(*Palæornis torquatus*) from India, a Grey-breasted Parrakeet (*Bolborhynchus monachus*) from Monte Video, two White-fronted Amazons (*Chrysotis leucocephalus*) from Cuba, two European Tree Frogs (*Hyla arborea*), European, deposited; a Barraband's Parrakeet (*Polytelis barrabandi*) from New South Wales, purchased; a Mountain Ka-Ka (*Nestor notabilis*) from New Zealand, received in exchange; two Canadian Beavers (*Castor canadensis*), three Gold Pheasants (*Thaumalea picta*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

FURTHER COMETARY DISCOVERIES.—Mr. W. R. Brooks, Smith Observatory, Geneva, New York, discovered a new comet, 1888 *c*, on August 7. The place for 8h. 46m., G.M.T., on August 7 is given as R.A. 10h. 5m., Decl. 44° 30′ N.. It was observed at Vienna on August 9, 9h. 53·5m., in R.A. 10h. 21m. 53s., Decl. 44° 49′ 26″. Faye's comet was picked up by M. Perrotin at the Nice Observatory on August 9, its place at 15h. 19·5m., Nice M.T., being R.A. 5h. 0m. 27·6s., Decl. 20° 0′ 42″ N. There are thus four comets now under observation. The following ephemeris, supplied in the *Dun Echt Circular*, No. 159, is derived from Dr. Kreutz's ephemeris for Faye's comet in the *Astr. Nachr.*, No. 2849, the time of perihelion passage having been increased by 2·6 days.

Ephemeris for Berlin Noon.

1888	R.A.	Decl.	1888	R.A.	Decl.
	h. m.	° ′		h. m.	° ′
Aug. 20	5 28·5	19 31 N.	Sept. 5	6 9·5	17 58 N.
24	5 39·0	19 13	9	6 19·2	17 27
28	5 49·4	18 51	13	6 28·6	16 54
Sept. 1	5 59·6	18 26 N.	17	6 37·8	16 18 N.

Dr. Backlund's ephemeris for Encke's comet, given in the last issue of NATURE (p. 350), should also have been given for Berlin noon, and not for midnight. The resulting error of the ephemeris at the time of discovery thus becomes O − C; R.A. + 8s.; Decl. − 1″·3.

The following ephemeris, by Dr. H. Kreutz, for Brooks's comet is for Berlin midnight :—

1888.	R.A.	Decl.	1888.	R.A.	Decl.
	h. m. s.	° ′		h. m. s.	° ′
Aug. 15	11 8 8	44 25·7 N.	Aug. 23	12 5 53	42 14·0 N.
19	11 37 41	43 32·9	27	12 32 21	40 33·4

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 AUGUST 19–25.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on August 19

Sun rises, 4h. 54m.; souths, 12h. 3m. 18·2s.; sets, 19h. 12m.: right asc. on meridian, 9h. 56·4m.; decl. 12° 34′ N. Sidereal Time at Sunset, 17h. 6m.

Moon (Full on August 21, 16h.) rises, 18h. 18m.; souths, 22h. 38m.; sets, 3h. 3m.*: right asc. on meridian, 20h. 32·6m.; decl. 19° 20′ S.

Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.	
	h. m.	h. m.	h. m.	h. m.	° ′
Mercury..	4 21 ...	11 47 ...	19 13 ...	9 40·3 ...	15 45 N.
Venus.....	5 51 ...	12 46 ...	19 41 ...	10 39·3 ...	10 3 N.
Mars.....	12 30 ...	16 58 ...	21 26 ...	14 52·2 ...	17 57 S.
Jupiter....	13 26 ...	17 48 ...	22 10 ...	15 41·9 ...	18 58 S.
Saturn....	3 28 ...	11 7 ...	18 46 ...	9 0·0 ...	17 47 N.
Uranus ...	9 24 ...	15 1 ...	20 38 ...	12 54·9 ...	5 12 S.
Neptune..	22 23*...	6 10 ..	13 57 ...	4 2·1 ...	18 59 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich).

