to be aware of various dairy and other agricultural schools which have been recently founded, or are now being promoted. Among these may be especially mentioned the Travelling Dairy School of the Bath and West of England Society.

JOHN WRIGHTSON.

"INFERNITO."

SOME strange natural phenomena are described in a recent report from the United States Consul at Maracaibo in Venezuela. That part of the department of Colon situated between the Rivers Santa Ana and Zulia and the Sierra of the Colombian frontier is very rich in asphalt and petroleum. The information we have regarding this extensive and interesting region, which is an uninhabited forest, is derived chiefly from the reports of the searchers after balsam copaiba, which abounds; but the following data were taken from the personal observations of an American gentleman who made a special exploration. Near the Rio de Oro, at the foot of the Sierra, there is a very curious phenomenon consisting of a horizontal cave which constantly ejects thick bitumen in the form of large globules. These globules explode at the mouth of the cave with a noise loud enough to be heard at a considerable distance; and the bitumen, forming a slow current, falls finally into a large deposit of the same substance, near the river bank. The territory bounded by the Rivers Zulia and Catatumbo and the Cordillera is rich in deposits and flows of asphalt and petroleum, especially towards the south, where the latter is very abundant. At a distance of a little more than 7 kilometres from the confluence of the Tara and the Sardinete, there is a sand mound of from 25 to 30 feet in height, with an area of about 8000 square feet. On its surface are a multitude of cylindrical holes of different sizes, which eject with violence streams of petroleum and hot water, causing a noise equal to that produced by two or three steamers blowing off simultaneously. For a long distance from the site of this phenomenon the ground is covered or impregnated with petroleum. The few explorers for copaiba who have visited this place call it the "Infernito" (little hell). Among other things, it is stated that from one only of these streams of petroleum was filled in one minute a receptacle of the capacity of four gallons. This represents 240 gallons in an hour, or 5760 gallons in 24 hours; and even if this calculation be somewhat exaggerated, the fact remains that such a considerable number of petroleum jets in constant active operation must produce daily an enormous quantity. This petroleum is of excellent quality, with a density of 83°, which is a sufficient grade for foreign markets. Considering the immense amount of inflammable gases which must be given out by the flows and deposits of petroleum as described above, it may be easily believed that this has a direct bearing upon the phenomenon known since the conquest as the Faro of Maracaibo. This, consisting of constant lightning without explosion, may be observed towards the south from the bar at the entrance to the lake, and Coddazzi in his geography explains it as being caused by the vapours arising from the hot water swamp situated about one league to the east of the mouth of the Escalante, at the southern extremity of the lake. Near the mountains, and not far from the River Torondoy, there are various flows of a substance which seems to be distinct from either asphalt or petroleum. It is a liquid of a black colour, with little density, and strongly impregnated with carbonic acid, and is almost identical with a substance met with in the United States among the great anthracite fields.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 2.—"On the Spectrum, Visible and Photographic, of the Great Nebula in Orion." By William Huggins, D.C.L., LL.D., F.R.S., and Mrs. Huggins.[1]

It might be suggested that the want of coincidence observed between the nebular line and the magnesium band, amounting to λ 0001·9 nearly, might be due to a motion of translation of the nebula towards the earth. The motion required to produce this shift of position is about sixty-seven miles in a second. [The earth's motion at the time of comparison with magnesium band may be taken at nearly seventeen miles in a second of recession from the nebula. This motion would bring the nebular line nearer the red, and diminish the apparent interval between that line and the termination of the band. If the nebula has a motion of approach, the earth's motion would bring the line back again, to an extent corresponding to about seventeen miles in a second, towards its true plane.—*May* 18.]

I showed in my paper on this subject in 1874 (Roy. Soc. Proc., vol. xxii. p. 253), that, in the case of the Orion nebula and six other gaseous nebulæ—namely, 4234, 4373, 4390, 4447, 4510, 4964, of Sir J. Herschel's "General Catalogue of Nebulæ"—"in no instance was any change of relative position of the nebular line and the lead line detected." We should have to resort, therefore, to the overwhelmingly improbable supposition that all seven nebulæ were approaching the earth with velocities such that, having respect to the earth's motion at the different times of observation, they all gave a sensible shift corresponding to 67 ± 15 miles in a second.[1] There is little doubt in my mind, therefore, from these comparisons, which, considering the strong evidence we possessed before of the relative positions of the nebular line and of the magnesium line, are, strictly speaking, supplementary and confirmatory evidence only, that this line of the gaseous nebulæ is not produced by "the remnant of the magnesium fluting."

