of the sugar when dissolved, say we do not know.

Beyond this fault, which is common, the book is of merit as giving many experiments with apparatus of easy make. There is at times a lack of exact knowledge displayed, as from one who has studied in the schoolroom and not in the physical laboratory. But with the young learner the work will, without doubt, prove fresh and instructive.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

ASTRONOMY.

Virtual change of the astronomical unit of time. — Mr. E. J. Stone has recently communicated to the Royal society an important paper on a virtual change of the astronomical unit of time, which has taken place in consequence of the difference between Bessel's expression for the sun's mean longitude and the corresponding formulae of Hansen and Leverrier. The investigation was primarily undertaken for the purpose of finding an explanation of the rapidly increasing discordance between the moon's place and that indicated by Hansen's lunar-tables; and, after a careful examination of a number of other hypotheses, Mr. Stone thinks he has found the cause as indicated above.

For the sun's mean longitude, —

Bessel gives $\odot = 280°46'36''.12 + 1{,}296{,}027''.6182\,t + 0''.00012218\,t^2$,
Hansen " $\odot = 280°46'43''.20 + 1{,}296{,}027''.6741\,t + 0''.00011069\,t^2$,
Leverrier " $\odot = 280°46'43''.51 + 1{,}296{,}027''.6784\,t + 0''.00011073\,t^2$,

in which t is reckoned, *as supposed*, in Julian years from Jan. 1, 1850, Paris mean noon. Now, the old observations which Hansen used in forming his lunar-tables, and in determining its constants, were reduced according to Bessel's formula. When we compare tables, thus formed, with observations in which the date of observation is referred to the sun's place by means of Leverrier's or Hansen's tables of the sun, just such a discordance must arise as if the length of the unit of time had altered; i.e , as if Bessel's Julian year were different from Leverrier's, which is now used in our ephemerides, having been adopted about 1864. Up to 1863, Hansen's lunar-tables were satisfactory: since then, the error of the moon's longitude has increased from $+0''.121$ to $+10''.265$.

Mr. Stone thinks this will also clear up some perplexing discrepancies in results as to the moon's secular acceleration. He points out that Hansen's tables "cannot safely be used in the discussion of ancient eclipses until the effects of this confusion of units of time have been cleared." [This abstract is made, not from the paper itself, which is not yet printed, but from an account given of it by Mr. Stone to the Royal astronomical society.] — (*The observ.*, May.) C. A. Y. [1014

MATHEMATICS.

Sub-invariants. — In the two instalments of his memoir which have thus far appeared, Prof. Sylvester enters upon a new development in the modern algebra; namely, the theory of semi-invariants regarded as belonging to a quantic of unlimited order, in which aspect he designates them as sub-invariants. An important distinction between regarding a semi-invariant as appertaining to a particular limited quantic and regarding it as a sub-invariant, is, that it may, while irreducible in the former character, be reducible in the latter. The new problem thus arises of determining the absolutely irreducible sub-invariants of any given degree and weight. In section I. a number of general theorems are established concerning sub-invariants appertaining to a single quantic, and to systems of quantics, all of unlimited order; and a method is indicated by which the author has succeeded in disproving the proposition that ground-forms and syzygants cannot coexist. Section II. contains tables of 'germs' for the quintic and sextic, the germ of a sub-invariant being the multiplier of the highest power of its last letter. Section III. is devoted to a systematization of the method of deducing the complete system of ground-forms of a quantic by direct algebraical operation from the simplest system of forms in terms of which any other form, multiplied by a power of the quantic, can be rationally and integrally expressed. The method is due to Prof. Cayley, and is easily applied to the cubic and the quartic; but, beyond these very simple cases, its application would be practically impossible without the aid of the methods now introduced by Prof. Sylvester. The application to the quintic is given *in extenso*. Section IV. treats of absolutely irreducible sub-invariants; the generating functions are obtained for absolutely irreducible sub-invariants of the first seven degrees; from the generating function for the seventh degree it is inferred that ground-forms and syzygants must necessarily coexist in the case of quantics of a sufficiently high order, which constitutes the disproof above referred to. This section is followed by an excursus on rational fractions and partitions. (See **1016**.) — (*Amer. journ. math.*, v. 1, 2.) F. F. [1015

Rational fractions and partitions. — In an excursus on this subject, Prof. Sylvester gives, in an improved and more complete form, the theory of simple denumeration first published by him in 1855. The object of the theory is to find an analytical expression for the general coefficient in the expansion of the generating function; but its cardinal theorem applies to the expansion of any rational fraction, and not only of such as arise in the theory of partitions or denumeration. — (*Amer. journ. math.*, v. 2.) F. F. [1016

PHYSICS.

Heat.

Radiation and absorption of rock-salt. — Herr C. Baur has made some observations on this subject. His results do not agree with those of Melloni and Magnus. Melloni considered that heat, radiated from rock-salt, was not absorbed by plates of rock-salt, any more than heat radiated from other substances. Magnus found that rock-salt plates absorbed heat radiated from rock-salt much more than that radiated from other substances. He believed that the radiation from perfectly pure rock-salt would be completely absorbed by a plate of the same substance, and that the apparent exceptions to this law were due to impurities in the radiating plate. Herr Baur concludes from his experiments that, 1. Rock-salt absorbs its own radiations better than those from

any other body ; 2. The absorption increases as the difference of temperature between the radiating and absorbing plates decreases ; 3. The absorption is probably complete when both plates are at the same temperature. Magnus' exceptions were probably not due to impurities, but to a difference of temperature of the two plates. — (*Ann. phys. chem.*, xix. 1.) C. B. P. [1017

Electricity.

Hall effect. — Dr. E. H. Hall finds that the values of the 'rotational coefficients' given by him at the York meeting of the British association for zinc, aluminum, copper, brass, and lead, are confirmed by later experiments. On trying the effect of change of temperature, only a negative result was obtained with gold; with iron, the increase was two-thirds of one per cent, with a rise of 1° C. The coefficient, with change in the strength of the field from 1,000 to 7,500 absolute units, seemed to increase; but, of this, Dr. Hall does not feel sufficient confidence to publish his results. The object of another experiment was to determine whether any part of the rotational effect could be made permanent. For this purpose, a thin piece of very hard steel spring was used as the plate. The direction of the equipotential lines was permanently changed by the action of the magnet. This change was in the same direction as the temporary effect due to the magnet's action, and perhaps equal to two per cent of this. — (*Amer. journ. sc.*, xxv. 215.) [1018

ENGINEERING.

