rivers, dating from the time when the Tertiary sea-bed was raised into land. Originally its source probably lay to the west of the existing Jurassic escarpment of the Cotswold Hills, and it flowed eastward before the Chalk escarpment had emerged. By degrees the Chalk downs have appeared, and the escarpment has retreated many miles eastward. The river, however, having fixed its course in the Chalk, has cut its way down into it, and now seems as if it had broken a path for itself across the escarpment. As all the escarpments are creeping eastward, the length and drainage area of the Thames are necessarily slowly diminishing. The Severn presents a much more complex course; but its windings across the most varied geological structure are to be explained by its having found a channel on the rising floor of Secondary rocks between the base of the Welsh hills and the nascent Jurassic escarpments. The Wye and Usk afford remarkable examples of the trenching of a tableland. The Tay and Nith are more intricate in their history. The Shannon began to flow over the central Irish plain when it was covered with several thousand feet of strata now removed. In deepening its channel it has cut down into the range of hills north of Limerick, and has actually sawn it into two.

SCIENTIFIC SERIALS

THE *American Journal of Science*, January, 1884.—The effect of a warmer climate on glaciers, by Capt. C. E. Dutton. The author fully discusses the theory of those who argue that the more copious snowfall required for a more extended system of glaciation implied more atmospheric moisture, greater evaporation, and a generally higher temperature; in fact, a warmer climate than at present, due probably to a greater rate of solar radiation. He concludes that the possibility of obtaining a greater snowfall by a warmer climate would be necessarily limited to the Arctic regions, or to altitudes far above the present snow line. Elsewhere a higher temperature would add to the rainfall, and actually diminish the snowfall. The advocates of the theory have failed to perceive that the additional moisture postulated could fall only as rain. Not until the air has discharged as rain all the moisture in excess of the quantity which saturates it at zero, can it begin to yield snow.—On the application of Wright's apparatus for distilling, to the filling of barometer tubes (one illustration), by Frank Waldo.—Account of a new method of measuring the energy expended on or rendered by a dynamo or a magneto machine in connection with the production of electricity in a large way, by C. F. Brackett. —On some points in climatology: a rejoinder to Mr. Croll, by Simon Newcomb. The assumed lower mean temperature of the northern hemisphere at some former geological epoch is attributed by Mr. Croll to a greater eccentricity of the earth's orbit, combined with a position of the perihelion near the northern solstice, causing a short perihelion summer and a correspondingly long aphelion winter. To this the author replies that too little is known of the laws of terrestrial radiation of heat through the atmosphere to justify the establishment of any theory of the glacial epoch, and that, in any case Mr. Croll fails to show why the mean temperature should be different at the supposed periods. Hence the conclusion, not that Mr. Croll's theory is false, but that it is not proven.—An account of some recent methods of photographing the solar corona without an eclipse, and of the results obtained (one illustration), by Dr. W. Huggins.—Elliptical elements of comet 1882 I., by F. J. Parsons.—The Minnesota Valley in the Ice Age, by Warren Upham.—On the so-called dimorphism in the genus Cambarus, by Walter Faxon. —Evolution of the American trotting horse, by Francis E. Nipher. In reply to the criticism of Mr. W. H. Pickering, the author argues that the known facts are not opposed to the conclusion that the trotting horse may finally trot his mile in about the same time that the running horse will cover the same distance.—On the origin of jointed structure, by G. N. Gilbert.—A theory of the earthquakes of the Great Basin, by the same author.

