journal devoted to experimental psychology was started at the Johns Hopkins University, last November, by Prof. Stanley Hall. The work of James at Harvard was also referred to. Allusion was further made to Russia, which might be expected to take a good place in the psychology of the future.

THE additions to the Zoological Society's Gardens during the past week include five Pea-fowls (*Pavo cristatus*, 2 ♂, 3 ♀) from India, presented by Her Majesty the Queen; a Pagoda Owl (*Syrnium sinense*), a Horsfield's Scops Owl (*Scops lempiji*) from Penang, presented by Mr. C. B. Ricketts; three Grey-breasted Parrakeets (*Bolborhynchus monachus*) from Monte Video, presented by Mrs. Macnab; a —— Gull (*Larus* ——) from Massowah, presented by Mr. D. Wilson-Barker; a Chilian Skunk (*Conepatus mapurito*) from Chili, a Black-necked Swan (*Cygnus nigricollis*) from Australia, a White-throated Monitor (*Varanus albogularis*) from South Africa, purchased; a West Australian Great Kangaroo (*Macropus ocydromus* ♂) from West Australia, two Wandering Tree Pies (*Dendrocitta vagabunda*) from India, received in exchange; a Japaneese Deer (*Cervus sika* ♀), a Burrhel Wild Sheep (*Ovis burrhel* ♀), born in the Gardens.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 JUNE 17–23.

(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 June 17

Sun rises, 3h. 44m.; souths, 12h. 0m. 43·7s.; sets, 20h. 17m.: right asc. on meridian, 5h. 45·4m.; decl. 23° 25′ N. Sidereal Time at Sunset, 14h. 3m.

Moon (at First Quarter June 17, 7h.) rises, 12h. 1m.; souths, 18h. 33m.; sets, 0h. 52m.*: right asc. on meridian, 12h. 19·2m.; decl. 2° 56′ N.

Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.
	h. m.	h. m.	h. m.	h. m. ° ′
Mercury..	5 37 ...	13 43 ...	21 49 ...	7 27·5 ... 21 58 N.
Venus ...	3 19 ...	11 32 ...	19 45 ...	5 16·3 ... 22 57 N.
Mars ...	13 43 ...	19 13 ...	0 43*...	12 58·5 ... 6 38 S.
Jupiter ...	17 36 ...	21 59 ...	2 22*...	15 45·3 ... 18 54 S.
Saturn ...	6 52 ...	14 43 ...	22 34 ...	8 28·0 ... 19 45 N.
Uranus...	13 23 ...	19 3 ...	0 43*...	12 49·3 ... 4 35 S.
Neptune..	2 27 ...	10 12 ...	17 57 ...	3 56·0 ... 18 44 N.

* Indicates that the setting is that of the following morning.

June. h.
18 ... 13 ... Mars in conjunction with and 5° 48′ south of the Moon.
20 ... 15 ... Uranus stationary.
21 ... 0 ... Sun at greatest declination north; longest day in northern latitudes.
21 ... 12 ... Jupiter in conjunction with and 3° 51′ south of the Moon.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·4	81 16 N.	June 20,	23 14	*m*
R Virginis	12 32·8	7 36 N.	,, 23,		*m*
δ Libræ	14 55·0	8 4 S.	,, 22,	2 28	*m*
U Ophiuchi... ...	17 10·9	1 20 N.	,, 23,	2 6	*m*
			,, 23,	22 14	*m*
Z Sagittarii... ...	18 14·8	18 55 S.	,, 19,	1 0	*M*
			,, 23,	0 0	*m*
η Aquilæ	19 46·8	0 43 N.	,, 20,	1 0	*M*
X Cygni	20 39·0	35 11 N.	,, 22,	22 0	*m*
δ Cephei	22 25·0	57 51 N.	,, 20,	22 0	*m*

M signifies maximum; *m* minimum.

Meteor-Showers.

	R.A. °	Decl. °	
Near β Ursæ Majoris	169	55 N.	
,, ζ Cygni	318	32 N.	
Between δ and ε Cephei	335	57 N.	... Swift.

GEOGRAPHICAL NOTES.