In the diagram on p. 134 (Roy. Soc. Proc., vol. xliii.), Mr. Lockyer represents this nebular line followed by fine lines, which give it the appearance of a fluting similar to that of the magnesium band placed above. I am unable to find in the paper any authority for this representation of the line. In another place (Programme Royal Society *Soirée*, May 9, 1888, p. 12) Mr. Lockyer says: "On one occasion, at Greenwich, it was recorded as a fluting in the spectrum of the nebula in Orion." Mr. Maunder's words are ("Greenwich Spectroscopic Results," 1884, p. 5): "None of the lines (with two-prism train) are very sharp. λ 5005 showed a faint fringe mainly on the side nearer the blue."

Mr. Maunder has recently sent a note to the Royal Astronomical Society, in which he explains that the observation was made with a second half-prism added to the half-prism spectroscope. He says:—"The three principal lines of the nebular spectrum were seen as very narrow bright lines, but none of them were perfectly sharp, each showed a slight raggedness at both edges; but in the case of the line near λ 5005 it was clear that this fringe, or raggedness, was more developed towards the blue than towards the red. In the case of the other two lines, they were not bright enough for it to be possible to ascertain whether the fringes were symmetrical or not. But λ 5005 was clearly a single line. There was no trace of any bright line, or series of bright lines, close to it on either side; no trace of a fluting, properly so called. The entire line, fringes and all, was only a fraction of a tenth-metre in total breadth" (*Monthly Notices R.A.S.*, vol. xlix., 1889, p. 308). [It should be noticed that, with the instrumental conditions under which Mr. Maunder observed, the second and third lines were not sharp, but also showed fringes.—*May* 18.]

My own observations of this line, since my discovery of it in 1864, with different spectroscopes up to a dispersion equal to eight prisms of 60°, show the line to become narrow as the slit is made narrow, and to be sharply and perfectly defined at both edges.

[1] Continued from p. 407.

[1] [The following observations of Orion for motion in the line of sight have been made at Greenwich:—

1884. February 15.—About thirty-one miles approach. Note, *measures purely tentative.*
February 18.—About fifty-one miles approach. Note, *the measures are not trustworthy.*
March 10.—*Direct comparison.* With neither one nor two prisms, after very careful direct comparison, could any displacement be detected; the coincidence of the two spectra was evidently very close.
March 12.—*Direct comparison.* . . . Direct comparison with one prism-train showed coincidence as complete as could be detected, considering the faintness of the two spectra. . . . No part of the nebula showed any marked displacement, but at a point a little preceding the Trapezium the pointer did not seem perfectly central on the line, but a little (perhaps one-tenth, certainly not more) towards the red.

1887. October 25.—Six measures, three of which show approach, and the other three recession. Note, lines in nebula faint, and bisections very rough.

In a letter dated May 17, Mr. Maunder permits me to state that the measures and estimations made in 1884 and 1887 are of no weight, but that he considers the *comparisons* in March 1884 to be as satisfactory as possible with so faint an object, and to show that the nebula has very little, if any, sensible motion in the line of sight.—*May* 18.]

As some importance attaches to the precise character of this line, I wrote to Prof. H. C. Vogel for permission to quote the result of his experience, which has been nearly as long as my own, of the character of this line. He says in his reply, dated March 20, 1889: "Beeile ich mich Ihnen mitzutheilen, dass meine langjährigen Beobachtungen über die Spectra der Gas-Nebel *vollkommen* mit den Ihrigen darin übereinstimmen, dass die Nebellinie λ 5004 schmal, scharf und nicht verwachsen ist. Auch D'Arrest hat in seiner Untersuchung über die Nebel-Spectra (Kopenhagen, 1872) nicht erwähnt dass die hellste Nebellinie unscharf sei."

