science and education in the Dominion. Thanks to the encouragement given by the Canadian Government, the Society has been able, year by year, to publish a large volume of the proceedings and transactions of its members. The papers and monographs therein contained embrace a wide field of literary effort—the whole range of archæological, ethnological, historical, geographical, biological, geological, mathematical and physical sciences; and they bear witness to fifteen years of creditable work for the intellectual welfare of the Dominion of Canada.

THE additions to the Zoological Society's Gardens during the past week include a White-collared Mangabey (*Cercocebus collaris*, ♀) from West Africa, presented by Miss Daisy Kendall; a Beisa Antelope (*Oryx beisa*), a Caffer Cat (*Felis caffra*) from Somaliland, two Arabian Gazelles (*Gazella arabica*, ♂ ♂) from Arabia, presented by Mr. J. Benet Stanford; a Zanzibar Antelope (*Nesotragus moschatus*, ♀), an Augur Buzzard (*Buteo augur*) from East Africa, presented by Mr. Cavendish; a Red River Hog ((*Potamochœrus penicillatus*, ♀) from West Africa, presented by Captain Smith, s.s. *Boma*; a Leopard (*Felis pardus*, ♂) from West Africa, presented by Captain Humfrey; a Chinchilla (*Chinchilla lanigera*) from Chili, presented by Mr. J. A. Wolffsohn; an Egyptian Ichneumon (*Herpestes ichneumon*) from Egypt, presented by Mr. Ernest A. Dixon; a Spotted River Turtle (*Emyda vittata*) from India, presented by Mr. A. Felix; a Geoffroy's Cat (*Felis geoffroii*), a Matamata Terrapin (*Chelys fimbriata*) from Brazil, presented by Mr. W. Brice; a Spotted Eagle Owl (*Bubo maculosus*), a Delalande's Lizard (*Nucras delalandii*), three Lineated Snakes (*Boodon lineatus*), eleven Rough-keeled Snakes (*Dasypeltis scabra*), four Crossed Snakes (*Psammophis crucifer*), ten Rufescent Snakes (*Leptodira holambœia*), two Rhomb-marked Snakes (*Trimerorhinus rhombeatus*) from Port Elizabeth, South Africa, presented by Mr. J. E. Matcham; a Wapiti Deer (*Cervus canadensis*, ♂), two Collared Fruit Bats (*Cynonycteris collaris*), born in the Gardens; a Great Wallaroo (*Macropus robustus*, ♀) from South Australia, purchased; a Cape Zorilla (*Ictonyx zorilla*) from South Africa, deposited.

OUR ASTRONOMICAL COLUMN.

THE LAW OF SPECTRAL SERIES.—Previously in this column (vol. lv. p. 137) we have referred to some of the work which has been done with the object of finding satisfactory formulæ for the computation of the wave-lengths of lines which form spectral series. Two further interesting communications have recently been published, which are important in that they suggest that the formulæ at present in use are only roughly approximate for the series as a whole, and that the anomalies which here and there are found may eventually be satisfactorily explained. The first of these communications is due to Prof. T. N. Thiele (*Astrophysical Journal* for August), who has for some time been occupied with investigations on the law of spectral series, and whose remarks are of considerable importance. The problem, as he states, is a very troublesome one, and those who occupy themselves with it cannot hope to make, so far as his experience goes, those little discoveries which relieve tedious investigations. In fact, one's fundamental assumptions often give way before the constant criticism to which they are exposed. The general law of series is, however, still wanting, although the more or less complete resolution of spectra into series may be now approximately accomplished. Prof. Thiele's work has proved that the law, which expresses the wave-lengths of the lines in a spectral series, must have the form

$$\lambda = f[(n + c)^2]$$

when λ is the wave-length, and c a constant which he calls the phase of the series: all other formulæ are only special cases of this general one. Accepting this formula and all its consequences some very interesting points arise, the most important being that it is necessary to take into account not only the lines corresponding to positive values of n, but those when n is less than 0. This involves that a *series* must in general be composed of *two groups of lines*, each of which would ordinarily be called a series, or, as Prof. Thiele calls them, two branches, but cases may arise when the two branches coincide. It does not necessarily follow that both series will always be seen, as the intensity of one may be much less than that of the other. In cases where there are three, four, or more branches, the pairs of branches must be separated out. Another point which arises from this new idea is the question as to whether the double series, ordinarily found in metallic spectra, may not also be regarded as constituting a single series in which both the negative and positive values of n are used. In the same paper Prof. Thiele gives a modification of Prof. Pickering's formula for use in more precise investigations. As an illustration of the question of the relation between sharp and diffuse series as branches of a single series, Prof. Thiele works out the lines in the spectrum of helium, and he is led to the conclusion that "in spite of the remarkable correspondence of these two series I must therefore (*sic*) deny their unity." The second paper, which we can now only briefly refer to, is that by L. Rummel, read before the Royal Society of Victoria in 1896, November 12 (vol. ix.). The author practically obtained a formula independently but similar to that given by Balmer for computing the wave-lengths of the spectral lines of the alkalis, working out the substances lithium, sodium, potassium, rubidium, and cæsium. In another paper, communicated by the author to the same Society in 1897, June 10 (vol. x.), he gives the result of his investigation on the relationship between the spectra of the alkalis and their atomic weights.