Aug.	Star.	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image.	
			h. m.	h. m.	°	°
21 ...	γ Capricorni	... 3½ ...	0 58 ...	2 10 ...	125	314
21 ...	50 Aquarii	... 6 ...	20 17	near approach	162	—
22 ...	ψ^3 Aquarii	... 5 ...	21 46 ...	22 30 ...	29	320
22 ...	ψ^2 Aquarii	... 4½ ...	21 55	near approach	172	—

Aug. h.
24 ... 1 ... Mercury in superior conjunction with the Sun.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
Algol	3 0·9 ...	40 31 N. ...	Aug. 23,	0 55	*m*
			,, 25,	21 44	*m*
λ Tauri...	3 54·5 ...	12 10 N. ...	,, 20,	0 57	*m*
			,, 23,	23 49	*m*
T Monocerotis ...	6 19·2 ...	7 9 N. ...	,, 25,	4 0	*M*
R Canis Minoris...	7 2·6 ...	10 12 N. ...	,, 21,		*M*
δ Libræ	14 55·0 ...	8 4 S. ...	,, 23,	22 34	*m*
U Coronæ	15 13·6 ...	32 3 N. ...	,, 22,	21 7	*m*
S Herculis	16 46·8 ...	15 8 N. ...	,, 23,		*M*
U Ophiuchi... ...	17 10·9 ...	1 20 N. ...	,, 19,	2 48	*m*
		and at intervals of		20 8	
W Sagittarii ...	17 57·9 ...	29 35 S. ...	Aug. 23,	20 0	*m*
U Sagittarii... ...	18 25·3 ...	19 12 S. ...	,, 23,	1 0	*m*
S Sagittarii	19 50·9 ...	16 20 N. ..	,, 19,	23 0	*M*
U Cygni	20 16·1 ...	47 33 N. ...	,, 20,		*m*
X Cygni	20 39·0 ...	35 11 N. ...	,, 22,	2 0	*M*
T Vulpeculæ ...	20 46·7 ...	27 50 N. ...	,, 19,	20 0	*M*
			,, 20,	21 0	*m*
R Vulpeculæ ...	20 59·4 ...	23 23 N. ...	,, 21,		*M*
δ Cephei	22 25·0 ...	57 51 N. ...	,, 25,	22 0	*M*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A.	Decl.	
	°	°	
Near γ Camelopardalis...	54 ...	71 N. ...	Swift; streaks.
	290 ...	60 N. ...	Bright and slow; with trains.

GEOGRAPHICAL NOTES.

A WORK of great interest in the history of early European cartography has recently been published by Messrs. Stevens and Sons, of Great Russell Street, and the manner in which it came to be compiled is not a little curious. One of the most famous of the early European cartographers was Johann Schöner, Professor of Mathematics at Nuremberg in the early part of the sixteenth century. He is best known now by a series of terrestrial globes which he prepared, one about 1515, another in 1520, and a third in 1533, all three of which are still preserved at Frankfort, Nuremberg, and Weimar respectively. Here, so far as cartography is concerned, students would have believed Schöner's work to have ceased, were it not for a small Latin pamphlet of four pages which existed amongst his numerous writings, and which was, in substance, a letter to a high ecclesiastical authority of Bamberg descriptive of a globe on which were marked the discoveries made during Magellan's famous circumnavigation of the globe. Only three copies of this pamphlet were known to exist. It was dated 1523, and it obviously did not refer to the globes of 1515 or 1520, for these did not contain any references to the discoveries in question. Hence it was assumed that another globe, between 1520 and 1533 had been prepared by Schöner, but no trace of this could be found, and, if it existed at all, it seemed to be lost for ever. But in 1885 the late well-known bibliographer, Mr. Henry Stevens ("of Vermont") found in the catalogue of a Munich bookseller a facsimile of a globe which he at once recognized as the long lost work of Schöner. He promptly purchased it, and ultimately it found its way into the remarkable collection of works on early American geography and history made by Mr. Kalbfleisch, of New York, where it still is. But Mr. Stevens, who regarded it as "one of the keys to unlock the many mysteries of early American geography," determined to reproduce Schöner's letter and globe in facsimile, and to append a translation and an introductory sketch of the early historical geography of America. While still labouring at this work he died, but his son took it up, and, aided by Mr. C. H. Coote, of the Map Department of the British Museum, has now succeeded in bringing it to a conclusion. Schöner himself was entirely indebted for his knowledge of the results of Magellan's voyage to a letter written by one Maximilianus Transylvanus, a natural son of the Cardinal Archbishop of Salzburg, and then employed about the Court of the Emperor Charles V., describing for his father the expedition in question. This pamphlet is styled "De Molvccis," and from the descriptions here given, Schöner depicted the new portions of his globe, or, in his own words, "being desirous to make some small addition