The power of a steamship. — The Oregon, of the Guion line, is to be the most powerful and the fastest of the transatlantic passenger-steamers. Her displacement is about 11,000 tons. Her engines have three cylinders, and are of 13,000-horse power. The boilers contain 74 furnaces, consume about 300 tons of coal per day, evaporate 2,700 tons of water, require 6,000 tons of air to support the combustion, or a volume of nearly 175.000,000 cubic feet, and the power developed is sufficient to raise about 200,000 tons one foot high per minute. The ship will make 20 nautical miles (knots) per hour, against an estimated resistance of 94 tons, or twenty times the resistance overcome by the most powerful locomotive. The Atlantic will be crossed in six days in good weather. — (*Lond. engineer*, April.) R. H. T. [1019

The exhaust-steam injector. — Mr. L. J. Groves read a paper before the Institution of engineers and shipbuilders in Scotland, March 20, describing the exhaust-steam injector. It resembles the feed-water injector of Henri Giffard both in principle and in its general construction. It forces the feed-water into the boiler by the action of the exhaust-steam at nearly atmospheric pressure, at the same time heating considerably the water passing through the instrument. It differs from the usual forms of Giffard injector in having the 'mixing' or 'combining' nozzle split in such a manner that it lies open when the apparatus is not working, but closes up to form the standard form of nozzle when the instrument starts into operation. The steam-nozzle is much larger than that of the common instrument, and has a central spindle, of cone shape, to direct and concentrate the jet. The instrument starts automatically when the engine starts. It draws cold water, and forces it into a high-pressure boiler at a temperature of 190° F. (88° C.). On a locomotive it has forced feed-water into the boiler at a temperature of 277° F. (136° C.), against a steam pressure of ten atmospheres. — (*Trans. inst. eng. shipb. Scotland*, April.) R. H. T. [1020

CHEMISTRY.

(*Organic.*)

Action of hydrochloric acid on caffeine. — When caffeine is heated with fuming hydrochloric acid to 260° in a closed tube, E. Schmidt finds that it is completely decomposed: —

$$C_8H_{10}N_4O_2 + 6H_2O = 2CO_2 + 2NH_2CH_3 + NH_3 + CH_2O_2 + C_3H_7NO_2.$$

Caffeine prepared from theobromine proved to be identical in its chemical and physical properties with the natural base. The decomposition of theobromine, when heated with hydrochloric acid, is shown by Schmidt and Pressler to be represented by the equation, —

$$C_7H_8N_4O_7 + 6H_2O = 2CO_2 + NH_2CH_3 + 2NH_3 + C_3H_7NO_2 + CH_2O_2.$$

By oxidation with nitric acid, theobromine gave methylparabanic acid and methylamine, and caffeine gave dimethylparabanic acid and methylamine. In the preparation of theobromine from cacao, Schmidt found in the mother-liquors needle-shaped crystals which proved to be caffeine. The action of hydrochloric acid upon xanthine is shown by the equation, —

$$C_5H_4N_4O_2 + 6H_2O = 2CO_2 + 3NH_3 + C_2H_5NO_2 + CH_2O_2.$$

— (*Ann. chem.*, ccxvii. 270.) C. F. M. [1021

Relative reactive power of the halogens in mixed haloid ethers. — L. Henry observed that in chlorbromethylen (CH_2ClCH_2Br) the bromine atom was removed by potassic hydrate, sodic ethylate, potassic phenolate, potassic acetate, and potassic sulphocyanate. Argentic nitrate substituted the group NO_3 for the bromine atom, and a bromnitrate of silver $\left(Ag_2\begin{matrix}Br\\NO_3\end{matrix}\right)$ was precipitated in quantity corresponding to the amount of argentic nitrate taken. The author regards this fact as evidence of the formula $\begin{matrix}Ag-NO_3\\|\\Ag-NO_3\end{matrix}$ for the nitrate. When the latter reaction was tried on chloriodethylen, iodnitrate of silver was precipitated. By the action of nitric acid, the iodine atom was replaced by the group NO_3. In bromiodethylen, the iodine atom seemed to be much less reactive than in the presence of chlorine; and, in general, the difference in reactive power between chlorine and bromine was much greater than between bromine and iodine. — (*Comptes rendus*, xcvi. 1062, 1149.) C. F. M. [1022

METALLURGY.

A new refining process. — At a recent meeting of the Société de l'industrie minérale, M. Thiollier communicated the details of a method of refining pig, and finished iron and steel, by the action of damp hydrogen. To assure himself that the well-known laboratory experiment may be carried out on a large scale, he has erected experimental works near Paris, having four furnaces with cast-iron retorts capable of treating about one ton at a time. The retorts are coated inside and out with a vitrifiable substance to prevent oxidation, and loss of gas through the pores of the metal. Hydrogen is introduced through small metal tubes; and, in order to prevent all danger of explosion, the air in the retort is displaced by carbonic-acid gas before the hydrogen is allowed to enter. After being annealed for a few hours in an atmosphere of hydrogen at a dark-red to cherry-red heat, malleable cast iron acquires all the properties of steel. Coarse steels may be changed into fine tool steel. On wrought iron the action is slower. The cost is esti-

mated at two francs per 100 kilos of poor-quality iron. — (*Iron*, April 6; *Eng. min. journ.*, March 31.) R. H. R. [1023

The working of blast-furnaces. — At a meeting of the Society of mechanical engineers, Jan. 25, Mr. Charles Cochrane read an elaborate paper on the working of blast-furnaces with special reference to the conditions under which the analysis of the escaping gases is of value. The object of the author is to establish the fact that all economy in fuel, consumed to make a ton of pig iron with any particular class or size of furnace, is governed by three conditions: 1. Temperature of air introduced; 2. Temperature of escaping gases; 3. The quantity of carbon which can be maintained in the condition of carbonic-acid gas after it has once been transformed to this degree of oxidation from the carbonic oxide produced in the hearth. The paper contains tables calculated for conditions varying from good to bad. Several illustrations of furnace-working are given, of which the No. 3 Ormsby furnace is one. The ratio of carbonic acid to carbonic oxide was 424. The temperature of the blast was 700° C.; of the escaping gases, 340° C. Carbon as coke, per ton of pig, was 21.98 cwt.; carbon in limestone flux, per ton of pig, was 1.50 cwt. By the tables it is shown, that, without the weight of carbon as a factor, there are six conditions of furnace-working indicated by the analysis of the gases; but, taking the carbon also into account, it is shown that the ideal furnace should have used but 16 cwt. of carbon per ton of pig: hence 5.98 cwt. of carbon have been reduced from carbonic acid to carbonic oxide. — (*Iron*, Feb. 2.) R. H. R. [1024

The Carvés coking system. — The ovens are long, high, narrow chambers of brick-work built side by side. The partition-walls contain horizontal flues as well as the floor of the ovens. No air is allowed to enter; and the only opening left during the heating is the pipe which carries the volatile products through condensation and absorption apparatus in order to save the tar and ammonia-water. The gas is conducted by the floor-flues to the small fire-grate at one end of the oven, and there burned; the products of combustion pass through the wall-flues, on their way to the stack; and, by this means, much heat is saved. There is no burning and consequent loss of the coal itself, as is the case in the beehive ovens; also the valuable by-products are saved. Tests show that the hardness of the coke increases as the width of the oven decreases. The cause of this is probably due to the quick and intense heating. The fixed carbon obtained in this way is about 75 per cent, while other methods give only 55 to 65 per cent. A battery of one hundred ovens will furnish steam for about 400 horse-power over and above the making of the coke and the rendering of the products. — (*Coal*, March 28.) R. H. R. [1025

Artificial fuel. — The process of Mr. E. F. Loiseau for making artificial fuel from coal-dust is in successful operation in Philadelphia, where from 80 to 300 tons, according to size of the lumps, are made daily.