THE VARIABLE STAR η AQUILÆ.—In the *Memorie della Società degli Spettroscopisti Italiani*, Prof. A. Belopolsky describes some preliminary researches which he has made with respect to the motion of the variable star, η Aquilæ, as determined by movement in the line of sight. Up to the present time he has been able to secure twelve photographs, the duration of exposure in all cases being less than an hour. The measures were made relatively to the solar spectrum, which was superposed on the spectrum of the star with the help of the artificial spectrum of iron. Twelve prominent lines were used, and three systems of readings were obtained; namely, those given by comparing the stellar and solar spectrum, the solar and artificial spectrum, and the stellar and artificial spectrum. By means of a graphical process the author determines the required and the direct displacement.

The following summary gives in tabular form the times of observation, the intervals of time between the minimum and the moment of observation, the radial velocity, and the velocity relative to the sun.

1897.	Mean time Pulkova. h.	Interval from minimum. d. h.	Radial velocity.	Vel. rel. to ☉.
July 10	12	2 14	−4·485	−3·86
11	12	3 14	−4·454	−3·89
12	13	4 15	−3·196	−2·70
13	12	5 14	−2·022	−1·58
17	12	2 10	−3·629	−3·44
21	12	6 10	−1·228	−1·29
22	12	0 6	+0·146	+0·02
25	11	3 6	−4·016	−4·32
25	12	3 7	−3·604	−3·91
26	11	4 8	−2·930	−3·29
30	12	1 2	+1·195	+0·58
Aug. 2	11	4 1	−2·856	−3·65

Plotting the curve of velocities, after the method of Rambaut and Lehmann-Filhés, Prof. Belopolsky finds that the period 7d. 4h. is sufficiently satisfied on the supposition that the changes of the radial velocity are due to orbital movement of the star. A computation of the orbit, after the method described in *Astronomische Nachrichten* (No. 3242), leads the author to the conclusion that the variation of light cannot be attributed to an eclipse, as the time of eclipse ought to take place 2d. 0h. or 5d. 11h. after the minimum, which is not in accordance with the actual facts. This result is interesting in that it tends to corroborate the conclusion arrived at by Dr. W. J. S. Lockyer ("Resultate aus den Beobachtungen des veränderlichen Sternes η Aquilæ," 1897, Dulau and Co., London) in the latest discussion of all the available observations of this star up to the year 1894 relatively to the form and changes of the light curve.

COMET PERRINE.—We have received a telegram from Prof. Kreutz, Kiel, dated October 18, in which we are informed that Comet Perrine on October 16, at 9h. 38·8m., Lick mean time, appeared of the eighth magnitude, and was situated in R.A. 3h. 36m. 8s. and N.P.D. 23° 13′ 16″. It was observed to have a small tail.

A later telegram, dated October 19, gives the following position and magnitude: October 18, 11h. 31·1m., Pola mean time, R.A. 3h. 25m. 31s., N.P.D. 20° 34′ 44″, magnitude 10·0.

HEREDITARY COLOUR IN HORSES.

MY attention has been drawn to a collection of data on the hereditary transmission of colour in horses, which appeared in the last Christmas Number of the *Horseman*, a newspaper published in Chicago, U.S. It is signed with the pseudonym of "Tron Kirk." I corresponded with the author, who is noted for his knowledge of horse-breeding, and he assures me of their substantial correctness. His statistics are chiefly obtained from breeders' catalogues, and, however valuable in other ways, fail seriously through the great disproportion which must exist between the number of the different sires and that of the dams, a single sire in the polygamatous arrangements of a stud begetting a numerous offspring from nearly as many dams. It is stated that no less than 3100 foals were begotten by only 46 different bay sires, or more than an average of 67 foals by each sire. Now the number of offspring of the 16 different forms of colour union registered in Table I. is, with one exception, by no means large; in 9 cases it is less than 100, and in one of these it is only 6. Consequently the prepotencies, or the reverse, of individual sire will fail to balance each other, and are sure to produce anomalous results.