to this wonderful survey of the earth, so that what appears very extraordinary to the reader may appear more likely when thus illustrated, I have been at the pains to construct this globe." The differences between this and former globes are considerable, and mark a great advance in geographical knowledge. America, instead of being broken up into many islands, as in all earlier globes, is shown as one large continent of tolerably correct shape; Florida is named for the first time in print; "the Moluccas have found a local habitation and their true places, as well as many of the real isles of the sea, while all the monsters and bogus elements of American geography are made to disappear."

THE new volume issued by Mr. Stevens opens with a long, learned, and most interesting introduction by Mr. Coote, on early American geography generally, and especially on the globes and maps of the first part of the sixteenth century. Mr. Coote also narrates the life of Schöner, and furnishes an estimate of his services to geography. One of his discoveries relating to Schöner is that the place-name *Timiripa*, from which he dates some of his letters, and which has hitherto puzzled all students, is merely the translation of part of the name of a small parish of which Schöner was pastor. The introduction is followed by a facsimile of Schöner's letter of dedication of the globe to the Canon of Bamberg, by the letter of Maximilianus, and by translations of both, as well as by a bibliography of Schöner's works. But, next to the introduction, the portion of the book which will receive most attention will be the facsimiles at the end, which are as follows: (1) the famous Hunt-Lenox globe, attributed to 1506–7: (2) the Boulonger globe, supposed to have been executed in 1514–17; (3) Schöner's first globe of 1515; (4) his second globe of 1520; (5) the third globe of 1523. "being the earliest geographical document to delineate the first circumnavigation of the earth by the Spaniards, 1519–22"; (6) the Portuguese so-called Cantino map of 1502. The reproduction of the letters of Schöner and Maximilianus Transylvanus have been done in exact facsimile by the phototypographic process, all the defects and peculiarities of the originals appearing with faithful minuteness. The long-lost globe consists of twelve gores, and its distinguishing feature is a line drawn completely round the circumference, showing the route of Magellan's fleet in the first circumnavigation of the earth.

THE following message from Mr. Joseph Thomson and Mr. Harved Crichton-Browne, transmitted by the Eastern Telegraph Company's cable from Tangier, has been sent to the Royal Society, the Royal Geographical Society, and to the friends of the explorers:—"City of Morocco, July 28.—We returned to Amsmiz across mountains, safe and well, July 24; many interesting geographical and geological notes; so far successful beyond our expectations. We were prevented going direct from Glamoa to Gundaffy by tribal revolt. We shall start on August 6 for third trip across the Atlas, further south-west this time."

THE GASES OF THE BLOOD.[1]

I.

MR. PRESIDENT AND GENTLEMEN,—The subject I have chosen is a consideration of the gaseous constituents of the blood in relation to some of the problems of respiration. This has been selected both because it deals with a province of physiology in which there are many profound problems connected with the molecular phenomena of life, and also because it gives me the opportunity of illustrating some of the methods of physiological research. I purpose to treat the subject chiefly from the physical stand-point, and to demonstrate some of the phenomena as I would endeavour to do to a class of students, believing that this will be of more interest to many of my audience than if I placed before you anything like an encyclopædic account of recent researches. I cannot help adding that as I speak in the class-room of one of the most distinguished physicists of the day, I feel the genius of the place is hovering over me, and I will be impelled to guide you to the borderland of physics and of physiology. It is in this territory that we meet with the most profound questions regarding the nature of vital activity, and it is here that the physiologist and the physicist must join hands in working out their solution.