The process of manufacture may be briefly outlined as follows: —

The coal-dust is fed into hoppers, together with about eight per cent of bituminous slack, from which it passes through a series of four cylindrical revolving drums, in which it is thoroughly dried. From these it is carried to a receptacle situated near the press. The dust, still at a temperature of about 140° F., is then thrown into the mixing apparatus, in which it is thoroughly stirred by revolving shafts with blades, while the proper quantity of pitch and coal-tar is added from a reservoir in which it is maintained at a temperature of 180° by steam-heat. The pitch is mixed with a certain quantity of coal-tar to give it the proper toughness. When thoroughly mixed with the melted pitch, the mass is plastic, and can readily be moulded into any desired shape. It is then carried to the press, where it is delivered between rolls having moulds upon their surfaces, from which the egg-shaped lumps are discharged. When discharged from the press, the lumps are quite hot, and have to be cooled by jets of water.

As thus prepared, the fuel is compact and very hard. Formerly clay was used as a cementing material, but now no incombustible or ash-producing material is required. The fuel is said to be even superior to the natural coal; and this opinion is borne out by an analysis which gave the following results: —

	Chestnut anthracite.	Loiseau fuel.
Carbon	73.40	82.01
Hydrogen	3.09	2.56
Moisture	0.44	2.41
Ash	17.95	10.47
Nitrogen and oxygen by difference	5.12	2.55
Theoretical calorific power, British thermal units	12,339.50	13,853.00
Equivalent to the evaporation, from and at 212°, of lbs. water	12.76 lbs.	14.33 lbs.

[1026

AGRICULTURE.

Earth-worms and fertility. — According to Hensen, earth-worms increase the fertility of the soil by forming burrows through which the roots of plants can descend into the subsoil. This applies chiefly to Lumbricus terrestris, while L. communis is confined chiefly or entirely to the surface-soil. The tap-roots of many plants, he thinks, may be able to force their own way through the hard subsoil; but the more slender side-roots descend chiefly through worm-burrows, or other channels, such as those left by old decayed roots. By excavating in frozen ground, he was able to trace roots downward through worm-burrows, and to observe that the layer of excrements with which the latter were lined was covered with a delicate network of root-hairs proceeding from the root in the interior. An important function of these roots Hensen believes to be, to supply the plant with water from the moist subsoil; and this is particularly important in the case of quick-growing annuals, like the cereals, which must develop their root-system rapidly, and frequently have to withstand prolonged dry weather. It is plain that no new material can be added to the soil by earth-worms; but they effect the fixation of vegetable matters in the soil by drawing into their burrows leaves, and other loose fragments of vegetation: they hasten their decomposition, and distribute them through the various layers of the soil. — (*Landw. jahrb.*, xi. 661.) H. P. A. [1027

GEOLOGY.

Lithology.

The Ardennes phyllites. — Extended chemical and microscopic examinations of the Ardennes phyllites by Renard show that they are composed of sericite, chloritoid, and either quartz or calcedony, with variable quantities of magnetite, hematite, pyrite, pyrrhotite, ottrelite, sillimanite, rutile, tourmaline, zircon, garnet, and carbonaceous material. Apatite was observed in one specimen. — (*Bull. mus. roy. Belg.*, i.) M. E. W. [1028

Archeological lithology. — Jannettaz and Michel from chemical and microscopic examination of two fragments of images obtained in Oaxaca, conclude that the rock is serpentine. Like examination of a pierced cylindrical bâton from Tetihuacan caused it to be regarded as a microcrystalline albite. The rocks were respectively colored greenish gray, deep green, and milk-white with a greenish tinge. — (*Bull. soc. min. France*, April, 1883.) M. E. W. [1029

Meteorites.

Fusion structures in meteorites. — The reviewer having expressed himself favorably (**24**) regarding an abstract of Wiechmann's paper, it becomes necessary, on examination of the completed form just published, to withdraw his commendation. The paper is a rambling, nearly worthless essay. So far as we can judge, the conclusions appear to be in the main correct; but they are mere guesses so far as this paper goes. The plates are coarse and unnatural. The only real evidence the article contains (which can be found on almost every page) shows the author to be destitute of the elements of the knowledge necessary for the work he has undertaken. — (*Ann. N. Y. acad. sc.*, ii. 289.) M. E. W. [1030

MINERALOGY.

Pachnolite and thomsenolite — Since the analyses of J. Brandl have shown these very similar minerals to have the compositions (Al F_3, Ca F_2, Na F) and (Al F_3, Ca F_2, Na F, H_2O) respectively, Des Cloizeaux has subjected the same to renewed optical and crystallographic examination. The crystals of pachnolite are always very small, and associated intimately with the thomsenolite. When heated in the closed tube, they decrepitate violently, giving no water. They are referred to the monoclinic system, with axial relation $c : b : a = 1.326676 : 1 : 0.859495$ $\beta = 89° 41'$. The thomsenolite is distinguished by its perfect basal cleavage. When heated in the closed tube it decrepitates violently, giving off acid water. The crystals are monoclinic, with the faces of the hemi-octahedron and prism striated parallel to their intersection with the base, and having the axial relation $c : b : a = 1.0883 : 1 : 0.998741$ $\beta = 89° 12'$.

These two minerals, which have been much confounded and united, are thus shown to be distinct, not alone in chemical, but also in physical and crystallographic properties. — (*Bull. soc. min.*, v. 317.) S. L. P. [1031

PHYSICAL GEOGRAPHY.

