diver the Gapu usually shifts its position from the carapace to the plastron of the turtle. At the end of the day's fishing the Gapu is eaten. The natives have a great respect for the Gapu, and firmly believe the fish possesses supernatural powers. For example, when there is something the matter with the bow of the canoe, the Gapu is said to attach itself to the neck or the nuchal plate of the turtle; when the lashings of the outrigger to the thwart poles are insecure, the Gapu is believed not to stick fast to the turtle, but to continually shift its position; if the strengthening ties in the centre of the hold of the canoe are faulty, the Gapu is stated to attach itself to the turtle and then immediately to swim away. More than once I was told, "Gapu savvy all the same as man; I think him half devil." The sucker-fish is not used to haul in the large green turtle. I was repeatedly told that it would be pulled off, as the turtle was too heavy. The above information was gathered from several sources, and checked by means of much questioning.

Amphioxus.—A species of Amphioxus, apparently very similar to *A. lanceolatus*, was not uncommon at one spot at Mabuiag, at a depth of from 3 to 4 fathoms. A species of this animal is catalogued as follows by Mr. Krefft, in his list of "Australian Vertebrata, Fossil and Recent": "*Branchiostoma lanceolatum*. Dredged in Bass's Straits, by H.M.S. *Herald*, at a depth of from 10 to 12 fathoms." I am not aware whether it has been found elsewhere in Australian waters.

ALFRED C. HADDON.

Thursday Island, November 12, 1888.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Sedgwick triennial prize has been awarded to Mr. Alfred Harker, Fellow of St. John's College. The subject of the essay is "The Petrology of the Igneous Rocks associated with the Cambrian (Sedgwick) of Carnarvonshire."

SCIENTIFIC SERIALS.

IN the number of the *Journal of Botany* for December 1888, Mr. S. Le M. Moore has an interesting article on photolysis in *Lemna trisulca*, in which he contests some of Stahl's conclusions as to the effect of day and night on the relative positions of the chlorophyll-grains on the cell-walls. The remaining articles, both in this number and in that for January 1889, are chiefly of interest to geographical or systematic botanists. Messrs. Britten and Boulger's "Biographical Index of British and Irish Botanists" has now advanced as far as the letter G.

IN the *Botanical Gazette* for November 1888, Miss E. L. Gregory completes her account of the development of cork-wings on certain trees, the trees described in the present instalment being species of *Acer* and *Liquidambar*.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 22, 1888.—"Report of Researches on Silicon Compounds and their Derivatives. Part I." By J. Emerson Reynolds, M.D., F.R.S., Professor of Chemistry, University of Dublin.

The present investigation was undertaken some years ago with a view to examine the action of the silicon haloids—but more especially of silicon tetrabromide—on various compounds containing nitrogen, as our knowledge of the relations of silicon and nitrogen is extremely limited.

It was ascertained at an early stage of the inquiry that the bromide of silicon is much superior to the chloride as a reagent with nitrogenized compounds, but since the bromide had apparently not been obtained in any quantity even by its discoverer, Serullas, considerable time had to be devoted to working out a method for the production of a sufficiently large supply of this material. The method adopted is described in the full paper.

In the purification of the crude tetrabromide a new *chloro-bromide*[1] *of silicon* was discovered, which boils at 141° C. This proved to be the compound $SiClBr_3$, which was required to complete the series of possible chlorobromides of silicon.

The first group of nitrogen compounds subjected to the action of silicon tetrabromide included the primary thiocarbamide or sulphur urea, obtained by the author in 1869, and the allyl-, phenyl-, and diphenyl-thiocarbamides.

All these are shown to unite with silicon tetrabromide, and afford the highly condensed compounds—

$$(H_4N_2CS)_8SiBr_4,$$
$$(C_3H_5,H_3N_2CS)_8SiBr_4,$$
$$(C_6H_5,H_3N_2CS)_8SiBr_4,$$
$$((C_6H_5)_2H_3N_2CS)_8SiBr_4.$$

These are more or less vitreous solids, with the exception of the allylic compound, which is a transparent and singularly viscous liquid. All are dissolved and decomposed by water and by alcohol.