Dr. Copeland permits me to quote the following sentences of a letter dated March 19, 1889:—"Respecting the appearance of the line λ 5004 in the spectrum of the Orion nebula, I may say that I have always drawn and seen it quite sharp and well defined on both edges. About nine years ago I made a special effort to divide it, if possible, with a large spectroscope in which the viewing telescope was 3 inches in aperture. The lines were then seen as sketched." (The diagram shows the nebular lines with sharply ruled lines for edges.) "They were drawn by holding the note-book 10 inches from the left eye, in such a position that the image seen in the instrument with the right eye was apparently projected on the paper. If I had noticed any peculiarity about λ 5004, it would certainly have been noted." [1]

In an early observation of the dumb-bell nebula Prof. Vogel, indeed ("Beobachtungen zu Bothkamp," p. 59, 1872), describes this line as less defined towards the violet side. In a letter (April 3, 1889) Prof. Vogel says this appearance of the line was probably due to a slit not sufficiently narrow. He says that he re-examined this line in his observations with the great Vienna refractor, and that it did not then appear otherwise than defined and narrow.

The other line in the spectrum of the nebulæ upon which Mr. Lockyer mainly relies for the presence of magnesium is the line shown in my photographic spectrum of 1882 (Roy. Soc. Proc., vol. xxxiii. p. 425), and to which I assigned the wave-length of about 3730. Mr. Lockyer says of this line (Roy. Soc. Proc., vol. xliii. 1887, p. 122): "In the bunsen as ordinarily employed the fluting at 500 far eclipses the other parts of the spectrum in brilliancy, and at this temperature, as already observed by Messrs. Liveing and Dewar, the ultra-violet line visible is that at 373." Passing by a minor point, which Liveing and Dewar have already pointed out (Roy. Soc. Proc., vol. xliv., 1888, p. 244), namely, that their observation was made at the higher temperature of burning magnesium, this statement is insufficiently complete, for what occurs at this part of the spectrum, and is characteristic of the magnesium-flame spectrum, is a triplet, of which the line given by Liveing and Dewar at about 3730 is the least refrangible member only.

I have given a representation of this triplet at the wave-lengths given by Liveing and Dewar, namely λ 3730, 3724, and 3720. In the photograph of 1888, in which the strong line can be seen distinct from the lines near it, the line is found to be very near the middle line of the triplet. I have therefore assigned to this line the position of about λ 3724. This line appears pretty strong, and therefore if it were really one of the lines of the triplet, the other two members of the triplet should have appeared on the plate. On one side of the star-spectra this line is a little broader than on the other side, but as a similar appearance is presented by G, and the stronger of the lines of the group, it may arise from some optical or photographic cause. The line at 3724 impresses me strongly as a single line, and there is certainly no trace of the first line of the triplet at 3730. The line appears to me stronger where it is upon the star-spectra.

As therefore there is little doubt that the "remnant of the fluting at 500, which far eclipses the other parts of the spectrum in brilliancy," is not coincident with the brightest nebular line, and the next most characteristic group of this spectrum, the triplet at 3722, 3724, and 3730, according to Liveing and Dewar, does not appear to be present in the photographs, we may conclude that the remarkable spectrum of the gaseous nebulæ has not been produced by burning magnesium.[1]

I should mention that Mr. Lockyer attributes one other line occasionally seen in the gaseous nebulæ to the flame spectrum of magnesium—namely, a very faint line at about λ 4700. Now, according to my experience, it is only in the spark and arc that a line of magnesium appears at this place, a condition of the spectrum when the lines at *b* are very conspicuous, and the band at λ 5006·5 is usually absent. When, however, the spark is taken in magnesium chloride, the band is present under some conditions, but the triplet at *b* is always bright. I therefore consulted Prof. Liveing, who says:—"I have never seen the line at λ 4703 in the spectrum of the magnesium flame. As it is a conspicuous line in the arc and spark, we looked for it in the flame, but did not find it."

With reference to the second nebular line at λ 4957, Mr. Lockyer says (Roy. Soc. Proc., vol. xliii. p. 133): "The lines at 500 and 495 have been seen in the glow of the Dhurmsala meteorite when heated, but the origin of 495 has not yet been determined." And further (at p. 135): "I should add that the line at 495 makes its appearance much more rarely than the one at 500 in meteorite glows." In the diagram on the same page this line is represented as coincident with the nebular line.