Ripple-marks. — The cause of the production of ripple-marks in marine sands, lately investigated by A. R. Hunt (*Proc. roy. soc.*, xxxiv. 1882, 1), has been further studied by C. de Candolle. He shows that they are caused by a horizontal oscillating or intermittent motion of the bottom-water, generally arising from the effect of wind on the surface, and makes it probable that they are produced at very considerable depths, and in directions independent of the surface-winds blowing. Such ripples are always formed on the surface of a viscous mass when a liquid moves back and forth, or intermittently forward, over it. Attention is called to the possibility that rippled cirrus clouds may have a similar origin, and to the resemblance between some artificial ripples and certain organic forms. Several well executed plates illustrate the paper. — (*Arch. sc. phys. nat.*, ix. 1883, 241.) W. M. D. [1032

Patagonia. — C. Martin calls attention to the contrast, dependent on the winds and consequent rain, between the country east and west of the southern Andes. North of lat. 40° S., where even the passes approach the height of Mont Blanc, this contrast is strongly marked; but farther south the cordillera is broken, and gives more open passage to the moist winds. At its eastern foot the numerous and large lakes are all fresh, having overflow during at least part of the year. Farther eastward the country becomes dry and barren, though nowhere being a desert of drifting sand. Its small lakes are saline. The Patagonian Andes, therefore, do not constitute a continuous range, but consist of a series of moderately high volcanoes on the ragged western border of the tableland, deeply cut by fiords and by rivers, that in some cases rise at a considerable distance from the Pacific coast, as found by the explorers, Cox, Fonck, and Musters. Forests extend as far north as lat. 35° S., but there they are found only on the mountain spurs. South of lat. 37° the lowlands also are forest covered, except where occasionally cleared by the Indians, who have, till lately, occupied this district to the exclusion of Spaniards and Chilians, and again between Valdivia and Osorno (lat. 40° to 42° S.), where opened by German colonists. The mainland and archipelago of the fiord region, where the Chilian hydrographer, Simpson, has counted over one thousand islands, are well wooded, the trees extending above the foot of the glaciers, up toward the snow-line. A brief description is given of the more important forest-trees. A peculiar building of lake-barriers is described (whether on sufficient observation or not does not appear) at several points in the southern fiords; for example, in the bay into which the glacier from the flank of San Valentino (3,870 met.) gives off its bergs, which, on melting, form a bar like a moraine, and in time enclose a part of the bay, which then becomes fresh by outward drainage. One such lake has already been formed here, and another is forming. — (*Mitth. erdk. Halle*, 1882, 88.) W. M. D. [1033

GEOGRAPHY.

(*Europe.*)

Surface and structure of Wurtemberg. — Beginning with a quotation from Murchison, — "No really good topography can be made by any surveyor who neglects geological data," — E. Hammer describes the close relation between the geological structure of Wurtemberg and the form of its eroded surface. Valleys cut in the *buntsandstein* have evenly rounded side-slopes; in the *muschelkalk* the slope begins abruptly at the line of a hard upper stratum, and sinks directly to the base; in the *keuper* the slope is broken by steps or terraces of harder and softer layers. Most of the larger streams follow the *muschelkalk*, and their upper courses meander so irregularly that the most ordinary topographic map reveals its presence. The forms of the successive lias, Jura, and tertiary deposits are given in detail. In upper Swabia, glacial deposits present their peculiar landscape of systemless hills and hollows, with drainage so imperfectly established that peat-swamps occupy a considerable part of the surface. The lack of illustrations decreases the value of this paper; but its method is excellent, and should find many followers. — (*Kettler's zeitschr. wiss. geogr.*, iii. 93, 148.) W. M. D. [1034

Area of Italy. — The official estimates of the area of Italy give a surface of 296,323 □ kil., according to figures established in 1864; but in the past year several statistical almanacs have changed this to 288,540 □ kil., according to the results of Gen. Strelbitsky (*Superficie de l'Europe*, 1882). Prof. G. Marinelli of the university of Padua does not ap-

prove of this change, as he regards the cartographic material on which the new estimate was made as of less than mediocre value. — (*Boll. soc. geogr. ital.*, vii. 1883, 241. Further discussion of the question is given in *Atti istit. venuto*, ix. 1883, 179, 295.) W. M. D. [1035

(*Asia.*)

Euphrates valley. — A corrected sketch-map of M. v. Thielmann's route from Kerbela, near the Euphrates, westward across the desert valley to Palmyra, is prepared by R. Kiepert. It shows the great barrenness of the adjacent flat country, slightly indented by dry stream-courses extending north-easterly to the river. Some of these are two hundred feet below the general surface, and sometimes contain pools and springs. — (*Zeitschr. f. erdk. Berlin*, xvii. 458.) W. M. D. [1036

Improvements in Persia. — Dr. J. E. Polak concludes his account of an expedition to the Karagan and Elvend regions in 1882 by noting the changes in the country since his earlier visit in 1860. In addition to the overland telegraph-line that connects India with Europe, there are several shorter lines across the country. The service is regular, and despatches can be sent in English and French as well as Persian. Many new roads have been constructed, and, although not to be compared with the smooth highways of Europe, they serve well for caravan traffic ; but roads are still lacking in many districts. A responsible postal-service is established, both for the interior and for foreign correspondence; and a uniform currency in gold and silver is introduced. With the improved means of communication, letters of credit can now take the place of a heavy supply of metallic money, that travellers formerly found necessary. Railroads are projected from the Caspian southward: they will have the advantage of finding coal and wood near their lines, but also the difficulties of heavy grades between the coast and the interior tableland, and a lack of good harbors at their termini. European methods are introduced in many civil and military arts, and a general tolerance of most sects and nationalities. Whether this improvement will continue or not is doubtful, as the present Shah is over fifty years old, and none of his sons give assurance of carrying on his reforms. — (*Mitth. geogr. ges. Wien*, xxvi. 1883, 106.) W. M. D. [1037

(*Pacific Ocean.*)

Polynesia. — An entertaining sketch of a three-years' voyage to many of the island-groups in the western Pacific is given by Dr. O. Finsch, who has lately returned to Europe with large collections. His studies were chiefly ethnological. Opportunity for such investigation is rapidly disappearing; for the local peculiarities of the natives on the various island-groups are fast fading away under the influence of traders and missionaries. Among the natives of the Marshall group, the making of large canoes from the trunks of breadfruit-trees is already a lost art. On one of the Caroline Islands, only about three hundred natives remain; and their earlier customs have largely disappeared with their conversion to christianity. In the Melanesian Islands there has been less change. The natives go naked, and retain their cannibal fashions; and, by the absence of certain peculiarities not at all flattering to our civilization, the lack of European influence is further proved. Herr Finsch found the atolls monotonous. "They are like American hotels: in knowing one, you know them all." The higher islands have much more interest. The irregularity of communication between the different islands makes travel very difficult. One must wait for accidental opportunities. With a little schooner of twenty tons, and a native crew of six or seven men, much more could be done. — (*Verh. erdk. Berl.*, 1882, 553.) W. M. D. [1038