Revue d'Anthropologie, tome vi. fasc. 4, Paris, 1883.—The larger portion of this number is devoted to M. Mathias Duval's lecture on Transformism, of which two parts have already appeared in the earlier fascicules of the *Revue* for 1883. For English readers generally the address lacks the interest of novelty, as it is little more than an exposition of the works and opinions of Darwin and of the principal authorities, chiefly English, whose observations corroborate his views. It is satisfactory, however, to find that, while maintaining with patriotic zeal Lamarck's claim to be regarded as the originator of the theory of evolution, M. Duval recognises in Darwin the one man who, through varied yet profound scientific acquirements, intellectual qualifications, and special personal and social conditions, was alone capable of giving to novel conclusions of such extraordinary significance the authoritative force and stability of a true science.—On so-called Wormian or supernumerary bones in domestic animals, by M. Cornevin, Professor in the Lyons Veterinary College. The author finds that while in man such bones are generally cranial, in animals they are facial, and he believes himself justified in drawing from his observations two important conclusions (which, however, need support) that in animals the Wormians appear some time after birth, developing more and more with age, and that they are of frequent occurrence in the less carefully bred races, while they are very rarely found in the high breeds of horses, oxen, sheep, pigs, &c.—On the Kalmuks, by M. Deniker. The author, who is a native of the regions which he describes, has made the presence of an encampment of Kalmuks in the "Jardin d'Acclimatation," at Paris, the occasion for bringing together all the most reliable historical, geographic, ethnic, and socio-physical data in connection with this people, whose various migrations, including their great exodus from the region of the Volga in the eighteenth century, he treats at great length. He considers the oblique opening of the eye, which most writers accept as an ethnic characteristic, as of little scientific value, since it is not of specially frequent occurrence among pure Mongols such as are the Kalmuks; but he recognises, on the other hand, that such an ethnological peculiarity is to be found in a peculiar introversion of the upper eyelid which in young Kalmuk children has often the effect of obliterating the eyelashes; while the general narrowness of the opening imparts a triangular form to the eye. Black, scantily developed hair, dark brown eyes, slightly yellow skin, and a stature somewhat below the mean (the adult Kalmuk presenting the proportions of Europeans of thirteen to fourteen years of age), constitute the chief physical characteristics of the Mongol race. The paper, which is illustrated by an admirable map of the Kourghees and Kirghees territories of South Russia and West Thibet, will be continued in a subsequent number.

Journal of the Russian Chemical and Physical Society, vol. xv. fasc. 7.—On the relations between the refracting power and the chemical constitution, by S. Kanonnikoff.—On the velocities of chemical reactions, by A. Potylitzin. The thermo-chemical equivalents obtained separately for several pairs of elements allow to foresee only the direction which will be taken by the reaction when they are brought together; the heat disengaged by one pair of elements brought into reaction in the presence of other bodies, which are also liable to chemical modifications, is not equal to the whole of the thermo-chemical work of the pair, a part of it being employed for chemical work in the accessory bodies; the thermo-chemical equivalents are proportionate to the velocities during the first moments of the reaction.—Sketch of the present state of the theory of explosive substances, by S. Tcheltsoff. The actual tendency of the technics to substitute determined chemical combinations, instead of the mixtures which were used at first as explosives, is quite rational. Not only the decomposition goes on with more regularity in a chemical compound, but also the potential energy is greater.—On the chloride of pyrosulphuryl, by D. Konovaloff.—On the cause of the changes in the galvanic resistance of selenium under the influence of light, by N. Hesehus. The author concludes in favour of the dissociation transmitted into the interior of the body as the cause of this change, and, following the hints of Messrs. Bidwell and Siemens, tries to prove it by mathematical arguments.—Notes on radiophony, by M. Geritch; and on resounding tubes, by M. Bachmetieff.

Zeitschrift für wissenschaftliche Zoologie, vol. xxxix. Part 2, November 6, 1883, contains:—Researches on the brain structures in Petromyzons, by Dr. F. Ahlborn (plates 13-17). A very excellent and detailed memoir, based chiefly on the brain in *Petromyzon planeri* and *P. fluviatilis*.—On the biology and anatomy of Clione, by N. Nassonow, assistant in the Zoological Museum of Moscow (plates 18 and 19). These investigations were carried on at the biological station at Sebastopol, and on an apparently new form called *C. stationis*, found in the shells of *Ostrea adriatica*, in it the oscula are prominent orange-coloured. Branching plasmodia were traced through the shell-structure, reminding one of the mycelial threads of a fungus.—Contributions to the histology of the Echinoderms, by Dr. Otto Hamann (part 2).—The nervous system of the Holothuria pedata: Cuvier's organ. The nervous system and sense organs of the Holothuria apedata (plates 20-22).—On some new species of Thalassema, by Kurt Lampert, Erlangen.