THE paper read at Monday's meeting of the Royal Geographical Society was on Hudson's Bay and Hudson's Strait as a navigable channel, by Commander Markham. It was really a brief sketch of a much larger memoir on Hudson's Bay which Commander Markham has prepared, and which will ultimately be published by the Society. For some years investigations have been carried on with a view to discover whether the navigation of Hudson's Bay could be so depended on as to justify its acceptance as a regular trade route, in conjunction with a railway, to the more northerly parts of Canada. Commander Markham briefly sketches the history of navigation in Hudson's Bay, and concludes with the results of his own visit in the summer of 1886 on board the *Alert*. The result, he states, of all the experience gathered from voyages during two centuries, and from observations at the stations, is that Hudson's Strait is perfectly navigable and free from ice in August and later in the season. It must be remembered that this passage has been successfully accomplished nearly every year for the last two centuries, while the vessels that have been employed on the service have been ordinary sailing-ships, dependent entirely on wind and weather. It is very rare indeed that they have failed to get through, and still more rare that any of them have been destroyed by the ice. It appears from the official records of the Hudson's Bay Company that Moose Factory, on the southern shore of the bay, has been visited annually by a ship since 1735, with but one exception, namely in 1779, when the vessel for once failed to achieve the passage of the strait. The percentage of losses by shipwreck among these vessels employed in Hudson's Bay is far less than would have to be recorded in a like number of ships engaged in general ocean traffic. Commander Markham pointed out that until quite recently only sailing-vessels attempted to navigate Hudson's Bay, and maintained that with a properly constructed steam-vessel, there need be neither difficulty nor danger. The establishment of new routes for commerce, Commander Markham concluded, is always a gain to the science of geography. In come cases new regions have to be discovered and explored. In others the physical aspects of an already known region must be more carefully studied, and many points of interest relating to the action of climates, or of winds and currents, may be ascertained. The proposed Winnipeg and Hudson's Bay Railroad is a striking instance. The objections of opponents to the route have had to be carefully examined. All former experience had to be collected, maturely considered, and passed in review. Observatories had to be established at several points, to make certain whether the historical records actually coincided with physical facts as they now exist. The route itself had to be sailed over and explored. All these various researches have been as great a gain to geography as to commerce. They have enriched our science with a fresh stock of information, have revised previous conceptions, and confirmed or rejected, as the case may be, the theories and views which may have been put forward. From this point of view, and from this point of view alone, can commercial or political questions receive consideration here. The study of the Hudson's Bay route involves a problem for which physical geography alone can furnish a solution.

DR. F. H. H. GUILLEMARD has been recommended, by the joint Committee of the Royal Geographical Society and the University, as Lecturer on Geography at Cambridge.

THE *Bollettino* of the Italian Geographical Society for May publishes the map of the Massawa district (Massawa to Saati) prepared to the scale of 1 : 80,000, by Prof. P. Durazzo, with the materials which have been supplied by the Italian Staff officers during the recent military operations in that region. Prof. Durazzo has also now completed his large map in two sheets, scale 1 : 800,000, of all the Italian possessions and protectorates in East Africa. These cartographic works embody the results of all the latest surveys, and contain several new features, as well as some important corrections of existing maps.

OUR ELECTRICAL COLUMN.

THE beautiful illustrations of stress in a dielectric in an electric field, due to Dr. Kerr, have been modified and amplified by Messrs. Rücker and Boys, and were shown to a large audience at the Institution of Electrical Engineers on March 22, and again at the *soirée* of the Royal

Society. The dielectric they used was carbon bisulphide (CS_2), and the beam of light passed through about four inches of the liquid. The presence and intensity of the electric field was evident to all by the brightness of the screen. They showed experiments to illustrate the fact that the repulsion of similarly electrified bodies may be regarded as an attraction between each of them and surrounding objects. They have devised an experiment visible to a large audience to show that in an electric field the structure of the CS_2 becomes crystalline—that is, the optical properties along and transverse to the electric lines of force are different; in other words, the velocities of propagation of light vibrations differ when parallel and perpendicular to the lines of force, contrary to the view formerly held on the Continent that the effect is due to unequal expansion. They were able to increase the stress so that the liquid displayed colours even to the green of the second order; and by observing the spectrum of the light passing through the field, black bands enter at the violet end and traverse its whole length as the potential rises. Faraday's experiments and speculations, Maxwell's mathematics and theories, are rapidly becoming acknowledged facts; and the apparatus of Messrs. Rücker and Boys will materially assist in spreading a knowledge of the confirmation which those theories receive from the work of Kerr and Quincke.

BLONDLOT (*Comptes rendus*, January 30, 1888) has been working in the same direction, but with vibratory discharges from a Leyden jar, in order to test the existence or non-existence of retardation in the optical effects. He could see no retardation.

COWLES'S process for the production of aluminium from its ores by the direct action of an electric current of 5000 amperes in an electric furnace has now become an industry. Works have been started near Stoke, and bronzes of wonderful quality are supplied at comparatively cheap prices.

THERE is a fashion in experimental investigation as in everything else. Self-induction is played out, and now the counter E.M.F. of the arc is passing through the same phase. Uppenborn (*Beiblätter*, No. 1, 1882, p. 83) is the last inquirer. He finds for a current of 7·7 amperes and 10 mm. carbons, that $a = 35{\cdot}4$ to $45{\cdot}4$; $b = 1{\cdot}74$ to $3{\cdot}2$ in Edlund's formula—

$$E = a + bl.$$

Since a decreases both for an increase of current and for an increase in the section of arc, he leans to a resistance hypothesis rather than an E.M.F.

KLEMENCIE (*Beiblätter*, No. 1, 1888, p. 57) finds the specific inductive capacity of mica to be 6·64; Cohn and Arons (*Ann. der Physik*, No. 1, 1888, p. 13) that of distilled water 76, ethyl alcohol 26·5, amyl alcohol 15, and petroleum 2·04.