The circumstance of a line appearing at 495 can scarcely be regarded, considering the very great number of spectral lines, as amounting to a presumption that the material to which it is due in the meteorite is the same as that present in the nebulæ which gives the line at 4957. If it should be shown that the unknown substance in the meteorite gives rise to a line at the position of the nebular line—namely, λ 4957—in that case the observation would have sufficient importance to make it desirable to compare the spectrum of the meteorite directly with that of the nebula.

Lines Observed and Photographed in the Spectrum of the Nebula.

Line measured by Dr. Copeland, probably D_3		λ 5874·0
Brightest line		5004·6 to 5004·8
Second line		4957·0
Third line, Hβ		4860·7
Fourth line, Hγ		4340·1
Line measured by Dr. Copeland		4476·0
Strong line in photographs 1882 and 1888, about		3724·0
Line in photographs 1888, about		3709 0
,, ,, ,,		3699·0
Photograph 1889. 1st pair	about	3752·0
	,,	3741·0
,, 2nd pair	,,	3285·0
	,,	3275·0
Line at	,,	3060·0
,, 3rd pair	,,	3053·0
	,,	3047·0
	,,	4116·0
Photograph 1888	,,	4123·0
Line across star spectra, 1st group	,,	4130·0
	,,	4142·0
	,,	4154·0
	,,	4167·0
	approximate	3998·0
2nd group	,,	3988·0
	,,	3975·0
	,,	3959·0
	,,	3895·0
	,,	3887·0
	,,	3878·0
	,,	3870·0
3rd group	,,	3859 0
	,,	3854·0
	,,	3848·0
	,,	3842·0
	,,	3832·0
	,,	3825·0

[1] Mr. Taylor, late of the South Kensington Laboratories, observing at Sir Henry Thompson's observatory in November 1888, says:—"The 5001 line is by far the brightest in the spectrum. It is never seen sharp, but with the narrowest slit always has a fluffy appearance, this being much more marked on the blue than on the red edge. This line was most carefully examined for evidence of structure, but was always found to be single, and no decided evidence of fluting structure could be made out. It may be that greater dispersion may show structure, but with the dispersion used here no structure could be seen."—*Monthly Notices R.A.S.*, vol. xlix. p. 125.

[1] On the narrower basis of the magnesium spectrum only, Profs. Liveing and Dewar point out that "the appearance of a line in the position of the first band without any trace of the second band, which is nearly as bright as the first, and without any trace of the *b* group, is quite sufficient to create a suspicion of mistaken identity when Mr. Lockyer ascribes the sharp green line in the spectrum of nebulæ to this band of magnesia. This suspicion will be strengthened when it is noticed that the line in question is usually in nebulæ associated with the F line of hydrogen, if it be borne in mind

Chemical Significance of the Lines.

Until I can obtain more photographs taken on different parts of the nebula, I wish to be understood to speak on this point with much hesitation, and provisionally only. We know certainly that two of the lines are produced by hydrogen. The fineness of these lines points to a high temperature and condition of great tenuity of the hydrogen from which the light was emitted. This condition of the hydrogen may give us a clue as to the probable interpretation of the other lines. These may come from substances of very low vapour-density, and under molecular conditions which are consistent with a high temperature. It is in accordance with this view that the recent measures of Dr. Copeland, since confirmed by Mr. Taylor (*loc. cit.*), show with great probability that the line known as 1_3, which has been supposed to indicate some substance of low vapour-density, which shows itself only at the hottest region of the sun, is present in the nebular spectrum. The great simplicity of the three pairs of lines seen in the photograph of 1889 suggests a substance of a similar chemical nature.

If hydrogen can exist at half its usual vapour-density, with a molecule of one atom only, we might possibly expect to find it in some of these bodies, but at present we do not know what its spectrum would be in such a condition. It may be possibly that it is in molecular states of our elements other than those we are acquainted with that we may have to look for an interpretation of some of the lines of these bodies.

[With respect to the groups of lines which cross the star spectra, any statements must also be provisional only.