Respiration may be shortly defined as the function or group of functions by which an interchange occurs between the gases formed in the tissues of a living being and the gases of the medium in which it lives. It is interesting to take a brief survey of the investigations which laid the foundations of our knowledge of this subject, as it illustrates to us the fact taught by the history of all sciences that those truths which we now regard as elementary were at one time unknown, and have been gained only by laborious inquiry.

The oldest writers do not appear to have had any clear notions even as to the necessity for respiration. Hippocrates dimly recognized that during breathing a *spiritus* was communicated to the body. Many of the older anatomists, following Galen, thought that the "very substance of the air got in by the vessels of the lungs to the left ventricle of the heart, not only to temperate heat, but to provide for the generation of spirits." This notion of cooling the blood was held by Descartes (1596–1650) and his followers, and seemed to them to be the chief, if not the sole, use of respiration. In addition, they supposed it aided in the production and modulation of the voice, in coughing, and in the introduction of odours. The celebrated Van Helmont (1577–1664) strongly expresses these views, and attaches particular importance to the necessity for cooling the blood, which otherwise would become too hot for the body.

About the middle of the seventeenth century clearer notions began to prevail. These rested partly on an anatomical and partly on a physical discovery. Malpighi (1621–94) discovered that the minute bronchial tubes end in air vesicles, or membranous cavities, as he termed them, on the walls of which, in the frog, he saw with his simple microscope the blood flowing through capillaries. This pulmonary plexus was for many years termed the "rete mirabile Malpighii." The physical observations were made by the celebrated Robert Boyle (1627–91), who describes in his treatise entitled "New Experiments, Physico-Mechanical, touching the Spring of the Air," published in 1662, numerous experiments as to the behaviour of animals in the exhausted receiver of the air-pump. He showed that the death of the animals "proceeded rather from the want of air than that the air was over-clogged by the steam of their bodies." He also showed that fishes also enjoyed the benefits of the air, for, said he, "there is wont to lurk in the water many little parcels of interspersed air, whereof it seems not impossible that fishes may make some use, either by separating it when they strain the matter thorow their gills, or by some other way."

His conclusion is "that the inspired and expired air may be sometimes very useful by condensing and cooling the blood;" but "I hold that the depuration of the blood in that passage is not only one of the ordinary but one of the principal uses of respiration." Thus, by the use of the air-pump, invented by Otto von Guericke about 1650, Boyle was able to make a contribution of fundamental importance to physiological science.

He also first clearly pointed out the real cause of the influx of air into the lungs. The older anatomists, from Galen downwards, held that the lungs dilated actively, and thus sucked in the air; and there was much controversy as to whether the chest, with the contained lungs, resembled a pair of bellows, which was filled because it was dilated, or whether the lungs resembled a bladder, which is dilated because it is filled. Boyle shows clearly that the cavity of the chest is actively dilated, and that the lungs are distended because the "spring" of the air is then less on their outer than on their inner surface. This simple explanation was not generally accepted, because the minds of Boyle's contemporaries were under the influence of an ancient idea that air existed in the cavity of the chest external to the lungs. This prevented them from seeing the simplicity and accuracy of Boyle's explanation, and to be constantly on the outlook for some mechanism by which the lungs could actively dilate. Such notions were held by Willis, Malpighi, and Erasmus Darwin. The opinion of Darwin is shown by the following passages in the "Zoonomia":—

"By the stimulus of the blood in the right chamber of the heart, the lungs are induced to expand themselves, and the pectoral and intercostal muscles and the diaphragm act at the same time by their associations with them." And, again, "to those increased actions of the air-cells are superadded those of the intercostal muscles and diaphragm, by irritative association."

Boyle's observations were published in 1660, and in 1685 we

[1] Address to the British Medical Association at its annual meeting at Glasgow. Delivered on August 10 in the Natural Philosophy class-room University of Glasgow, by John Gray McKendrick, M.D., LL.D., F.R.SS.L. and E., F.R.C.P.E., Professor of the Institutes of Medicine in the University of Glasgow.