Vol. xxxix. Part 3, December 21, 1883, contains:—On the Rotifers of the environs of Giessen, by Karl Eckstein, natural history student, Giessen (plates 23-28), enumerates and describes in detail fifty species (one new genus Distyla, with two new species, *D. giessensis* and *D. ludwigii*). A list of all known genera is given, with a general description of the anatomy, development, and habits of the group. A very complete bibliography is appended.—On the digestive apparatus of the Decapods, by Dr. F. Albert (plates 29-31, and woodcuts).

Vol. xxxix. Part 3, December 31, 1883, contains:—On Bucephalus and Gasterostomum, by Dr. H. Ernst Ziegler (plates 32 and 33) (*Bucephalus polymorphus* was found in considerable quantities in *Anodonta mutabilis*).—On the central nervous system in *Periplaneta orientalis*, by Dr. Max Koestler (plate 34).—On the varieties of the cerebral fissures in Lepus, Ovis, and Sus, by Dr. Victor Rogner (plate 35).—On the structure and fissiparity of *Ctenodrilus monostylus*, sp. nov., by Max Graf Zeppelin (plates 36 and 37).—On the nervous system of the snout and upper lip in oxen, by Ivan B. Cybulsky (plates 38 and 39).—On the anatomy and physiology of the proboscis in Musca, by Dr. Karl Kraëpelen (plates 40 and 41).—On the connective tissue of the epiphyses in Plagiostomes, Ganoids, and Teleostea, by Dr. J. Th. Cattel.

SOCIETIES AND ACADEMIES

London

Royal Society, January 10.—"On the Amount of Light Reflected by Metallic Surfaces." By Sir John Conroy, Bart., M.A. Communicated by Prof. Stokes, Sec.R.S.

In a paper which Prof. Stokes did me the honour of communicating to the Royal Society, and which appeared in the *Proceedings*, vol. xxxv. p. 26, I gave an account of some experiments I had made on the amount of light reflected by polished metallic surfaces when ordinary unpolarised light was incident upon them.

The light of a paraffin lamp fell either directly, or after reflection from the metallic surface, on a photometer, and the readings were made by altering the distance at which another similar lamp had to be placed from the photometer in order to produce an equal illumination.

I have repeated the experiments with the steel and speculum metal mirrors with polarised light. The polish of the tin and silver mirrors being defective, it was not thought worth while to re-examine them.

The general arrangement of the apparatus remained the same; but in order to obtain a more intense light, a magic lantern (the one known as the "Sciopticon" being used) was substituted for the paraffin lamp carried by the goniometer.

The metal plates were clamped to the vertical stage, and their adjustment examined by placing a second, or analysing, Nicol in the path of the reflected light and crossing the Nicols, the former being placed with its principal section either in or perpendicular to the plane of incidence, and adjusting the stage screws till the light reflected from the plate was completely extinguished.

The experiments were made in the manner described in the former paper, the light being polarised in, or perpendicularly to, the plane of incidence by the Nicol. It was found that the illumination of the paper varied with the position of the Nicol, being always greatest when the light which fell on the paper was polarised in the plane of incidence.

Four sets of observations and their means, made with the steel and speculum metal mirrors, are given in the tables.