These lines are distinct and fairly strong in the star spectra, and do extend, some farther than others, into the adjoining nebular matter. Whether they are peculiar to these particular stars and the matter close about them, or whether they will be found everywhere in the nebula, or in certain parts of greater condensation only, can be known only from future photographs.

The first group shows some general agreements with a strong iron group, but there are also formidable discrepancies.

The position of the third group suggested the well-known cyanogen group, especially as this group, beginning at λ 3883, is the first to appear under the chemical conditions which might have been conceived to exist under circumstances of condensation (see Liveing and Dewar, Roy. Soc. Proc., vol. xxxiv., 1883, p. 128). Under these conditions this group appears alone in a photograph, without the less refrangible group, as was probably the case in the photograph I took of Comet II., 1881. I therefore took a photograph of an oxy-coal-gas flame, the coal-gas having passed through ammonia, and a magnesium-flame spectrum on the same plate for comparison.

On comparing this photograph with that of the nebula it was seen by eye, and afterwards confirmed by measurement, that the nebula group begins soooner by one strong line than the cyanogen group, and presents besides in the relative strength and grouping of the lines a distinctly different character. The evidence appears to me to be against attributing these lines to cyanogen.

I took great pains to ascertain if the group of lines which accompanies the triplet of the magnesium-flame spectrum could be made to agree with the much longer group of lines in the nebula at this part of the spectrum. Again, as in the case of the cyanogen group, the whole aspect of the grouping of lines is quite different. The groups begin and end differently, and the relative strength of different parts of the group is not the same. The great increase of strength which is seen in the middle of the magnesium group is not present at the corresponding part of the nebula group. I do not think therefore there should be much weight given to the near positions of several individual lines of the two groups, which in the case of so close a grouping might well be accidental, especially as the wave-lengths can be but approximate only. (The strongest lines of the magnesium-flame group are those forming the triplet which appears also in the spark and the arc. A nebular line is near the middle line of the triplet, but there are no lines corresponding to the other lines of the triplet. The other lines of the flame group are too faint to be expected to appear, unless the triplet at 3720—3730 were strong upon the plate.—*May* 18.)

The three pairs of lines in the photograph of 1889, which are doubtless rhythmically connected, appear to me to possess great interest, especially if it should come to be found from future photographs that these groups are characteristic of the most tenuous part of the nebula. At present, I am not able to make any suggestion as to their chemical origin, but the suggestion presents itself that we may have to do with some molecule of very low vapour density.

The pair of lines on the more refrangible side of the line at λ 3724, may possibly be connected with the state of the nebula as it exists in the neighbourhood of the stars.—*April* 26.]

General Conclusions.

It seems to me premature until we can learn more of the significance of the new groups of lines, and especially of their connection with the nebular matter generally, or with certain condensed parts only, to express more than provisional suggestions as to the nature of these nebulæ. It may be that they represent an early stage in the evolutionary changes of the heavenly bodies.

As some physical importance, in the relation of these nebulæ to each other, has been given to my inability, in consequence of insufficient optical means in my original observations in 1864, to see all three of the bright lines in some faint nebulæ, I may mention that in the case of one object, the Ring Nebula in Lyra, in which at that time the light appeared monochromatic, as only the brightest line could be certainly seen, as soon as larger means were placed at my disposal by the loan of the Royal Society telescope in 1870, I had no difficulty in seeing all three lines on any night of sufficient clearness. There is little doubt that the came cause prevented me from seeing more than the brightest line in Nebula 4572 of Herschel's "General Catalogue." Vogel saw two lines ("Beobachtungen zu Bothkamp," 1872, p. 59).

These bodies may stand at or near the beginning of the evolutionary cycle, so far as we can know it. They consist probably of gas at a high temperature and very tenuous, where chemical dissociation exists, and the constituents of the mass, doubtless, are arranged in the order of vapour-density. As to the conditions which may have been anterior to this state of things, the spectroscope is silent. We are free, so far as the spectroscope can inform us, to adopt the hypothesis which other considerations may make most probable. On Dr. Croll's form of the impact theory of stellar evolution, which begins by assuming the existence of stellar masses in motion, and considers all subsequent evolutional stages to be due to the energy of this motion converted into heat by the collision of two such bodies, these nebulæ would represent the second stage in which these existing solid bodies had been converted into a gas of a very high temperature. They would take the same place, if we assume with Sir William Thomson (Roy. Instit. Proc., vol. xii. p. 15) the coming together of two or more cool solid masses by the velocity due to their mutual gravitation alone.