Philippine Islands. — Dr. S. Kneeland regards this group, with many others south-east of Asia, as the remains of a sunken continent, finding evidence for this view in their broken outline, in the distribution of races and their monuments, and in the numerous volcanoes on the fracture along the border of the lost land ; but this latter point is certainly open to question, as is his opinion concerning the finished condition of the earth, and the office of volcanoes as safety-valves to earthquakes. Volcanic and seismic phenomena are very marked on these islands. The symmetrical cone of Mayou gave forth a continuous stream of lava from its very summit for the last five months of 1881, and, in earlier years, has done great damage to the villages on its flanks. The ruins of the old town of Daraga, on the south-east, may still be seen partly covered by the lava of 1814. Majay-jay or Banajao, now dormant, formerly contained a lake that was destroyed in the eruption of 1730. 'Large stones thrown from it are scattered far and wide beyond its lava-flows.' From the lake of Bonbon, seventy miles in circumference, rises the cinder-cone of Taal, twelve hundred feet high, with a ragged crater six miles around, within which is a sulphurous lake giving forth suffocating fumes. The effect of earthquakes is seen in the change from heavy stone to light wooden buildings of Spanish construction. The most violent recent shocks at Manila were in 1863 and 1880. A meteorological observatory in charge of the Jesuits publishes a daily weather bulletin ; January and February have the coolest weather, with dry north winds; April and May are hottest; and August and September have the heaviest rains. Having an extent from north to south over several degrees of latitude, and a strongly broken surface, the islands enjoy a remarkable variety of climate, and the pine and maize flourish as well as the palm and orange. The author's chief attention was given to ethnographic questions, and some of his results have already appeared in SCIENCE. — (*Bull. Amer. geogr. soc.*, 1883, no. 2.) W. M. D. [1039

BOTANY.

Flowers of Turneraceae. — From studies by Urban, it appears, that, of the eighty-three species, fourteen are certainly homogone, and five probably so, while forty-eight are dimorphic, and eight probably so. Six species are incompletely dimorphic; one has six varieties homogone and six heterogone, and one is unknown, with respect to the length of the essential organs. Mathurina penduliflora, Piriqueta capensis, Berneriana madagascariensis and odorata, which depart most from the other Turneraceae, and are remarkable for their geographical distribution, are homogone. Aside from these, the homogone species are represented in all genera, and in most of the smaller groups of naturally related species, and they are distributed as widely as the order.

When a single individual of a species, found homogone in many specimens from different localities, shows an inclination to heterogony, this manifests itself in the increased length of the style, while the stamens retain their usual length. The northernmost variety of Turnera ulmifolia is represented only by the long-styled form. Certain species are characterized as incompletely dimorphic. The long-styled form is as it should be, while in the short-styled flowers the branches of the stigma nearly or quite reach the anthers. In these self-fertilization can

occur if insect visits fail. These are found only in groups where specific distinctions are not well marked.

In completely heterogone species, the differentiation extends only to the relative length of stamens and pistil, or it may include the direction of the short styles, which diverge so much as to bring the stigmas in contact with the perianth, or even the length of the stigmatic rays and the form and pubescence of the style. The colors of the flowers do not stand in any relation with the monomorphism or dimorphism. Dimorphic species have more conspicuous flowers than their nearest homogone relatives, this depending either on the size of the individual flowers or on their grouping in compact clusters. The duration of the several species shows a remarkable connection with the presence or absence of heterogony. The large-flowered, dimorphic species are perennials, while most of the small-flowered, homogone species are annuals. — (*Berichte deutsch. bot. gesellsch.*, 1883, heft 2.) W. T. [1040

Floral evolution in monkshood. — Grant Allen gives a popular account of the flower of Aconitum, contrasting it with a buttercup, and showing how symmetry and regularity have been lost, and its blue color acquired, through the advantage derived from the visits of bees favored by these changes. The bilateral structure, and the suppression of the lower three petals, are connected with the lateral position of the flowers on the axis of inflorescence; while the reduction in the number of carpels, and the increase in the ovules, secure the production of as much seed from a single visit of a bee as the buttercup secures from numerous visits of the mixed group of insects to which it is open. The differences in the relative position of the essential organs during anthesis would also have proved very interesting in this connection. — (*Knowledge; Pop. sc. monthly*, May.) W. T. [1041

The relation of the tension of the bark to the formation of annual rings in wood. — It is stated in several text-books, that, owing to the slighter pressure exerted by the bark in the spring, wider wood-cells are produced than at a later period, when the pressure is considerably augmented. Experiments by De Vries certainly can be interpreted in this way. Krabbe has recently investigated the subject in a somewhat different manner, and has arrived at a different conclusion. It cannot be said that the subject has yet been settled. It offers a promising field for further work.

Krabbe's method is the following: strips of bark, not as yet covered with cork, are carefully cut from the stem, and the amount of force required to restore them to their original breadth determined exactly by means of weights. It is well known that such strips of bark shrink at once, and that a considerable force is needed to bring them back to their former size. The tangential tension of the bark increases with the growth of the stem up to the time when the corky layer is formed, unless some injury influences the phenomenon. But if we look at the radial pressure (reckoned as the quotient of the tangential tension divided by the radius), it is found that this diminishes with increase of the stem in thickness. Furthermore, the radial pressure in autumn is about that of spring, never differing from it more than one gram in the square millimetre; hence being, as Krabbe thinks, too slight to account for the difference between the spring and autumnal wood. He explains the increase of growth, when pressure is removed by taking off the bark, by the pathological activity following wounds. — (*Sitzungsb. akad. wiss. Berl.*, Dec. 14, 1882.) G. L. G. [1042

ZOÖLOGY.

(General paleontology.)

Jurassic of Galicia. — In volume v. of the memoirs of the academy of sciences of Cracovia, Dr. Alth, under the title of the 'Limestone of Nizniow, and its fossils,' describes the recently discovered and very important beds of that locality. From the character of the fossils he refers them to the upper white Jurassic, answering to the united strata of the Kimmeridge and Portland. This work is important as showing the existence of the Jurassic in eastern Galicia, where it was formerly unknown, and of great paleontological importance as describing 179 species of fossils, of which 124 are new. Of these, 5 are annelids, 93 gastropods, 57 acephalans, 5 brachiopods, 2 echinoderms, 6 corals, 6 rhizopods, and 4 plants. Curiously, only one cephalopod has been found, the Nautilus Geinitzi. — (*Bull. soc. geol. France*, Jan., 1883.) J. B. M. [1043