PALMIERI (March 1888) has observed that in a bright clear sky, with a high and steady barometer, and every indication of continued fine weather, the electrometer will give an indication of change long before the barometer.

W. KOHLRAUSCH (*Electrotechnische Zeitschrift*, March 1888) has estimated the current and quantity of electricity in a lightning-flash. He calculates that it will take 9200 amperes to melt a copper rod of 2·5 centimetres diameter. Preece's constant (Proc. R.S., March 1888) makes it 10244. Such a current concentrated in a flash would contain from 52 to 270 coulombs, which would decompose from 5 to 25 milligrammes of water, and from 9 to 47 cubic centimetres of explosive gas. If this energy were stored up and distributed for electric lighting, it would require from 7 to 35 such flashes to keep one glow lamp alight for an hour.

VOGEL (*Electrotechnische Zeitschrift*, January 1888) had previously calculated the relative value of copper and iron as lightning-protectors, giving iron a section 2·5 times that of copper to act with equal efficiency. Preece's constants give the relative efficiency—

Iron	3148
Copper	10244

for equal diameters—that is, an inch rod will fuse with the above currents in amperes; or, if we take the same current, say 300 amperes—

Iron	0·2086
Copper	0·095

are the diameters in inches of the wires such currents will fuse, or in the ratio 2·2 to 1; Vogel's ratio being 13·54 to 9·6. Vogel did not consider the emissivity of the surface, and therefore his results are not so accurate as Preece's experimental figures.

THAT patient worker, H. Tomlinson, has proved that the temperature at which nickel begins to lose its magnetic properties is between 300° and 320° C.; but that the rate of decrease of magnetic permeability, and the temperature at which permeability practically vanishes, vary with the magnetizing force, and hence the widely different results by different observers. Faraday made the former point 330° to 340°; Becquerel 400°; Pouillet 350°; Chrystal 400°. Iron behaves in the same way: permeability vanishes between 750° and 770° according to Ledeboer.

PROF. EWING AND MR. COWAN have been examining the magnetic qualities of nickel on the same lines as the former examined iron. They confirm Sir W. Thomson's observation that longitudinal pull diminishes magnetism to a surprising extent. Their paper in the Philosophical Transactions will be looked forward to with much interest.

S. ARRHENIUS (*Wiener Berichte*, xcvi. p. 831) has shown that the electrical conductivity of chloride and bromide of silver was influenced by the intensity of the rays of light which fell upon the salts. It was most intense at G of the spectrum, and is therefore an effect of light, and not of heat.

F. KOHLRAUSCH (*Wiedemann's Annalen*, No. 4, 1888) has shown that the electric conductivity of

Hard steel	is 3·3
Soft steel	,, 5·5
Wrought iron	,, 7·6

mercury being 1; while their thermal conductivities in C.G.S. units were—

Hard steel	0·062
Soft steel	0·111
Wrought iron	0·152

the ratios being the same. Hence the conditions that determine the conduction of heat and electricity are the same.

MR. C. V. BOYS'S interesting magnetic and electric experiments with soap-bubbles, and his wonderful manipulative skill, remind old *habitués* of the Royal Institution how exquisitely Faraday handled soap-bubbles blown with oxygen to illustrate the magnetic character of that gas. Mr. Boys blows one bubble inside another, and, on bringing the two into an electric field, the perfect indifference of the inner one to any change of potential clearly shows that electrification is confined to the absolute surfaces of a conductor, and that it is not felt at any depth within it, however small.

WHEAT CULTIVATION.[1]

THE most interesting sections of this number of the Journal are those bearing upon the subject of wheat cultivation. The permanent wheat and barley experiments at Woburn, reported upon by Sir John Lawes, Bart., is followed by a paper upon the condition of wheat-growing in India by Dr. George Watt, Reporter upon Economic Products to the Government of India. Next comes an article by Mr. W. E. Bear upon the Indian wheat trade. Lastly, in this connection, comes a highly interesting account of modern improvements in corn-milling machinery. These four papers occupy one-third part of the volume, and taken in connection with each other throw considerable light upon the difficulties under which the English wheat-grower is struggling. Dr. Watt and Mr. Bear both show the extraordinary extent of the wheat-producing area of our Indian Empire, and the rapidity with which this vast field is being opened up. With reference to the latter point men in middle life are scarcely likely to realize the fact that in 1853 there were in all only 20½ miles of railway in India, that in 1873 there were 5695 miles of railway, while in 1887 there were 13,386 miles. Telegraphic communication with India was first opened in 1865, and the opening of the Suez Canal in 1869 was scarcely of less importance in developing her trade—first, by shortening the passage, and secondly, by mitigating the risk from wheat weevil. Another agency has been the development of irrigation works.

[1] The Journal of the Royal Agricultural Society of England, vol. xxiv. (second series), part 1. (John Murray, Albemarle Street.)