I pointed out in 1864 (Phil. Trans., 1864) that the gaseous nature of these bodies would afford an explanation of the appearance of flat disks without condensation which many of them present. The light emitted by the portions of the gas further from us would be in part or wholly absorbed by the gas through which it would have to pass, in this way giving to us the appearance of a luminous surface only.

In some of these bodies there is also a very faint continuous spectrum, which if we had more light might be found to consist, in great part at least, of closely adjacent bright lines. Such is probably the nature, in part, of the apparently continuous spectrum of the nebula with which this paper deals chiefly, the Great Nebula in Orion.

In other gaseous nebulæ strong condensations are seen, and a stronger "continuous" spectrum. When we come to nebulæ of which the nebula in Andromeda may be taken as representative, the strong bright-line spectrum is absent, and we have what for convenience I called, in my original observations of these bodies, a "continuous" spectrum, though I was careful to point out that it was probably "crossed by bright or dark lines."

Out of about sixty nebulæ and close clusters observed by me up to 1866, I found a proportion of about one-third—namely, nineteen—to present the spectrum of bright lines (Phil. Trans., 1866, p. 383).

The stage of evolution which the nebula in Andromeda represents is no longer a matter of hypothesis. The splendid photograph recently taken by Mr. Roberts of this nebula shows a planetary system at a somewhat advanced stage of evolution; already several planets have been thrown off, and the central

that the spark of magnesium in hydrogen does not give the bands, and that the oxyhydrogen flame hardly produces them from magnesia when the hydrogen is in excess" (Roy. Soc. Proc., vol. xliv. p. 245). Mr. Taylor records a brightening of the continuous spectrum of the nebula at λ 5200, which he suggests may be magnesium. But this position is twenty-five units from that of the middle of the magnesium triplet at *b* (*Monthly Notices R.A.S.*, vol. xlix p. 125).

gaseous mass has condensed to a moderate size as compared with the dimensions it must have possessed before any planets had been formed.

SYDNEY.

Royal Society of New South Wales, July 3.—Prof. Liversidge, F.R.S., President in the chair.—The Chairman announced that Mr. C. S. Wilkinson, the Government Geologist, had kindly consented to deliver (gratuitously) a course of (three) lectures in connection with the Clarke Memorial, commencing in October or November next.—The following papers were read:—Notes on the high tide of June 15–17, 1889, by John Tebbutt; and on the marine and fresh-water Invertebrates of Port Jackson and the neighbourhood, by Thomas Whitelegge. At the conclusion of the latter paper the President presented the Society's bronze medal, which, together with a money prize of £25, had been awarded to Mr. Whitelegge for his paper.—Prof. Anderson Stuart showed a modification of the "kymoscope" which he exhibited at the Society's last monthly meeting. This form demonstrated the phenomena of interference in wave motion—one series of tubes had one wave, a parallel series had the other, and both opened into a common series in which the interference was made visible. The two waves came from pumps which could be so arranged as to vary the amplitude of the waves and to change the position of the straight lines produced when the waves met or "interfered."

PARIS.