The sigillarian stumps of Nova Scotia. — One of the most interesting results of the later visits of Sir Charles Lyell to this country was his discovery, in company with Dr. Dawson of Montreal, of a number of animals entombed in stumps of sigillarians in the coal-measures of Nova Scotia. Dr. Dawson has recently renewed his explorations in the field by aid of a grant from the Royal society of London, and his conclusions have just been published. Up to 1876, only three additional trees, of those which became accessible by the wasting of the beds, furnished animal remains. But by cutting and blasting, twenty others have now been examined, ten of them proving productive. Dr. Dawson finds that "the circumstances of the growth and entombment of this forest entirely contradict those theories as to Sigillaria and Stigmaria which suppose that these plants grew in water, or on submerged areas. . . . The surface on which the trees grew . . . must have been underlain by several feet of peaty matter." The number of terrestrial batrachians found in the stumps has been doubled by these investigations, additional species of Hylonomus and Hylerpeton having been found, and Fritschia and Sparodus added to the genera, besides a new form called Amblyodon, represented imperfectly by a few teeth and bones, — making, in all, seven genera and twelve species. Of land-snails, besides Zonites priscus, and Pupa vetusta, found before, another species of Pupa, called P. Bigsbii, has occurred. Of articulates, S. H. Scudder reports two more (unnamed) species of Archiulus, bringing the number of myriapods to six, and fragments of scorpions — not before recognized — probably belonging to two species. A half a dozen plates illustrate the batrachian remains. A note is added on the footprints of batrachians observed in carboniferous rocks of Nova Scotia, which are referred to six species, equally divided between Sauropus and Hylopus. — (*Phil. trans. roy. soc. Lond.*, 1882, 621.) [1044

Mollusks.

Variations in Unionidae. — Rev. W. C. Hey contributes a suggestive paper on the variations observed by him in Anodonta and Unio in the waters of the Ouse and the Foss, and the canals communicating with them, within a very limited area. The point of it is, that, apparently, very slight changes in the environment produce important changes of appearance in the mollusks referred to; though why such causes should produce such effects is not by any means clear. — (*Quart. journ. conch.*, 1882.) W. H. D. [1045

Action of the heart during hibernation. — C. Ashton has studied the action of the heart in hibernating helices. The observation is difficult owing to the opacity of the parts and the necessity of guarding against the temperature radiating from the observer's body. The pulse seems to be irregular, or rather, perhaps, to pass through active and quiescent cycles. Absolute inactivity of the heart probably does not occur during hibernation. Under scrutiny, the pulsations varied from three to twenty-two per minute. The animal is extremely susceptible to changes of temperature, as a touch of the finger will often double the rate of pulsation, which also rises with exercise or motion. — (*Quart. journ. conch.*, 1882.) W. H. D. [1046

Malacological notes. — Dr. W. Kobelt proposes to issue through Theodor Fischer, in Kassel, an iconography of European shell-bearing marine mollusks, which is much needed, and will be extremely useful to malacologists. It is to contain anatomical as well as conchological details, and will be issued in parts containing four plates each, in a colored and an uncolored edition, at the rate of a volume annually. —— Dredgings by Admiral Spratt in the Black Sea have been examined by Dr. Jeffreys, who finds them to contain six species of shells, hitherto unrecorded, from that basin, one of which (Trophon breviatus) appears to be peculiar. He regards the Black Sea zoölogically to be a mere offshoot of the Mediterranean, as the latter is of the North Atlantic. —— Bergh has printed in the *mittheilungen* of the zoölogical station at Naples a contribution toward a monograph of the nudibranchiate genus Marionia of Vayssière, — a group belonging to the Tritoniidae, and of which a few species are known in the Mediterranean and Red Seas. The paper is illustrated by a beautiful colored plate. — W. H. D. [1047

VERTEBRATES.

The heart as a suction-pump. — It has long been discussed whether the ventricle of the heart is not only a force-pump in systole, but also a suction-pump in diastole, actively dilating, and drawing blood into it from the veins. That within the closed thorax there is, due to the negative pressure prevailing in that cavity, an active diastole cannot be doubted; but is there such a diastole when the chest is opened, or does then the blood returned to the heart from the veins merely push apart the flaccid walls of the heart-chambers?

Goltz and Gaule have, among others, maintained the doctrine of such active diastole. Even with an open thorax, they found a negative pressure occurred in the heart during some part of a cardiac period · and, though their method of work did not enable them to determine at what moment in the heart's cycle this negative pressure occurred, they assumed that it was during the diastole. Moens, however, in a subsequent noteworthy paper, brought forward experimental and other proofs that the negative pressure in the left ventricle occurred at the end of the systole, and not in the diastole at all: if so, the heart was not a suction-pump. Jager now returns to the question; and taking as starting-points the assumptions, that, if negative ventricular pressure occurred at the close of the systole it must show itself in the aorta, but if during diastole in the auricles, he concludes that it is diastolic; since his experiments show that at no time is there a negative pressure in the aorta, while there may be such in either auricle. Accordingly, he maintains that the heart is a suction-pump. We may remark, however, that the correctness of his primary assumption is by no means certain: hence his whole argument falls to pieces. There is, on the contrary, strong reason to believe that the ventricular contraction lasts after closure of the semilunar valves, and that it is just at this very end of the systole that the negative intracardiac pressure occurs. — (*Pflüg. archiv*, xxx. 491.) H. N. M. [1048

'Mastzellen' of connective tissue. — The granular cells described in 1877 by Ehrlich, and since known by the name of 'mastzellen,' have been studied by Raudnitz. Their frequency in different organs and animals is very variable. They are generally abundant in the tongue, but are rare or wanting in the human tongue, and could not be found in any part of the rabbit. They are wanting in embryos, and are few in young animals. Raudnitz supposes that they are cells undergoing mucous degeneration. — (*Arch. mikr. anat.*, xxii. 228.) C. S. M. [1049

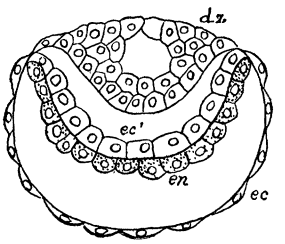
Haematoblasts of Hayem. — These little granular masses, which were first accurately described by Max Schultze (1865), have since been frequently observed; but their meaning and history have not been hitherto satisfactorily determined. Hayem believed them to be red blood-globules in process of development, and accordingly named them haematoblasts. Bizzozero has studied these bodies, which are about one-half the diameter of the red globules, in the circulation of living mammalia as well as in extravasated blood. In the latter they change with extreme rapidity, and each one becomes a centre from which the filaments of fibrine radiate, upon coagulation. When unaltered, these little disks are colorless, and bounded by nearly parallel surfaces. They have no nucleus, and contain two optically distinct substances, and exhibit with various reagents essentially the usual changes of protoplasmic bodies. Bizzozero denies that they change into red blood-corpuscles, as maintained by Hayem. The bulk of the memoir deals with the relation of these bodies to thrombosis and coagulation. The closing section is devoted to an account of these plates in cold-blooded animals. [Are not these bodies products of degeneration, perhaps amyloid?] — (*Virchow's arch.*, Nov., 1882. *Résumé* in *Arch. ital. biol.*, ii. iii.) C. S. M. [1050

