MESSRS. LOVELL, REEVE, AND CO., have in the press a volume on St. Helena, comprising a physical, historical, and topographical description of the island, with its geology, fauna, flora, and meteorology. The author is Mr. J. C. Melliss, C.E., F.G.S., F.L.S., late Commissioner of Crown Lands, Surveyor and Engineer of the Colony.

THE *Scotsman* reports that a piece of gold-bearing quartz has been found in the island of Bute.

BEE-KEEPING has become a vocation or avocation of so much importance in America that there actually exists a "North American Bee-keepers' Society," which, like more important associations, meets yearly in one of the towns of the States. This year the society met at Louisville and continued its sittings for several days. Among the papers read was one by General D. L. Adair against the practice, common among apiarians, of clipping the wings of the queen, the paper showing a very considerable acquaintance with the structure of the bee.

THE *Times* takes the following from an American paper, and asks "Why not in London?":—"In Pittsburg, Pennsylvania, an electric clock has been established to move the hands of seventy different clocks, scattered all over the city. The motive clock is powerful, and has a pendulum composed of hollow coils of copper wire. These swing to and fro over the poles of horseshoe magnets, and every time they pass from one pole to the opposite a current of electricity is called up inductively in the coils, flows up the wire, and then to the seventy dials, giving a current of an opposite nature at each swing. Behind each dial is an astatic permanent magnet, suspended on a pivot, and surrounded by a coil of wire, and it rotates under the electric influence from the wires. A small weight may be used to each dial if the hands are heavy, and the pivoted magnet may merely regulate the time. Of course every clock will be exactly alike, and will run with very little attention. To prevent the pendulum of the motive clock from moving too fast by the increase in the length of vibration of the pendulum, a magnetic bridling apparatus is attached."

A LETTER appears in the *Times* of the 30th instant, from a correspondent with the "Livingstone East Coast Expedition," dated Mdaburu, Ugogo, Central Africa, July 15, and is principally occupied with a description of the many annoyances to which the expedition was subjected.

THE finest kitchen garden in France is that of Versailles, which belongs to the State, and brings in a yearly revenue, taking good and bad years together, of about 20,000f. The Assembly has determined to apply this valuable property to the formation of a model market garden and school of horticulture. The details of the institution are not yet arranged, but it is presumed that it will be self-supporting, and that it will render valuable assistance in the development of horticultural science in France.

THE additions to the Zoological Society's Gardens during the past week include two Violaceous Plantain-cutters (*Musophaga violacea*) from W. Africa, purchased; two Senegal Touracous (*Corythaix persa*) from W. Africa, presented by Mr. Hawkins; two Chinese Storks (*Ciconia Boycei*) from China, presented by Mr. R. B. Boyce of Shanghai; a Grivet Monkey (*Cercopithecus lalandii*) from W. Africa, presented by Mrs. Couteam; a Coati (*Nasua nasica*) from S. America; three Derbian Screamers (*Chauna derbiana*) from Columbia; a Chinese Water Deer (*Hydropotes inermis*); a Common Otter (*Lutra vulgaris*), British, deposited; two Black-tailed Hawfinches (*Coccothaustes melanurus*) from China, purchased.

ON THE SPECTRA OF COMETS *

THE spectrum-analytic method of examining the light from comets has only been applied hitherto to comets of weak light; yet the observations are fitted to extend considerably our knowledge of these objects. The spectra of all the comets that have been examined have consisted of a few bright lines or bands of light, and a very faint continuous spectrum. The chief part of the comet's light appears, accordingly, to be proper to it, and is probably from glowing gas, while the remaining portion is reflected sunlight.

Among the brightest comets which have appeared since the introduction of spectrum analysis are those of Brorsen (I. 1868) and Winnecke (II. 1868). The spectrum of the former consisted of three bright bands, whose position Huggins sought to determine with great accuracy; but he found no coincidence with the spectral lines of any terrestrial substance. The spectrum of Winnecke's comet, also examined by Huggins, was somewhat different, but similarly consisted of three bright bands (in addition to the continuous spectrum always present), which were sharply defined on the side nearest to the red end of the spectrum, but diffuse on the other. A comparison of the comet's spectrum with that of olefiant gas showed striking similarity between them; and Huggins was able to establish, with some certainty, a coincidence of the three bright bands. The expressed opinion that the material of this comet might be hydrocarbon found general acceptance; and the inference has been extended to other comets, so that it has been taken as demonstrated, that the comets are formed of hydrocarbons. (Dr. Zenker in *Astr. Nachr.* Nos. 1890 to 1893.)

I will now give a summary of all the observations known to me of cometary spectra, from which it will be seen how far the conclusion in question is warranted.

1. The first comet examined by spectrum-analysis is the Comet I. 1864. Donati found its spectrum to consist of three bright bands, which (if one may judge from the figure in *Astr. Nachr.* No. 1488) do *not* coincide with those of the hydrocarbon spectrum.

