the paper, showing that when spectra of the vapours given off by electrodes are studied in this manner, the vapours close to the electrode give lines which disappear from the spectrum of the vapour at a greater distance from the electrode, so that there appear to be long and short lines in the spectrum.

The following elements have been mapped on this method:—Na, Li, Mg, Al, Mn, Co, Ni, Zn, Sr, Cd, Sn, Sb, Ba, and Pb, the lines being laid down from Thalen's maps, and the various characters and lengths of the lines shown.

In some cases the spectra of the metals, enclosed in tubes and subjected to a continually decreasing pressure, have been observed. In all these experiments the lines gradually disappear as the pressure is reduced, the *shortest lines disappearing first, and the longest lines remaining longest visible.*

Since it appeared that the purest and densest vapour alone gave the greatest number of lines, it became of interest to examine the spectra of compounds consisting of a metal combined with a non-metallic element. Experiments with chlorides are recorded. It was found in all cases that the difference between the spectrum of the chloride and the spectrum of the metal was that under the same spark-conditions all the short lines were obliterated. Changing the spark-conditions, the final result was that only the very longest lines in the spectrum of the metallic vapour remained. It was observed that in the case of elements with low atomic weights, combined with one equivalent of chlorine, the numbers of lines which remain in the chloride is large, 60 per cent., *e. g.*, in the case of Li, and 40 per cent. in the case of Na; while in the case of elements with greater atomic weights, combined with two equivalents of chlorine, a much smaller number of lines remain—8 per cent. in the case of barium, and 3 per cent. in the case of Pb.

The application of these observations to the solar spectrum, to elucidate which they were undertaken, is then given.

It is well known that all the known lines of the metallic elements on the solar atmosphere are not reversed. Mr. Lockyer states what Kirchhoff and Ångström have written on this subject, and what substances, according to each, exist in the solar atmosphere. He next announces the discovery that, with no exception whatever, *the lines which are reversed are the longest lines.* With this additional key he does not hesitate to add, on the strength of a small number of lines reversed, zinc and aluminium (and possibly strontium) to the last list of solar elements given by Thalen, who

rejected zinc from Kirchhoff's list, and agreed with him in rejecting aluminium. It need scarcely be added that these lines are in each case the longest lines in the spectrum of the metal.

The help which these determinations afford to the study of the various cyclical changes in the solar spectra is then referred to.

December 19, 1872.

Sir GEORGE BIDDELL AIRY, K.C.B., President, followed by Mr. BUSK, Vice-President, and Dr. SIBSON, Vice-President, in the Chair.

The following communications were read :—

I. "Magnetical Observations in the Britannia and Conway Tubular Iron Bridges." By Sir GEORGE BIDDELL AIRY, K.C.B., P.R.S., Astronomer Royal. Received October 12, 1872.

(Abstract.)

The author states that he was first induced to make these experiments by consideration of the perpetual tremor to which the iron of these structures is subjected, and which appeared likely to have made them unusually sensitive to the production of induced and perhaps subpermanent magnetism. The experiments were actually conducted by Mr. James Carpenter (then Assistant at the Royal Observatory), with the friendly cooperation of Captain Tupman, R.M.A. Permission was given by the Directors of the London and North-Western Railway Company, and every possible assistance was given by the resident Officers of the Company, with a degree of zeal and liberality which cannot be too highly appreciated. The observations were made in the axis of each tube, a large step-ladder and stage adapted to the circumstances having been provided; the observations made were those of disturbed magnetic azimuth, disturbed time of vibration of a horizontal needle, and disturbed dip. The places of observation were :—in each line of the Britannia Bridge, a station on each of its five supporting towers and a station in the middle of each of the four sections of the continuous tube, and also stations in the prolongations of the axis of the bridge to a considerable distance in each direction, making in all twenty stations; and in the Conway bridge, stations in each line at the piers and in the middle of the tube, and also distant stations in the prolongation of the axis of the bridge, making eight stations in all.

The means of the results at each station are given in a Table. For further treatment, the means of those means for collateral stations are used; and the means of those for the two distant stations at each bridge are adopted as giving undisturbed local constants. By treatment of