Zeitschrift f. Elektrochemie. They point out that no trustworthy details of the method employed in the various works where the metal is now produced have hitherto been made public. Using a small experimental fusion cell, and the ordinary lighting supply current of the Karlsruhe Technical Institute, they were able to reduce alumina without difficulty and to obtain as much as 230 grams of the metal in one operation. The metal obtained was remarkably pure, one sample tested containing only ·05 per cent. C and ·034 per cent. Si. The mechanical tests made with six samples of the aluminium gave an average tensile strength of 21,425 lb. per square inch. The fused mixture used in the carbon cell contained 33 per cent. AlF_3, 33 per cent. NaF and 33 per cent. Al_2O_3, the high percentage of aluminium fluoride being conducive to fluidity. The current density employed was about 2800 amperes per square foot, and the E.M.F. varied between 7 and 10 volts. The authors, as the result of their experiments, have come to the conclusion that the steady improvement in the efficiency of the process as carried out in the aluminium works is due, not to secret modifications in the process, but to the more careful attention now given to the purity of the raw materials employed. They also point out that the carbon contained in the aluminium obtained in their experiments was not present in the combined form, and as it was graphitic in character they assume that it represented mechanically enclosed particles, due to the disintegration of the anode and kathode carbon. By remelting the aluminium, it was possible to remove a portion of this impurity from the metal. The necessity of employing carbons comparatively free from ash is insisted on, since any impurities of the carbon used will be found in the final product.

The additions to the Zoological Society's Gardens during the past week include a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, presented by Mr. J. S. Sweetman; a Ring-tailed Lemur (*Lemur catta*) from Madagascar, presented by Colonel Ewart; a Tiger (*Felis tigris*) from India, presented by Mr. A. Forbes; two Two-spotted Paradoxures (*Nandinia binotata*) from West Africa, presented respectively by Major D'Arcy Anderson and Mr. Walter O'Brien; two Bank Voles (*Arvicola pratensis*) British, presented by Mr. G. T. Rope; a Broad-fronted Crocodile (*Osteoloemus tetraspis*) from West Africa, presented by Dr. W. F. Macfarlane; a White-collared Mangabey (*Cercocebus collaris*) from West Africa, a Black-faced Spider Monkey (*Ateles ater*) from Eastern Peru, a White-fronted Capuchin (*Cebus albifrons*) from South America, a Common Marmoset (*Hapale jacchus*), a Six-banded Armadillo (*Dasypus sexcinctus*) from Brazil, a Vulpine Phalanger (*Trichosurus vulpecula*) from Australia, two Petz's Conures (*Conurus canicularis*) from Mexico, a Western Boa (*Boa occidentalis*) from Argentina, deposited; five American Pochards (*Fuligula americana*) from North America, received in exchange.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN SEPTEMBER:—

Sept. 3. 7h. 59m. Minimum of Algol (β Persei).
6. 8h. 1m. to 11h. 43m. Transit of Jupiter's Sat. III.
13. 11h. 28m. to 15h. 11m. Transit of Jupiter's Sat. III.
15. Venus. Illuminated portion of disc = 0·945, of Mars = 0·948.
22. 9h. 2m. to 9h. 25m. Moon occults δ^1 Tauri (mag. 4·0).
22. 9h. 14m. to 10h. 2m. Moon occults δ^2 Tauri (mag. 4·7).
23. 8h. 13m. to 13h. 6m. Transit of Jupiter's Sat. IV.
23. 9h. 41m. Minimum of Algol (β Persei).
Sept. 23. 10h. 34m. to 11h. 12m. Moon occults 115 Tauri (mag. 5·4).
23. 12h. 0m. Sun enters Libra. Autumn commences.
23. 13h. 28m. to 13h. 53m. Moon occults 120 Tauri (mag. 5·3).
24. 17h. 0m. Mercury at greatest elongation (26° 11′ E.).
24. 17h. 32m. to 18h. 38m. Moon occults 26 Geminorum (mag. 5 1).
25. 13h. 40m. to 14h. 40m. Moon occults 68 Geminorum (mag. 5·0).
26. 6h. 30m. Minimum of Algol (β Persei).
27. 15h. 22m. to 15h. 38m. Moon occults ω Leonis (mag. 5·6).

NEW DISCOVERIES OF VARIABLE VELOCITIES IN LINE OF SIGHT.—In addition to the thirty-two binaries previously announced, Prof. Campbell records the data of six more spectroscopic binaries which have been detected with the Mills spectrograph; they are the following:—

ϕ *Persei*: α = 1h. 37m.; δ = + 50° 11′. The maximum variation as yet recorded is from +24 km. (December 16, 1900) to −12 km. (November 11, 1901). This star has bright hydrogen lines, Hγ appearing as a narrow absorption line with very bright borders.

η *Geminorum*: α = 6h. 09m.; δ = + 22° 33′. Maximum variation as yet recorded is from +14 km. (January 15, 1900) to 25 km. (February 2, 1902).