2. Huggins and Secchi observed Tempel's Comet I. 1866, and got from it a weak continuous spectrum, in which Secchi saw *three* bright lines, Huggins only *one* The line seen by both was the brightest, and situated in the middle between *b* and *F* of the solar spectrum; accordingly *no* coincidence with the hydrocarbon spectrum.

3. In the spectrum of Comet II. 1867, the continuous spectrum was relatively so strong that Huggins found it difficult to detect bright lines. "Once or twice," he says, "I suspected the presence of two or three bright lines, but of this observation I was not certain. The prismatic observation of this faint object, though imperfect, appears to show that this small comet is probably similar in physical structure to Comet I., 1866." In this case, again, probably no hydrocarbon.

4. Brorsen's Comet I. 1868, was observed by Huggins and Secchi. Both observed three zones of light; the middle one being brightest, and lying in the green; while its brightest part was somewhat less refrangible than the brightest line of the air spectrum (wave-length = 500·3 mill. millim.). From this observation, and the determination of the position of the other two faint bands, it appears that the comet spectrum was *neither* similar to that of *nitrogen*, nor to the *hydrocarbon spectrum*.

5. Winnecke's Comet II. 1868, was also observed by Huggins and Secchi. The measurements and direct comparisons of Huggins gave an agreement of the cometary spectrum with that of carbon in olefiant gas. From Secchi's measurements it appears, that the sharply defined side of the middle band (towards the red end), nearly coincided with the line-group *b* of the solar spectrum; at which part also the beginning of the middle band in the spectrum of hydrocarbons is situated.

6. Comet I. 1870 was observed by Wolf and Rayet; the spectrum consisted of three bright bands, whose position, however, was not accurately determined.

7. Comet I. 1871 was observed by Huggins and myself. Huggins found *three* bands, I only *two*. The measurements of the bands observed in common agree well; the spectrum appears to be identical with that of Brorsen's comet.

8. Comet III. 1871 (Encke) was observed by Huggins three days, by Young four, and by myself six; it showed, as usual, a spectrum of three bands. Huggins thought this agreed with

* Abstract of paper in Poggendorff's Annalen, by H. Vogel.

the hydrocarbon spectrum; while Young and I observed *no* such coincidence.

9. Comet IV. 1871 (Tuttle), examined only by me, gave a spectrum of three bands. Accurate measurement of their position showed *no* coincidence with the hydrocarbon spectrum.

Of these nine comets, there is only one (I. 1870) for which we have no observations as to the position of the bright bands. Of the remaining eight, the spectra of five (1, 2, 4, 7 and 9) have shown *no* agreement with the hydrocarbon spectrum. As regards the Comet II. 1867 the supposition is offered that its spectrum was similar to the spectrum named; as to Encke's Comet III. 1871, it remains uncertain in which class it is to be reckoned (Huggins' observations being at variance with those of Young and myself). There remains only the Comet II. 1868, for which Huggins' and Secchi's observations assert a probability of coincidence of the lines in its spectrum with those in the spectra of volatile hydrocarbons.

It thus appears a somewhat questionable view, that the comets consist of such matter; and we should, I think, content ourselves with the deduction, that a portion of the light emitted by the comet is its own light, and very probably from glowing gas. Perhaps a brighter comet may enable us to find out their nature more exactly, yet it seems to me extremely difficult to determine the nature of the glowing gas of the comet through a comparison of spectra from the electric spark in Geissler tubes; since there must be, in the comet, circumstances of pressure and temperature, which it is impossible for us to imitate, and through which, it is known, the spectrum undergoes great modifications.

Dr. Zenker has further asserted (*Astr. Nach. loc. cit.*) that "in the spectrum of Brorsen's comet, Huggins has recognised the bright line of nitrogen." This statement is incorrect; the observation having been, that the bright band situated in the green of the spectrum, had *nearly* the same position as the brightest line of the nebulæ, which, it is known, coincides with the double line of nitrogen. The band in the comet spectrum is a little displaced towards the red end; and this displacement could not be due to the motion of the comet, for, as Huggins pointed out, the latter was moving towards the earth, and the line would have been displaced towards the *violet*. At an earlier date, Huggins, observing the Comet I. 1866, gave out the opinion that the material forming it might be nitrogen; the spectrum appeared to consist of only *one* band of light, which nearly coincided with the brightest nitrogen line. But Secchi disproved this view, having observed three bands, and the weaker bands showing no coincidence with those of the nitrogen spectrum. The accurate measurements afterwards made by Huggins with the bright Brorsen comet, are of interest specially because they put it beyond doubt, that there is no connection between the spectrum of nitrogen and that of the comet.