The action of alcohol on the compound $(H_4N_2CS)_8SiBr_4$ was studied in detail, and it was shown that not only do ethyl bromide, thiocyanate, and diethylic silicate result, but that the representatives of two new classes of thiocarbamide derivatives are formed.

The first of these is a beautiful *tetrathiocarbamide* compound whose formula proved to be—

$$(H_5N_2CS)_4NBr,$$

which may obviously be written—

$$(H_4N_2CS)_4H_4NBr.$$

This body separates from alcohol in fine masses of crystals resembling sea anemones in appearance, which melt at 173°–174°, and begin to decompose at 178°–180°. The synthesis of this substance was effected by heating ammonium bromide with thiocarbamide.

Several homologues of the above *tetrathiocarbamidammonium bromide* were produced by synthetic methods; some of these contain chlorine or iodine instead of bromine. The following are examples of the compounds found in the course of this part of the investigation:—

$$(H_4N_2CS)_4H_4NBr,$$
$$(H_4N_2CS)_4H_4NCl,$$
$$(H_4N_2CS)_4H_4NI,$$
$$(H_4N_2CS)_4(CH_3)H_3NBr,$$
$$(H_4N_2CS)_4(C_2H_5)_2H_2NBr,$$
$$(H_4N_2CS)_4(C_2H_5)_3HNCl.$$

By the action of silver nitrate on the tetrathiocarbamidammonium bromide the crystalline *dithiocarbamide* compound with silver bromide was obtained—

$$(H_4N_2CS)_2AgBr.$$

This was subsequently produced by the direct union of thiocarbamide with the pure silver haloid. The compound—

$$(H_4N_2CS)_2AgCl$$

was also obtained in fine crystals, as were other similar substances.

A *trithiocarbamide* compound is also formed during the action of ethyl alcohol on $(H_4N_2CS)_8SiBr_4$, but it is much more soluble than that which first separates. It is also crystalline, and its analysis and reactions lead to the formula—

$$(H_5N_2CS)_3Br,C_2H_5Br.$$

Hitherto only mono- and di-thiocarbamide derivatives have been known, but the results above stated in outline prove that tri- and tetra-thiocarbamide compounds are formed in presence of silicon tetrabromide and certain other agents, which latter form addition products with the condensed amide.

So far, cases were only dealt with in which silicon tetrabromide combined with nitrogenized groups without loss of its halogen. The next stage of the inquiry involved the investigation of certain interactions in which the tetrabromide loses *all* its halogen. One of the chief results obtained in that direction forms the subject of a separate communication

[1] The chlorine required for the production of this compound was derived from the crude bromine (which always contains chloride of bromine) used in preparing the tetrabromide.

Mathematical Society, January 10.—J. J. Walker, F.R.S., President, in the chair.—Mr. Basset made a few remarks on the steady motion and stability of dynamical systems.—Dr. Glaisher, F.R.S., gave several forms of expression of Bernoulli's numbers derived from the consideration of lemniscate functions.—The President (Sir J. Cockle, F.R.S., in the chair) read a paper on results of ternary quadratic operators on products of forms of any orders.—Mr. Jenkins communicated a note by Mr. R. W. Christie on a theorem in combinations.

EDINBURGH.