γ *Canis Minoris*: α = 7h. 23m.; δ = + 9° 08′. Range of variability as yet detected is from +40 km. (November 6, 1901) to +54 km. (December 22, 1901).

ζ *Herculis*: α = 16h. 38m.; δ = 31° 47′. This is a well-known visual binary having a period of about thirty-three years, but the earlier observations of Belopolsky, Campbell and Newall in 1893, 1898 and 1897–99, respectively, did not establish the variability. However, by taking the means of these early observations and comparing them with the mean of the recently observed velocities determined at the Lick Observatory, it is found that the velocity has changed by about 4 km. since 1898.

α *Equulei*: α = 21h. 11m.; δ = +4° 50′. The velocity of this star varied from − 26 km. on June 25, 1900, to − 2 km. on June 25, 1901, and then returned to − 26 km. on June 2, 1902.

o *Andromedae*: α = 22h. 57m.; δ = + 41° 47′. The range of variability, so far as it is yet known, is from − 11 km. (October 9, 1900) to − 20 km. (June 25, 1901).

Miss Maury, of the Harvard College Observatory, has discovered the composite character of the spectra of the two last-mentioned stars.

Out of the 350 stars observed up to date, 41 have proved to be spectroscopic binaries, giving a proportion of one binary to every eight stars observed, not taking into account a number of suspected cases which await confirmation.

The variable velocity of the sun has a double amplitude of only a few hundredths of a kilometre, and Prof. Campbell suggests that, with increased accuracy in our methods of observation, we shall probably find that there is a regular gradation from this comparatively minute quantity up to the much greater velocities already recorded, and that it will be found that a star which is *not* a spectroscopic binary is a rare exception (Lick Observatory *Bulletin*, No. 20).

THE NAMING OF NEW VARIABLE STARS.—No. 3808 of the *Astronomische Nachrichten* contains a list of the titles which have been assigned to the 24 variables discovered during the years 1900, 1901 and 1902 by the commission appointed to this duty. Among the 24 there are only four variables of the Algol type, one of which has the remarkable period of 31·3 days.

The published table gives the star's number in Chandler's catalogue, its temporary name, the assigned permanent name, the maximum and minimum magnitudes, and the data regarding the position for 1900.

THE SPECTRUM OF NOVA PERSEI.—Prof. Campbell and Mr. Wright subscribe a short note to the Lick Observatory *Bulletin*, No. 20, on the later spectrum of Nova Persei (1901).

Spectrograms, obtained throughout the autumn and winter, up to January 7, 1902, showed no appreciable difference from the immediately preceding ones, the fine dark H (calcium) line referred to in *Bulletin* No. 8 still remaining visible. It was suggested that the corresponding K line did not appear because there was no light in that region of the spectrum for the calcium vapour to absorb, but this suggestion has been proved incorrect

by the appearance of the K line on a negative, obtained by Mr. Wright, which was given a very long exposure with the intention of deciding whether this line did, or did not, exist in the Nova spectrum.

The writers suggest that it would now be an exceedingly interesting experiment to test the presence of the absorption lines of calcium, sodium and other elements, in the gaseous nebulæ, by giving exposures long enough to record their continuous spectra.

THE CHANGES IN THE NEBULA SURROUNDING NOVA PERSEI.—Prof. Louis Bell, writing in the *Astrophysical Journal* (No. 1, vol. xvi.), discredits the "simple reflection" explanation of the changes which have taken place so rapidly in the nebulous matter surrounding the Nova, for the following reasons:—(1) Reflected light would be more or less polarised, and Perrine reports the total absence of polarisation in the light received from this nebula. (2) Reflection does not satisfactorily explain the persistence of strongly illuminated nebulosity at small angular distances from the Nova. (3) At the enormous distances (210 light days) from the Nova that some of the bright portions are situated, reflection would not account for the brightness of these parts.

Prof. Bell supports the theory of Seeliger, which accounts for the apparent movements of the brightest portions of the nebula, by supposing that the various parts of this highly tenuous matter are successively lighted up by the effects of a travelling electromagnetic wave-front, and shows that this theory agrees entirely with the observed phenomena.

HUGH MILLER: HIS WORK AND INFLUENCE.[1]

AMONG the picturesque figures that walked the streets of Edinburgh in the middle of last century, one that often caught the notice of the passer-by was that of a man of good height and broad shoulders, clad in a suit of rough tweed, with a shepherd's plaid across his chest and a stout stick in his hand. His shock of sandy-coloured hair escaped from under a soft felt-hat; his blue eyes, either fixed on the ground or gazing dreamily ahead, seemed to take no heed of their surroundings. His rugged features wore an expression of earnest gravity, softening sometimes into a smile and often suffused with a look of wistful sadness, while the firmly compressed lips betokened strength and determination of character. The springy, elastic step with which he moved swiftly along the crowded pavement was that of the mountaineer rather than of the native of a populous city. A stranger would pause to look after him and to wonder what manner of man this could be. If such a visitor ventured to question one of the passing townsmen, he would be told promptly and with no little pride, "That is Hugh Miller." No further description or explanation would be deemed necessary, for the name had not only grown to be a household word in Edinburgh and over the whole of Scotland, but had now become familiar wherever the English language was spoken, even to the furthest western wilds of Canada and the United States.