The origin of apnoea. — In his third contribution, Knoll discusses the origin of apnoea. When rabbits in which the vagi are intact are made apnoeic by free artificial respiration, spontaneous respirations again appear only after the blood has become sufficiently venous to stimulate the vaso-constrictor, cardio-inhibitory, and other centres in the medulla. This depression of the irritability of the breathing-centre is so great, that, even when the blood-flow to the brain is cut off, no breathing-movements are called forth, although the vaso-constrictor centre becomes powerfully stimulated. This is in opposition to the results obtained by Rosenthal. The difference between his and Rosenthal's results may be owing, he thinks, to the latter having experimented upon animals with the chest opened. Although the respiratory centre in the apnoeic animal does not respond to stimuli from the blood, yet reflex stimulation, electrical or mechanical stimulation of the vagus or of the nasal mucous membrane, for instance, can still produce inspiratory contractions; not so readily, however, as in an animal not apnoeic. The production of apnoea in artificial respiration he attributes, in part at least, to a rhythmic stimulation of the vagi. In rabbits in which both vagi were cut, he succeeded in bringing about apnoea by artificial respiration only in five cases out of twenty; and in three of these there was evidence of diminished irritability of the respiratory centre from other causes. In the other cases a flattening of the respiratory curve could be perceived, —

a condition which he calls 'relative apnoea.' To obtain 'absolute apnoea,' one vagus at least must be intact. Moreover, when, by a special apparatus, the central end of the divided vagus was stimulated by a constant current at each artificial inflation, 'absolute apnoea' could in most cases be produced; although in the same animal, without corresponding stimulation of the vagus, only 'relative apnoea' was the result of artificial respiration. That this rhythmic stimulation of the vagus is only one of the factors in the production of apnoea is shown by the fact that artificial stimulation alone does not cause apnoea; while, with the vagi cut, artificial respiration alone will bring about a partial or relative apnoea, indicating a diminished irritability of the respiratory centre. — (*Wiener sitzungsb.*, lxxxvi. iii. 101.) W. H. H. [1051

Mammals.

Early development of rodents. — In a very important and interesting contribution to this subject, Kupffer describes the following discoveries from observations of the ova of the field-mouse, made upon sections through the uterus and egg *in situ*. The ovum of Arvicola forms a normal vesicle. In the germinal area lie the ectoderm and entoderm in the usual manner. The ectoderm consists, as in rabbits, of a 'deckschicht' (Rauber, *Sitzungsb. naturf. ges. Leipzig*, 1875) of thin cells, and a main layer of cubical cells, which alone enter into the formation of the embryo. The 'deckschicht' is temporary in the rabbit; but in the field-mouse it is the seat of a rapid and early proliferation, which leads to the formation of a knob of cells, which, on the one hand, is attached to the uterine-wall, and, on the other, forces in the germinal area, both ectoderm and entoderm. From the germinal area thus invaginated, into the interior of the ovum, the embryo is developed according to the typical method in mammalia. The mass of mesoderm-cells marking the primitive streak, and the position of the future allantois, appear at one end. The amnion folds are developed in front and behind from the inner ectodermal layer, and therefore inside the 'deckzellen.' The invagination of the germinal area goes so far that the whole egg is elongated in that direction, until it acquires a cylindrical form It is thus evident, that although the ectoderm occupies, as a result of the invagination, a central position, yet morphologically it always remains strictly the outside layer. — (*Sitzungsb. akad. wiss. München*, 1882, 621.) C. S. M. [1052



ec, ectoderm; *ec'*, ectoderm of germinal area; *en*, entoderm; *dz*, 'deckzellen.'

Embryology of rodents. — Paladino gives the following *résumé* of his results; and, as they have a slight priority of publication over recent German papers (ante **849-851**), they deserve especial attention. The whole cylinder formed during the first developmental stages of certain rodents is the embryo, and it is implanted on the decidual new formation by the caudal extremity. This is proved especially by the fact that it is this part from which the allantois arises. The cylinder, and the vascular portion of the decidual new formation, are continuous, and so remain throughout gestation by means of the vessels falsely called omphaloid. The decidua forms not only the placenta, but also the first envelope around the embryo, — the chorion, falsely so called. (This is in direct contradiction to the latest opinions of Hensen.) Between the embryo and the decidua is a large space, filled at first with blood, which Paladino thinks is probably produced by the metamorphosis of the granulosa cells discharged from the Graafian follicle along with the ovum (!). — (*Arch. ital. biol.*, ii. 363.) C. S. M. [1053

Germinal layers not homologous. — Repiachoff, whose singular hypothesis concerning the mammalian ovum was reported (**627**), has advanced the still more remarkable opinion that the germinal layers in vertebrates are not homologous primitive organs, and maintains that the same organ may arise in different animals from different layers. (This is directly opposed, especially as regards the notochord and the mesoderm, to which Repiachoff refers as illustrations, by the best recent investigations, and, indeed, the whole theory seems to the reporter without foundation.) — (*Zool. anz.*, vi. 148.) C. S. M. [1054

ANTHROPOLOGY.

Tylor's lecture at Oxford. — On Feb. 15 and 21, Prof. E. B. Tylor lectured at the University museum, Oxford, upon anthropology. The occasion was the instalment of a museum of civilization, the nucleus of which is the Pitt-Rivers collection, previously mentioned in SCIENCE. The speaker first drew attention to the fact that the theory of development has had its own evolution parallel with the progress of knowledge. Pritchard recognized the descent of mankind from one pair, whom he considered to have been negroes; and as we have been able to reconstruct the ancestry of the horse, Huxley leads us to hope that we may some day discover the fossil pedigree of his rider.

Mr. Tylor next spoke of the approach which craniоscopy is making to an exact science, drawing his illustrations from the crania of the British barrows, and other localities of undisturbed population. Comparative philology, properly understood, may tell its story in perfect accordance with anatomy. The blended parentage of the Fijians is heard in their speech, as it is seen in their faces. The cross-section of a single hair, examined microscopically by Pruner's method, shows it circular, or oval, or reniform; its follicle curvature may be estimated by the average diameter of the curls, as proposed by Moseley; its coloring-matter may be estimated by Sorby's method. This examination enables one to judge in what division of the human species to classify its owner. Climate, albinism, 'Addison's disease,' and other natural causes in their relation to race-color, are carefully considered.