Again, Dr. Zenker arrives at the conclusion that there must be water-vapour in the comets; since they have, according to Schmidt, a yellowish-red colour, and the sun's rays, when they pass through a considerable thickness of aqueous vapour, are coloured thus. But apart from the consideration that sunlight has a yellowish-red colour on passing through other vapours, as well as aqueous, I would remark, that we must take the proper light of the comet, which appears from spectral analytic observations, to be generally more intense than the reflected light, as determining its colour. According to the observations made, we should expect that the comet is, on the whole, of greenish or greenish-blue colour, since all the spectra consist, as we have seen, of two or three bands of light, of which one is in the yellow, the second and brightest in the green, and the weakest in the beginning of the blue. Of the (generally very faint) continuous spectrum, only the brightest part—yellow, green, and commencement of blue—is visible. The entire image, therefore, even where the weak continuous spectrum appears, will seem of greenish colour. Colour-data have been furnished by other observers besides Schmidt; and the head of the Comet 1811, *e.g.* had, according to Herschel, a greenish or bluish-green colour; the nucleus was slightly red. The colour of Halley's comet, at its return in 1825, was a bluish-green (Struve). Winnecke says of the comet of 1862, "The colour of the neck appears to me yellowish; the coma has bluish light."

With regard, lastly, to Dr. Zenker's proposition that "every gas belonging to the solar system, as soon as it is visible on the dark ground of the heavens, must appear with the same lines of the spectrum, as, according to its nature, it absorbs out of the sunlight," I may be permitted to remark that I am not quite convinced of this; there is not yet furnished a satisfactory experimental basis for the assertion. But to seek to explain the line spectrum of a nebula thus, and by saying that the nebula is shone upon by a fixed star in its "near neighbourhood," is doubtful, inasmuch as it is a very rare case that bright stars are situated in such nearness to nebulæ (especially the planetary, which best show the gas spectrum), that one can suppose a physical connection between them and the nebulæ.

I have been prompted to the foregoing remarks by the observation that in recent speculations on the constitution of the universe, the value of perceptions of sense, on which these speculations rest, has been greatly over-estimated. The principles on which the edifice of an hypothesis is raised must, above all, be secure, and observations not sufficiently confirmed, or even denoted as uncertain by those who have made them, should preliminarily be disregarded, if it is desired that the hypothesis have a stimulating and furthering influence on the progress of scientific research.

SCIENTIFIC SERIALS

Justus Liebig's Annalen der Chemie. Band 169, Heft 3.—This number of the Annalen contains the following papers:—On the decomposition of nitric acid by heat, by L. Cairus. This paper, upwards of seventy pages in length, deals exhaustively with the subject. Very numerous tables of the results of various conditions of temperature, &c., are given, and the paper is illustrated with two plates.—On the chlorides of molybdenum, by Dr. L. P. Liechti and B. Kempe.—Chlorides of the formulæ $MoCl_2$, $MoCl_3$, $MoCl_4$, and $MoCl_5$ are described. The authors point out the parallelism shown by these bodies to the Tungsten chlorides, where, however, Tungsten wants the corresponding trichloride, while molybdenum wants the hexachloride. In both these series the colours of the salts become darker as the chlorine increases in quantity.—On the atomic weight of molybdenum, by L. Meyer. The author from sixteen results deduces the atomic weight 95·86 for molybdenum, chlorine being taken as 35·37 and silver 107·66. This agrees very well with the result obtained by Dumas 96, and by Debray 95·94. The author also points out the following relations in three groups of elements:—

V	51·2	Cr	52·4	Cu	63·3
Plus	43		43·2		44·4
Nb	94	Mo	95·6	Ag	107·7
Plus	88		88·4		88·5
Ta	182	W	184·0	Au	196·2

On chromic dioxide, by E. Hintz. The author describes the preparation, &c., of this body.—The number concludes with a paper on sulpho-ortho-toluidinic acid, by F. Gerver, and one on the specific heat of zirconium silicon, and boron, by W. G. Mixter and E. S. Dand.

THE new number of the *Quarterly Journal of Microscopical Science* contains many papers of interest. Prof. Allman commences by giving an account of Kleinenberg's researches on the anatomy and development of Hydra, in which, while he has confirmed many of the statements of former observers, he has shown the incorrectness of others, and has discovered several important points in its anatomy, specially in connection with the structure of the ectodermic layer, and the subject of development.—Prof. Martin Duncan records some observations on the method of development in *Fucus vesiculosus*, in which, after suggesting that they obtain their nutrition in part at least, from the organic matter always present in sea-water, he describes the growth of the terminal cells of two sets of finger-shaped processes; showing that by in-growths from the lateral walls, membranous septa are formed at the apices of the processes, an active mass of protoplasm occupying the extreme end.—Following this is a translation, with a plate illustrating it, of George O. Sars' paper on the anatomy of that aberrant form *Rhabdopleura mirabilis* (M. Sars), so peculiar in combining a creeping stem in which is an axial cord; lateral cells in which the somites are free, except that a contractile cord binds each to the axial cord; a pair of tentacular arms; a differentiated alimentary canal, and a foot-like process between the alimentary orifices. Mr. E. R. Lankester, in a separate paper, very clearly shows, with the aid of some excellent diagrams, that this animal is a true molluscan form, intermediate between the Polyzoa and Mollusca, and not in reality related to the Hydrozoa as imagined by M. M. Sars.—Mr. Tomes' observations on the development of the teeth of the Armadillo are referred to in our Notes.—A translation follows of the researches of Ph. van Tieghem and G. Le Monnier, on the *Mucorini*, condensed from their memoirs in the