A hundred years have passed since this notable man was born, and nearly half that interval has elapsed since he was laid in the grave. The hand of time, that resistlessly winnows the wheat from the chaff of human achievement, has been quietly shaping what will remain as the permanent sum of his work and influence. The temporary and transitory events in his career have already, in large measure, receded into the background. The minor contests in which, from his official position, he was so often forced to engage are mostly forgotten; the greater battles that he fought and won are remembered rather for their broad and brilliant results than for the crowded incidents that gave them such vivid interest at the time. His contemporaries who still survive him—every year a sadly diminishing number—can look back across the half century and mark how the active and strenuous nature whose memory they so fondly cherish, now

> "Orbs into the perfect star
> We saw not when we moved therein."

A juster estimate can doubtless be formed to-day of what we owe to him than was possible in his lifetime. That the debt is great admits of no dispute, and that it is acknowledged to be due could hardly be more fittingly shown than by the widespread desire which has brought us here to-day from so many distant places in order to raise in the town of his birth, which he made a place of pilgrimage to many a lover of English literature, a visible memorial of him in an institution of which he would himself have heartily approved.

In order adequately to realise the nature and extent of the work achieved by Hugh Miller during his too brief career, we should clearly picture to ourselves the peculiar conditions in which he grew up. Happily he has himself, in one of the most charming pieces of autobiography in the language, told the story of his youth and early manhood. Descended from both a Highland and a Lowland ancestry, he combined in his nature the vivid imagination and poetic impulse of the Celt with the more staid and logical temperament of the Teuton. He was born amidst an English-speaking community, but at a distance of only a few miles from the fringe of the mountainous region within which men use the Gaelic tongue. He knew some survivors of Culloden, and had heard his own grandfather tell how, when a stripling, he watched, from the hills above Cromarty, the smoke wreaths of the battle as they drifted along the ridge on the further side of the Moray Firth. From infancy he was personally familiar with the people of the hills and their traditions, as well as with the ways of the hardy fisher-folk and farmers of the plains. The hereditary predispositions of his mind were in this way fostered by contact with the two races from which they sprang.

Happy in the possession of this racial blending, he was still more fortunate in the place of his birth. He used to remark with satisfaction that both Sir Roderick Murchison and he had been born on the Old Red Sandstone of the Black Isle; but while the career of the author of the "Silurian System" owed practically nothing to his birthplace, which he left while still an infant, Miller's life from beginning to end bore the impress of the surroundings amid which he was born and educated. It would hardly be possible to choose in this country a place of which the varied features are more admirably fitted to stimulate the observing faculties, to foster a love of nature, and to appeal to the poetic imagination than the winding shores, the scarped cliffs, the tangled woods, the wild boulder-strewn moors and distant sweep of blue mountains around Cromarty. And how often and lovingly are these scenes portrayed by him under every varying phase of weather and season! They had stamped themselves into his very soul and had become an integral part of his being.

> "The sounding cataract
> Haunted him like a passion; the tall rock,
> The mountain, and the deep and gloomy wood,
> Their colours and their forms were then to him
> An appetite, a feeling, and a love."

But while Nature was his first and best teacher, he has told us in grateful words how much he owed to two uncles—hard-working, sagacious and observant men, by whom his young eyes were trained to discriminate flower and tree, bird and insect, together with the teeming organisms of the shore, and whose high moral worth he, even as a boy, could appreciate. Having learnt to read while still of tender years, he developed an insatiable thirst for books. What he acquired in this way for himself seems to have been at least as useful as the training gained during the rather desultory years spent by him at the town grammar-school. He was an intelligent but wayward boy, as much ahead of his schoolmates in general information as in all madcap adventures among the crags and woods. When the time arrived at which he had to choose his calling in life, he selected an occupation that would still enable him to spend his days in the open air and gratify his overmastering propensity for natural history pursuits. Much to the chagrin of his family he determined to be a stone-mason, and at the age of seventeen was apprenticed to that trade. For some fifteen years he continued to work in quarries and in the erection of buildings in various districts of the north country, and even extended his experience for a short time into Midlothian. Deeply interesting and instructive is the record he has left of these years of mechanical toil. But amidst all the hardships and temptations of the life, the purity and strength of his character bore him nobly through. His keen love of nature and his intense enjoyment of books were a never-failing solace. He continued to gain access to, and even by degrees to possess, a considerable body of the best literature in our language, reading some of his favourite authors over twice in a year. He thus laid up a

[1] An address given at the centenary celebration of the birth of Hugh Miller held in Cromarty on August 22, by Sir Archibald Geikie, D.C.L., F.R.S.