Academy of Sciences, August 19.—M. des Cloizeaux, President, in the chair.—Remarks on the conditions under which the fixation of nitrogen is effected in argillaceous soils, by M. Berthelot. Here is described a fresh series of experiments on the fixation of nitrogen in the ground with the co-operation of living organisms, microbes, and more highly organized plants. Replying to a recent communication of M. Schlœsing on the negative results of his studies, M. Berthelot accepts these conclusions, and even claims priority for them, adding, however, that they were given by him as defining the negative conditions of the phenomenon—that is, the conditions under which the fixation of nitrogen does not take place. In a second paper M. Berthelot describes some further researches on the fixation of nitrogen by vegetable humus under the influence of electricity.—Note on the glacial epoch, by M. H. Faye. It is argued that glaciation does not depend on any direct cause, such as a passing obscuration of the sun at the beginning of the Quaternary epoch, but is due to a far more remote cause—that is to say, the appearance of the seasons and of the poles of low temperature at a time when the sun had acquired its definite form and dimensions. A repetition of the great changes that took place during Tertiary times has been prevented by the continually increasing thickness of the terrestrial crust and by the slower rate of progress of the cooling process.—Observations on the sardine frequenting the Mediterranean waters, by M. A. F. Marion. The results are here communicated of the researches made by the author during the fishing season 1888-1889, for the purpose of verifying and completing his previous observations on the migrations and life-history of the sardine periodically visiting the shores of the Mediterranean.—On the total eclipse of August 19, 1887, by M. N. Egoroff. This is a summary of the Russian report on the observations of the eclipse of 1887 made at the seven stations of the Russian Physico-Chemical Society in accordance with the programme prepared by the Special Commission.—Electric figures produced by lightning, by M. Ch. V. Zenger. The curious effects are described of an electric discharge which struck a silvered mirror during a terrific thunderstorm near Prague, on June 9, 1889. The mirror shows over ten points at which the electric fluid penetrated through its gilded frame, volatilizing and transferring the gold to the anterior face of the glass, while on the opposite side the volatilization of the silver coating produced the most beautiful electric figures. These figures show that there occurred repeated and successive discharges, as also indicated by recent photographs of flashes taken with the oscillating camera obscura.—Observation of the occultation of Jupiter and its satellites by the moon, taken at the Observatory of Nice, by M. Perrotin. The hours of the various phases of the occultation that took place on August 7, 1889, are tabulated at mean time at Nice. The satellites are shown to have disappeared, not instantaneously, but gradually during several tenths of a second.—Observations of the new planet discovered at the Observatory of Nice on August 3, 1889, by M. Charlois. The observations are for the period August 3–6, when the planet had the brightness of a star of magnitude 13·5 to 14.—On a new mode of teaching music, based on the periodicity of the octave, by M. Ricard. The author aims at a radical reform in the teaching of music, and expounds his system in a series of fundamental propositions, such as: musical effect is quite different from acoustic effect; there can be no physical gamut, a major and a minor, but one only, that of the white notes of the piano, called the major, and so on.—On contraction in solutions, by M. Charpy. The object of these researches is to determine how the contraction produced in the process of solution varies with its concentration.—On the phosphotungstic acids, by M. E. Péchard. The methods hitherto employed for the preparation of these acids have all been indirect. But the study of metatungstic acid has suggested to M. Péchard the possibility of realizing the direct union of this acid with phosphoric acid. The general method of preparation consists in evaporating, under suitable conditions, a mixture of both acids in determined proportions.—On the passivity of cobalt, by M. Ernest Saint-Edme. It is shown that certain treatises on chemistry are wrong in stating that cobalt in the presence of concentrated nitric acid becomes *passive* like iron and nickel.—On the heat of combustion of some organic compounds (continued), by M. S. Ossipoff. The author's series of determinations is here concluded with teraconic acid, malic anhydride, methyl fumarate, and maleate of methyl.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Leçons Synthétiques de Mécanique Générale: M. J. Boussinesq (Paris, Gauthier-Villars).—Traité d'Optique, tome premier, M. E. Mascart (Paris, Gauthier-Villars).—Index Generum Avium; a List of the Genera and Subgenera of Birds: F. H. Waterhouse (Porter).—The Alternate Current Transformer in Theory and Practice; vol. i. The Induction of Electric Currents: J. A. Fleming (*Electrician* Office).—Album von Celébes-Typen: Dr. A. B. Meyer (Dresden).—Lung-Ch'Uan-Yao oder Altes Seladon-Porzellan: Dr. A. B. Meyer (Berlin, Friedländer).—Le Développement de l'Image Latente: A. de la Baume Pluvinel (Paris, Gauthier-Villars).—Traité Pratique du Développement: A. Londe (Paris, Gauthier-Villars).—Le Cylindrographe: P. Mégssard (Paris, Gauthier-Villars).—History of Higher Education in South Carolina: C. Meriwether (Washington).—Education in Georgia: C. E. Jones (Washington).—History of Education in Florida: G. G. Bush (Washington).—Higher Education in Wisconsin: Allen and Spencer (Washington).

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