Royal Society, December 3, 1888.—A restatement of the theory of organic evolution, by Prof. Patrick Geddes. In the introduction to this paper Prof. Geddes gives to the four customary divisions of biology more general meanings. He considers that morphology, besides being a description of individual forms, deals with specific and generic ones. Taxonomy is thus the higher and more generalized morphology. Embryology includes the description of the development of species and genera in addition to that of individuals. Morphology and embryology, then, deal with the descriptions of the form, and the development of the form, not only of individuals but of races. Similarly, physiology is applied to the description of the functions of the individual, and also to those of species, genera, and higher groups. As the description of the relations of organs characterized the physiology of the individual, so that of interspecific adaptations is the physiology of the race. As morphology and embryology are related, so are physiology and ætiology. Ætiology gives the laws of variation of individual and race. It deals not merely with functions in a balanced state in the individual, and perfected adaptation between races, but also with the origin of both of these in the temperament of the unit organism, and of the sum of organisms. This question has to be separated from the deeper one of the origin of organismal temperament in the influence of environment or otherwise. The following diagram shows these relationships:—

	Structure.		Function.	
	Embryology.	Morphology.	Physiology.	Ætiology.
Group ...		Linnæus	Darwin	
Class ...			↑	
Order ...			↑	
Genus ...			↑	
Species ...			↑	
Species unit (pair, &c.)			.....	.....>
Individual				
Organ ...				
Tissue ...				
Cell ...				

From this division of the field of biology, a clearer and more exact estimate of Mr. Darwin's position can be had. It is plain that the theory of natural selection, which Mr. Romanes rightly describes as rather that of "the origin of adaptations," is part of the higher physiology, or the relation of races to one another. It is thought by many that Mr. Darwin dealt with problems of ætiology—that he described the origin of the functions in the individual. But he openly deferred the consideration of the laws of variation, and confessed entire ignorance of them. He, indeed, at different times, had two impressions of the import of natural selection. Like others, he sometimes makes the mistake of thinking that an account of adaptations, which species acquire, explains their origin. At other times he clearly sees that there must be a science of variation—an ætiology—which shall tell of the origin of variations acted on by natural selection to form the raw material of adaptations. Both pre- and post-Darwinian writers have dealt with the explanations of variations as arising from temperament. The former have theorized in a general way; the state of their knowledge not allowing them to prove that variation is definite. This point of view must again be taken, and all recent results read from it. The object of the present paper is to show how this may be accomplished throughout the organic world, as the author has already done in finding a definite *rationale* of sex and reproduction. Prof. Geddes then took up the matter in detail for the vegetable world, under such headings as: inflorescence; floral structure; floral colour; the antithesis between floral and grassy types; variations in the leaf; thorns and spines; evergreens; corelations between the reproductive and vegetative systems. The classes of the animal kingdom were treated *seriatim*, the definite lines of variation being traced from the synthetic types in each. He next showed, and illustrated with masses of detail, that throughout a great number of species there are individuals with vegetative and others with reproductive diathesis; and similarly in every genus. Some species are more vegetative, some more reproductive in character; and so, further, of orders and large groups. The vegetative or self-maintaining activities are opposed to, and balanced by, the reproductive or species-maintaining ones. The history of the individual life, or of the development of the race, is a series of alternations between predominating vegetation with subordinate reproduction, and prevailing reproduction with diminished vegetation. The differentiation of sex, the development of parental care and of sociality, are the most obvious results of the reproductive, the race-maintaining diathesis; and these play at least as important a part in organic progress as struggle for individual advantage. In conclusion, Prof. Geddes contrasted his own views of the process of nature, as a materialized ethical process, with that of Prof. Huxley, expressed in his *Nineteenth Century* article, where he considers organic evolution an intellectual but not a moral process. A second paper is to follow, carrying out the argument into the ethical, social, and economic relations of humanity.

BERLIN.