Table I.—*Steel, with Light Polarised in the Plane of Incidence*

Angle of incidence	A	B	C	D	Mean
°					
30	57·01	61·67	63·06	61·05	60·70
40	61·73	64·04	68·18	62·90	64·21
50	65·31	67·41	71·97	69·41	68·52
55	68·76	70·41			
60	70·88	74·55	77·96	74·31	74·42
65	77·22	76·02	81·40	74·83	77·37
70	81·48	80·77	85·22	81·57	82·26
75	84·09	84·92	90·32	84·71	86·01
80	84·58	86·34	91·55	89·01	87·87

Table II.—*Steel, with Light Polarised Perpendicularly to the Plane of Incidence*

Angle of incidence	A	B	C	D	Mean
°					
30	49·27	50·53	53·67	47·28	50·19
40	45·53	45·39	49·79	44·40	46·28
50	40·45	41·24	43·47	38·78	40·98
55	37·47	37·34			
60	35·54	33·79	36·90	32·89	34·78
65	29·57	28·88	31·97	29·70	30·03
70	25·69	26·61	27·72	26·14	26·54
75	23·71	25·55	25·38	24·30	24·73
80	26·29	26·46	27·60	26·04	26·60

Table III.—*Speculum Metal, with Light Polarised in the Plane of Incidence*

Angle of incidence	A	B	C	D	Mean
°					
30	64·58	64·09	63·37	66·18	64·55
40	67·76	68·22	65·14	69·86	67·74
50	72·65	72·23	69·04	71·90	71·45
60	76·63	78·65	77·57	77·95	77·70
65	79·65	79·68	79·44	81·26	80·01
70	83·09	81·25	84·94	83·90	83·29
75	82·94	84·20	86·93	88·01	85·52
80	87·52	86·78	90·96	89·72	88·74

Table IV.—*Speculum Metal, with Light Polarised Perpendicularly to the Plane of Incidence*

Angle of incidence	A	B	C	D	Mean
°					
30	59·31	57·86	59·83	59·63	59·16
40	53·30	54·01	56·41	54·29	54·50
50	49·47	51·44	49·61	49·69	50·05
60	41·50	43·36	44·02	43·83	43·18
65	39·95	39·12	40·50	40·85	40·10
70	38·27	35·84	37·42	38·29	37·45
75	36·20	34·45	36·84	35·88	35·84
80	40·51	38·67	41·22	41·15	40·39

The amount of light which, according to Cauchy's theory, ought to have been reflected by the mirrors was calculated out by the formulæ, the principal incidences and azimuths for the two mirrors having been determined—

$$J^2 = \frac{\theta^2 + \cos^2 i - 2\theta \cos \epsilon \cos i}{\theta^2 + \cos^2 i + 2\theta \cos \epsilon \cos i}$$

and

$$I^2 = \frac{\theta^2 \cos^2 i + 1 - 2\theta \cos \epsilon \cos i}{\theta^2 \cos^2 i + 1 - 2\theta \cos \epsilon \cos i},$$

and the observed and calculated results are set forth in Tables V. and VI.

Table V.—*Amount of Light Reflected by Steel Mirror*

	Observed		Calculated	
°	J^2	I^2	J^2	I^2
30	60·70	50·19	63·17	54·95
40	64·21	46·28	66·44	51·31
50	68·52	40·98	70·80	42·09
60	74·42	34·78	76·72	39·24
65	77·37	30·03	79·52	35·32
70	82·26	26·54	83·04	31·62
75	86·01	24·73	86·85	29·46
80	87·87	26·60	90·97	32·39

Table VI.—*Amount of Light Reflected by Speculum Metal Mirror*

	Observed		Calculated	
°	J^2	I^2	J^2	I^2
30	64·55	59·16	69·78	62·82
40	67·74	54·50	72·53	59·74
50	71·45	50·05	76·18	55·37
60	77·70	43·18	80·77	49·59
65	80·01	40·10	83·42	46·38
70	83·29	37·45	86·32	43·53
75	85·52	35·84	89·44	42·29
80	88·74	40·39	92·77	45·88

As far as regards the general character of the phenomena the agreement is complete and in accordance with the observations of