The data I propose to use are those contained in Table I.; they have been extracted from the memoir in the *Horseman*, but are newly arranged both in line and column. I have omitted grey altogether, no grey stallions being recorded, and all the grey foals coming from grey dams.

TABLE I.

No. of observations	Colour of		Per cents. of colours in offspring				Totals
	Dam	Sire	Chestnut	Bay	Brown	Black	
68	Ches	Ches	100	—	—	—	100
1900	Bay	Bay	10	81	6	3	100
19	Brn	Brn	—	42	52	5	99
25	Blk	Blk	—	4	28	68	100
407	Ches	Bay	33	61	4	2	100
366	Bay	Ches	30	63	3	4	100
52	Ches	Brn	—	86	11	2	99
69	Brn	Ches	16	65	10	9	100
72	Ches	Blk	6	76	15	3	100
57	Blk	Ches	30	40	—	30	100
221	Bay	Brn	1	79	14	6	100
450	Brn	Bay	6	66	18	10	100
156	Bay	Blk	3	60	30	7	100
268	Blk	Bay	7	53	16	24	100
55	Brn	Blk	—	22	38	40	100
6	Blk	Brn	—	16	50	33	99

My first inquiry was to determine whether the sire or the dam exercises the larger influence in transmitting his or her own colour to the offspring, this being a point on which different breeders express contradictory opinions. The truth in the present instance is easily arrived at by means of Table II., where the percentages of the offspring who resemble their Dam are compared with those that resemble their Sire. This is done in each several pair of "reciprocal" unions, such as that which consists of [*Dam*, bay—*Sire*, brown]; and of [*Dam*, brown—*Sire*, bay]. The table shows a total of 394 cases of resemblance

TABLE II.

Colour of the Dam	Per cent. of offspring who in colour resemble their Dam						Totals
	Sire	p.c.	Sire	p.c.	Sire	p.c.	
Chestnut ...	Bay	33	Brn	0	Blk	6	39
Bay	Ches	63	Brn	79	Blk	60	202
Brown ...	Ches	10	Bay	18	Blk	38	66
Black ...	Ches	30	Bay	24	Brn	33	87
							394

Colour of the Sire	Per cent. of offspring who in colour resemble their Sire						Totals
	Dam	p.c.	Dam	p.c.	Dam	p.c.	
Chestnut ...	Bay	30	Brn	16	Blk	30	76
Bay	Ches	61	Brn	66	Blk	53	180
Brown ...	Ches	11	Bay	14	Blk	50	75
Black ...	Ches	3	Bay	7	Brn	40	50
							381

in the one set, to 381 in the other; in short, it proves that the potency of the dam in transmitting colour is substantially the same as that of the sire.

The intention of the second inquiry was to test an important part of my recent theory on "The average contribution of each several ancestor to the total heritage of the offspring" (*Proc. R. Soc.*, June 3, 1897, and NATURE, July 8, 1897). According to this theory each of the two parents contributes *on the average* one quarter of the total heritage, each of the four grandparents one sixteenth, and so on. If this be strictly true, and if the potency of the two sexes be the same, one half of the varied offspring from the [bay—bay] pairs added to one half of those of an equal number from the [brown—brown] pairs, would be identical in character with the same number of the offspring of [bay—brown], also with those of [brown—bay]. The same holds true for every other form of union between sires and dams of different colours. However, the statistics in Table I. run so roughly that this particular comparison would fail to lead to trustworthy results. It is true that reciprocal unions are seen to give rise to similar results in [chestnut and bay], to fairly similar ones in both [bay and brown], and in [brown and black], and to not very dissimilar ones in [bay and black], but each of the two remaining sets is incongruous. Moreover, the figures contained in them run wildly; thus in the line [black—chestnut] the sequence of the numbers, 30, 40, 0, 30, is a statistical impossibility, and in the line [chestnut—brown] the sequence of 0, 86, 11, 2, is very suspicious. It is obvious that a more trustworthy interpretation of the true state of the case might be deduced from these rude data, if the four entries in each line could be appropriately consolidated so as to be expressed by a single number. It occurred to me that a good way of doing so would be to determine the amount of red pigment corresponding to each entry in the same line, and to sum those amounts. Guided at first by the judgment of the eye, and afterwards by observing how nearly each successive assumption satisfied the observed facts, I fixed on the following allowances, supposing full red pigmentation to count as 1. For chestnut, 0·8; for bay, 0·7; for brown, 0·4; and, recollecting the considerable amount of red pigment in the blackest human hair, I fixed the allowance for black at 0·1.

There are twelve equations in which these four values appear; so if all are fairly well satisfied by the above assumptions, we may rest content. I did not take pains to have the red pigment