Meteorological Society, December 4, 1888.—Dr. Vettin, President, in the chair.—Dr. Andries developed an original theory as to the constitution of the sun, by which he explained a large number of phenomena. During the discussion which ensued, the theory was attacked from various sides.—Prof. von Bezold made a report on Prof. Kiessling's book, "Untersuchungen über die Dämmerungserscheinungen" ("Researches on the Phenomena of Twilight"), after he had briefly alluded to the recent and more comprehensive work of the English Commission on the Krakatão eruption, which had appeared simultaneously with that of Prof. Kiessling. He pointed out that these two works complement each other, inasmuch as Prof. Kiessling had confined himself entirely to the optical phenomena arising out of the eruption, describing them fully, and illustrating them by physical experiments, while the Commission had dealt comparatively briefly with these phenomena.—Dr. Less spoke on falls of snow during high temperatures. On the morning of November 20 the temperature was 9° C.; it reached a maximum of a little over 11° between 9 and 10 a.m., and then fell irregularly with repeated showers of rain to about 3° C. At 9.45 a.m., when the temperature was above 11°, one of the watchers in the Meteorological Institute announced that he had observed some few flakes of snow falling with the commencing rain. Since the speaker could not find anybody from among his acquaintances who could confirm the above observation, he addressed himself to the public at large by means of the newspapers: he thus obtained very valuable and reliable reports, not only from various parts of Berlin, but also from outlying districts, of snow having fallen, either in solitary large flakes or in larger quantities, at temperatures as high as 9° to 11° C. Dr. Less had once before in this year (1888) observed the same phenomenon, on May 8, when the temperature of the air was 12° C. On going over the literature of this subject in the synoptic weather reports for Germany for the years 1876 to 1888, he came upon twenty-eight cases in which snow had fallen, either in larger quantities or as solitary flakes, when the temperature was above 5° C. He explained the formation of the snow-flakes as the result of low-lying currents of air whose temperatures were much lower than those at the earth's surface. Out of the twenty-eight cases quoted above, eleven were accompanied by marked and wide-spread thunder during the ensuing twenty-

four hours. This circumstance may be taken as supporting Sohncke's theory of aërial electricity, according to which the electricity during a storm results from the friction of drops of ice and water, and this can only take place when cold currents of air at comparatively low levels flow over warm, moist masses of air.

Physical Society, December 14, 1888.—Prof. von Helmholtz, President, in the chair.—Dr. Thiessen gave an account of experiments which he had carried out in order to measure the amount by which gravity varies at different heights. The method he employed was that of Jolly, but with the introduction of a modification, in order to eliminate the irregularities due to differences of temperature at the higher and lower stations. Scale-pans were attached to each arm of the balance—one close up to the beam, the other some distance below it—and the weight was interchanged between the pans, both at the upper and lower stations, thus eliminating the influence of differences of temperature and of any inequality of the balance. The upward force of the air had no influence on the results, notwithstanding the varying volumes of the weights used. The distance between the upper and lower scale-pans was 11·5 metres, and the weight used was 1 kilogramme. Twenty-four determinations were made, which gave as a result that the kilogramme, when in the lower pan, weighed 2·8 milligrammes more than when it was weighed in the upper pan. After making some corrections, and, among these, one necessitated by the fact that the weight in its lower position was 4 metres below the general surface of the earth, it was found that the weight of 1 kilogramme varies by 0·28 milligramme for each 1 metre of difference in altitude.—The President gave an account of a paper by Prof. Hertz, which he had yesterday communicated to the Berlin Academy. It contained a description of further experiments on electrodynamic waves, and their analogy with waves of light. Weak induction-discharges between small metallic cylinders with rounded ends were employed, and a similar apparatus for the detection of the electrodynamic waves. The action was not propagated more than 2 or 3 metres through space; when it fell on a metallic surface it was reflected, interference phenomena were observed, and from these the length of half a wave was found to be 30 centimetres. When a metallic parabolic mirror, 1 metre across its opening, was placed behind the apparatus used to produce the discharge, the action was propagated to a distance of 8 metres; and the action was greatly increased when a second concave mirror was placed behind the receiving apparatus. When a conductor was interposed, the action ceased, while non-conductors allowed the waves to pass. By interposing perforated metallic screens, it was found that the waves are propagated in straight lines; the waves passed through a dry wooden partition. Polarization of the waves could be determined in several ways. When the receiver was placed at right angles to the apparatus producing the waves, no action between them could be detected, the vertically-produced waves not being picked up by the horizontally-placed receiver. When the two pieces of apparatus were placed parallel to each other, and a wooden cube, with a number of insulated metallic wire rings wrapped round it, was placed in the path of the electrodynamic waves, it produced the same effect as does a tourmaline plate on polarized light. When the wires were vertical—that is to say, parallel to the exciting apparatus—the action was not propagated through the cube; but it was, on the other hand, when the wires were horizontal. When the receiver with its mirror was placed horizontally, so that it did not record any action as reaching it, and the wire arrangement, described above, was placed in the path of the waves, no change took place in the receiver when the wires on the cube were either vertical or horizontal, but the receiver was affected when the wires were placed at an angle of 45°. The laws of reflection of electrodynamic waves at metallic surfaces were found to be the same as those for the reflection of light at plane mirrors. Finally, Prof. Hertz has determined the refraction which the waves undergo in a prism made of pitch, and finds that the refractive index of this substance for electric waves is 1·68.—Dr. Ritter demonstrated by experiments the action of the ultra-violet rays of light on electric discharges in accordance with the experiments of Hertz, Wiedemann, and Eberts.