It is upon the evolution of civilization, however, that Mr. Tylor is most happy, a subject to which he has devoted the most of his life. The last portion of the addresses, therefore, is devoted to the unfolding of several phases of social life in their relation to race and history. — (*Nature*, May 3.) [1055

The Trenton gravels. — Dr. C. C. Abbott has been observing closely the removal of gravel from the drifts of the Delaware near Trenton by railroad excavations, and has discovered new evidences of the existence of paleolithic man. The removal of the material reveals the fact that the beds were deposited at different times, masses of bowlders being overlaid by masses of sand, one of which, averaging a foot in depth, and extending nearly three hundred yards along the exposure, yielded not only the typical paleolithic implement, but four chipped stones of less definite shape, all of argillite. These objects were overcapped by a deposit nearly seven feet in

thickness, undisturbed, and containing several bowlders of large size.

Further research in the deposit, especially after a very severe storm, brought to light other rude implements which seem to be very old, and a human wisdom tooth. Dr. Abbott reviews also the discussion respecting the age and geological relation of the beds. — (*Proc. Bost. soc. nat. hist.*, xxii.) J. W. P. [1056

Nago language and proverbs. — Under the title of '*Les noirs peints par eux-mêmes*' (Paris, 1883), the Abbé Bouche, late missionary on the Slave Coast, presents an interesting pamphlet containing a large number of proverbs in the Nago language, with both literal and liberal translations and explanatory remarks. The proverbs show much of the customs and modes of thought of the people and give a favorable view of their intelligence. They are, however, in large part extracted from the 'Vocabulary of the Yoruba language,' by Samuel Crowther, a native Nago, afterwards bishop of the Anglican church, though the Abbé Bouche claims to have made important emendations in the linguistic part of the work.

This pamphlet is the first publication of *L'oeuvre de Saint Jérome*, which was lately instituted to furnish mission-schools with 'classical works in the language of the natives,' or, in other words, to facilitate the study of the several languages in current texts of those languages, not to rely upon forcing a translation of religious works into the foreign tongue, which in many cases does not contain the words necessary to express the ideas connected with the Christian religion. This new departure in the right direction, by missionaries, is the mode employed by the Bureau of ethnology of the Smithsonian institution, and its general adoption will prove of the highest philologic value. — J. W. P. [1057

Chuckchis and Chuckchi-land. — An unsigned article on the Chuckchi describes their distribution, migrations, mode of life; the habits of the bands who live by herding reindeer, by trade between the American Innuit and the Russians on the Anui and Anadyr rivers, or by coast-fisheries; the care and diseases of the deer; the fishing population of eastern Siberia, and the fish they catch; and the initiation, purposes, and results of the Maidel-Neumann expedition to Chuckchi-land. The harmonious relations between the Russians and reindeer-Chuckchis now existing, and the manner in which they were brought about, are clearly stated. There is little new ethnological matter in the article, but a good deal of useful and interesting historical material, while the rest has been brought up to date. — (*Deutsche geogr. bl.*, vi. ii.) W. H. D. [1058

EGYPTOLOGY.

Book of the dead. — The editing of a critical edition of the Book of the dead was, by resolution of the International congress of orientalists held at London, committed to the hands of M. Edouard Naville. The work is now done, and is to be published under the direction of the academy of Berlin. It has been edited from the papyri of the seventeenth to twentieth dynasties. There is but little before that period to contribute to this edition; and, after that period, the acquaintance with the hieroglyphs of the Book of the dead was lost, and the chapters were written in the hieratic characters. The scribes copied mechanically, without understanding the signs they traced; and so the papyri in hieroglyphs, after the twentieth dynasty, are filled with errors. The most important papyri, which have been made the base of the present work, are those of London (9,900 and 9,964), of Paris (III. 1, III. 85, III. 93), and that of Mesemneter. These are all texts of the eighteenth dynasty. Almost all the chapters of the Book of the dead, as published by Lepsius, have been found elsewhere, and forty-three chapters, hitherto unedited, have been added. The first volume will contain the text and all the variants of the vignettes, which often differ from those published by Lepsius. The second volume will contain the variants of the text. While the title, 'Book of the dead,' has been retained, Naville calls attention to the special name of the book in Egyptian, '*per em hrou*,' and says, "I believe that it means 'departure from the day' (*'sortie du jour'*); that is, departure from his day. The Book of the dead contains expressions like the following: 'I have been delivered from the evil of those who are in their days,' or again, 'I have not blasphemed the King during his day,' where the variants are, 'during the continuance of his life.' To leave his day is not really to lose life or existence (life continues beyond the tomb), it is merely to be delivered from the period set for every terrestrial life, and to have neither beginning nor end, — an existence without limits in time or space: hence the frequent addition to the expression, 'departure from the day,' of 'under all the forms which the deceased wishes'; that is, to become released from the limits of time and space. . . . Whatever advantage there might have been in taking the Egyptian title, though imperfectly translated, yet I believe that now it is better not to break with usage, and to call the book 'Book of the dead' until Egyptologists agree upon a translation of the expression of '*per em hrou;*' for which I propose 'departure from the day or from his day.'" — (*Revue egyptol.*, iv.) H. O. [1059

EARLY INSTITUTIONS.

Land-system of the Franks. — H. Hahn sums up the conclusions of Dr. Schröder in his book entitled '*Die Franken und ihr recht.*' He tells us how the writer takes a position opposed to that of von Inama-Sternegg, whose *Wirthschaftsgeschichte* we read with so much satisfaction a few years ago (1879). According to this new view, the freemen were distributed in strictly communistic village communities (dörfer mit strenger flurgemeinschaft), under the over-lordship (obereigenthum) of the kings. This, we are told, was the condition of things as late as the sixth century. After that time, the system of isolated farmsteads with private estates (einzelhof-system) was introduced very generally. According to von Inama-Sternegg, as the reader will remember, the einzelhof-system was the primitive system. We are quite at a loss to imagine upon what grounds this new theory can rest. It seemed to us that that of von Inama-Sternegg was well established by the testimony of the early records. We wonder, for example, how Dr. Schröder reconciles his theory with the statement of Tacitus in Germania 16: 'Colunt discreti ac diversi,' and with that other statement (Germ. 25), that the freemen had slaves set out upon the land like Roman coloni. We wonder, too, how he explains the references to private property in arable meadow, and even forest-land, in Lex salica, xxvii. And what did the freemen do with their slaves, if they lived in communistically organized villages? Slaves are mentioned in at least nine sections of the Lex salica. Then, we remember all the early formulae and documents in which landed property is described. How can Dr. Schröder do away with all this testimony? We must not, however, attempt to discuss, still less must we criticise, an argument of which we have seen only a very brief report. — (*Mitt. hist. litt.*, 1882, heft 3.) D. W. R. [1060