STOCKHOLM.

Royal Academy of Sciences, January 9.—On the researches and studies made at the zoological station of the Academy at Christineberg in Bohuslan, during the past year, by Prof. S. Lovén. He gave an account of papers by Dr. Aurivillius on the disguise amongst the Oxyrhynchous Crabs, by Dr. Virén on a Nereid Annelid (*Nereis fucata, forma inquitina*), by Herr Lönnberg on cestodes in marine fishes and birds.—Researches on the periodic system of the elements, by Dr. T. R. Rydberg.—Baron Nordenskiöld exhibited some uncommonly large crystals of magnetic iron from the Nordstjerne mine near Vestanfors, and gave an account of some remarkable Swedish localities with crystallized magnetite. He also showed four meteorites, for the collection of the State Museum, received from the British Museum. Amongst these were (1) a sample of a small, highly-interesting block of iron, which fell near Rowton, in Shropshire, August 20, 1876; (2) a fragment of a meteorite which fell in Hisen, in Japan.—On some transcendents, which appear at the repeated integration of rational functions, by Dr. A. Jonquière, of Bern.—On natural etching figures and other phenomena of solution on beryllium, from Muovinsk, by Herr W. Peterson.—Researches on minerals from Fiskernæs, in Greenland, by Herr N. V. Ussing.—Mineralogical notes, II., 3-4, by Herr G. Flink.—Anatomical studies on Echidna, by Miss C. Westling.—On the dimorphism of the *Rhizopoda reticulata*, by Dr. A. Goës.—The insect fauna of Greenland; I. Lepidoptera and Hymenoptera, by Prof. Chr. Aurivillius.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Memoirs and Memoranda in Anatomy, vol. i.: Cleland, Mackay, and Young (Williams and Norgate).—Molekularphysik, Erster Band: Dr. O. Lehmann (Williams and Norgate).—Thomas Jefferson and the University of Virginia: H. B. Adams (Washington).—Transactions of the Sanitary Institute of Great Britain, vol. ix. (Stanford).—Life Register (West, Newman).—Essai d'une Théorie du Soleil et des Étoiles Variables: A. Brester (Delft).—Industrial Education in the South: Rev. A. D. Mayo (Washington).—Kew Observatory, Richmond, Report for the year ending December 31, 1888 (Harrison).—L'Écoulement des Glaciers: Dr. A. A. Odin (Lausanne).—Arnold Toynbee: F. C. Montague (Baltimore).—Journal of Physiology, December (Cambridge).—Journal of Chemical Society, December (Supplementary Number) and January (Gurney and Jackson).—Himmel und Erde, 1 Jahrg. Heft 2, 3, 4 (Berlin, Pactel).—Annalen der Physik und Chemie, 1889, No. 1 (Leipzig, Barth).

CONTENTS.